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<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA</td>
<td>Biological Assessment</td>
</tr>
<tr>
<td>BEACH</td>
<td>Washington’s Beach Environmental Assessment, Communication and Health Program</td>
</tr>
<tr>
<td>BETX</td>
<td>Benzene, Ethylbenzene, Toluene, or Total Xylenes</td>
</tr>
<tr>
<td>BNSF</td>
<td>Burlington Northern Santa Fe</td>
</tr>
<tr>
<td>CAO</td>
<td>Critical Areas Ordinance</td>
</tr>
<tr>
<td>CARAs</td>
<td>Critical Aquifer Recharge Areas</td>
</tr>
<tr>
<td>CWA</td>
<td>Clean Water Act</td>
</tr>
<tr>
<td>DMMP</td>
<td>Dredged Material Management Program</td>
</tr>
<tr>
<td>DNR</td>
<td>Department of Natural Resources</td>
</tr>
<tr>
<td>DOE</td>
<td>Department of Ecology</td>
</tr>
<tr>
<td>ECDC</td>
<td>Edmonds Community Development Code</td>
</tr>
<tr>
<td>Ecology</td>
<td>Washington State Department of Ecology</td>
</tr>
<tr>
<td>EFH</td>
<td>Essential Fish Habitat</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>ESA</td>
<td>Endangered Species Act</td>
</tr>
<tr>
<td>FEIS</td>
<td>Final Environmental Impact Statement</td>
</tr>
<tr>
<td>FEMA</td>
<td>Federal Emergency Management Agency</td>
</tr>
<tr>
<td>FHWA</td>
<td>Federal Highway Administration</td>
</tr>
<tr>
<td>FS</td>
<td>Feasibility Study</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information Systems</td>
</tr>
<tr>
<td>GMA</td>
<td>Growth Management Act</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>HDPE</td>
<td>High-Density Polyethylene</td>
</tr>
<tr>
<td>HPA</td>
<td>Hydraulic Project Approval</td>
</tr>
<tr>
<td>JARPA</td>
<td>Joint Aquatic Resource Permit Application</td>
</tr>
<tr>
<td>LUST</td>
<td>Leaking Underground Storage Unit</td>
</tr>
<tr>
<td>MHHW</td>
<td>Mean Higher High Water</td>
</tr>
<tr>
<td>MLLW</td>
<td>Mean Lower Low Water</td>
</tr>
<tr>
<td>MSA</td>
<td>Magnuson-Stevens Fisheries Conservation and Management Act</td>
</tr>
<tr>
<td>MSL</td>
<td>Mean Sea Level</td>
</tr>
<tr>
<td>MTCA</td>
<td>Model Toxics Control Act</td>
</tr>
<tr>
<td>MW</td>
<td>Monitoring Well</td>
</tr>
<tr>
<td>NMFS</td>
<td>National Marine Fisheries Service</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>NPDES</td>
<td>National Pollutant Discharge Elimination System ()</td>
</tr>
<tr>
<td>NWSSC</td>
<td>Northwest Salmon and Steelheaders Council</td>
</tr>
<tr>
<td>OHW</td>
<td>Ordinary High Water</td>
</tr>
<tr>
<td>OHWM</td>
<td>Ordinary High Water Mark</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Name</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
</tr>
<tr>
<td>PAH</td>
<td>Polycyclic Aromatic Hydrocarbon</td>
</tr>
<tr>
<td>PCBs</td>
<td>Polychlorinated biphenyls</td>
</tr>
<tr>
<td>PSAMP</td>
<td>Puget Sound Ambient Monitoring Program</td>
</tr>
<tr>
<td>PSDDA</td>
<td>Puget Sound Dredge Disposal Analysis</td>
</tr>
<tr>
<td>RCRA</td>
<td>Resource Conservation and Recovery Act</td>
</tr>
<tr>
<td>RCW</td>
<td>Revised Code of Washington</td>
</tr>
<tr>
<td>RI</td>
<td>Remedial Investigation</td>
</tr>
<tr>
<td>SMA</td>
<td>Shoreline Management Act</td>
</tr>
<tr>
<td>SMP</td>
<td>Shoreline Master Plan</td>
</tr>
<tr>
<td>SQG</td>
<td>Small Quantity Generators</td>
</tr>
<tr>
<td>SQS</td>
<td>Sediment Quality Standards</td>
</tr>
<tr>
<td>SVOCs</td>
<td>Semivolatile Organic Compounds</td>
</tr>
<tr>
<td>SWM</td>
<td>Surface Water Management</td>
</tr>
<tr>
<td>TMDL</td>
<td>Total Daily Maximum Load</td>
</tr>
<tr>
<td>TPH</td>
<td>Total Petroleum Hydrocarbons</td>
</tr>
<tr>
<td>USACE</td>
<td>U.S. Army Corps of Engineers</td>
</tr>
<tr>
<td>USFWS</td>
<td>United States Fish and Wildlife Service</td>
</tr>
<tr>
<td>USGS</td>
<td>United States Geologic Survey</td>
</tr>
<tr>
<td>UST</td>
<td>Underground Storage Tanks</td>
</tr>
<tr>
<td>VOCs</td>
<td>Volatile Organic Compounds</td>
</tr>
<tr>
<td>WAC</td>
<td>Washington Administrative Code</td>
</tr>
<tr>
<td>WDFW</td>
<td>Washington Department of Fish and Wildlife</td>
</tr>
<tr>
<td>WDNR</td>
<td>Washington Department of Natural Resources</td>
</tr>
<tr>
<td>WISAARD</td>
<td>Washington Information System for Architectural and Archaeological Records Data</td>
</tr>
<tr>
<td>WRIA</td>
<td>Water Resources Inventory Area</td>
</tr>
<tr>
<td>WSF</td>
<td>Washington State Ferries</td>
</tr>
</tbody>
</table>
1. Introduction

1.1 Background and Purpose
The purpose of the Shoreline Inventory and Characterization Report is to document baseline environmental conditions in the shoreline jurisdiction of the City of Edmonds (City), Washington. This inventory and characterization provides a basis for updating the City’s Shoreline Master Program to comply with the Shoreline Management Act (SMA), Revised Code of Washington (RCW) 90.58, and its implementing guidelines, Washington Administrative Code (WAC) 173-26. The inventory and characterization will help the City evaluate ecological functions and values of natural resources in its shoreline jurisdiction, and explore opportunities for conservation and restoration.

This report provides a framework of information that will support future updates to the City’s shoreline environment designations, shoreline management policies, and regulations.

1.2 Shoreline Jurisdiction and Study Area Boundary
Under the SMA, the shoreline jurisdiction includes areas that are 200 feet landward of the ordinary high water mark (OHWM) of waters that have been designated as “shorelines of statewide significance” or “shorelines of the state.” These designations were established in 1972 and are described in WAC 173-18. Generally, “shorelines of statewide significance” include portions of Puget Sound and other marine water bodies, rivers west of the Cascade Range that have a mean annual flow of 1,000 cubic feet per second (cfs) or greater, rivers east of the Cascade Range that have a mean annual flow of 200 cfs or greater, and freshwater lakes with a surface area of 1,000 acres or more. “Shorelines of the state” are generally described as all marine shorelines and shorelines of all other streams or rivers having a mean annual flow of 20 cfs or greater and lakes with a surface area greater than 20 acres. For this inventory, OHWM was defined as an elevation equivalent to mean higher high water (MHHW), to be consistent with interpretations by state agencies (e.g., Washington Department of Ecology).

This characterization focuses on the approximately 5.2 miles of Puget Sound marine shoreline within the city limits of the City of Edmonds (Figure 1). The shoreline of Puget Sound, including the shoreline within the City limits, is defined as a “shoreline of statewide significance” waterward of the line of extreme low tide [RCW 90.58.030(2)(e)(iii)], extending waterward (in Edmonds) to the offshore city limit (see Figure 1). Although there are other areas in Puget Sound with additional characteristics that are designated as “shorelines of statewide significance,” none is present in the Edmonds vicinity. Lake Ballinger, with a surface area of about 100 acres, qualifies as a “shoreline of the state” but is too small to be a “shoreline of statewide significance.” No streams within the City qualify as either a “shoreline of the state” or a “shoreline of statewide significance.”
Under the SMA, the shoreline area to be regulated under the City’s Shoreline Master Program must also include adjacent “shorelands,” which are defined as the upland area within 200 feet of OHWM, as well as any associated wetlands (RCW 90.58.030). “Associated wetlands,” means those wetlands that are in proximity to and either influence or are influenced by tidal waters or a lake or stream subject to the SMA (WAC 173-22-030 (1)). These are typically identified as wetlands that physically extend into the shoreline jurisdiction, or wetlands that are functionally related to the shoreline jurisdiction through a surface water connection and/or other factors. Specific language from the RCW describes the limits of shoreline jurisdiction as follows:

“Those lands extending landward for two hundred feet in all directions as measured on a horizontal plane from the ordinary high water mark; floodways and contiguous floodplain areas landward two hundred feet from such floodways; and all associated wetlands and river deltas” (RCW 90.58.030(2)(f)).

For this inventory, we included all wetlands and creeks that are directly hydraulically connected to shorelands as part of the Edmonds’ shoreline jurisdictional boundary. The approximate area of the shorelands is shown with a dashed line on some of the figures in this document; this line is not a surveyed line. It is a representation of the approximate location of the setback 200 feet from the OHWM jurisdiction.

1.3 Methodology

Information collected and reviewed to create this inventory and characterization was obtained from many sources, including the City, Snohomish County, and state and federal agencies. Some of the primary sources of data for the inventory’s geographic information systems (GIS) database are:

- City of Edmonds Community Development Code (2005);
- Snohomish County Marine Shore Inventory and Database (2001);
- City of Edmonds records and files;
- Washington State ShoreZone Inventory (2001);
- Coastal Zone Atlas of Washington (2001);
- Washington State Department of Fish and Wildlife Priority Habitats and Species, Priority Resident and Anadromous Fish Presence, Wildlife Heritage Points, Seabird Colonies, and Sea Lion Haulout Site reports (2006);

Numerous other data sources, including local and state databases and reports, were reviewed for best available science and information to inventory and characterize the Edmonds shoreline. These sources are cited in the document and References section. Data gaps are identified in Appendix A.

1.4 Shoreline Planning Segments

For the shoreline ecological inventory, the City’s shoreline jurisdiction was divided into nine segments (A through I), based on biological and physical features and ecological functions described in a recent Shoreline Habitat Assessment (Pentec Environmental 2001). The inventory segmentation focused on the aquatic environment and the adjacent shoreline features that directly
influence it. The subsequent characterization and analysis required that the segments be considered in conjunction with existing land uses and zoning designations, using a broader-scale assessment of ecological differences and similarities observable along the shoreline to develop four shoreline planning reaches that are consistent with Edmonds’ Comprehensive Plan and the Critical Areas Ordinance. Shoreline segments are described in Table 1 and depicted on Figure 2. Detailed segment descriptions are provided in Section 7. Shoreline planning reaches, which combine similar shoreline segments, are described in Table 2 and depicted on Figure 2.

Table 1. Shoreline Segments

<table>
<thead>
<tr>
<th>Segment</th>
<th>General Boundaries</th>
<th>Approx. Length (feet)(^1)</th>
<th>Approx. Percentage of City’s Shoreline Jurisdiction</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Lund’s Gulch to Perrinville Creek</td>
<td>7,100</td>
<td>23%</td>
</tr>
<tr>
<td>B</td>
<td>Perrinville Creek to Southwest County Park</td>
<td>2,100</td>
<td>7%</td>
</tr>
<tr>
<td>C</td>
<td>Southwest County Park to Fruitdale Creek</td>
<td>5,300</td>
<td>17%</td>
</tr>
<tr>
<td>D</td>
<td>Fruitdale Creek to Shell Creek</td>
<td>3,300</td>
<td>11%</td>
</tr>
<tr>
<td>E</td>
<td>Shell Creek to Edmonds Underwater Park</td>
<td>3,300</td>
<td>11%</td>
</tr>
<tr>
<td>F</td>
<td>Edmonds Underwater Park to Port of Edmonds</td>
<td>1,850</td>
<td>6%</td>
</tr>
<tr>
<td>G</td>
<td>Port of Edmonds Marina (including Edmonds Marsh and Shellabarger Creek)</td>
<td>3,200</td>
<td>10%</td>
</tr>
<tr>
<td>H</td>
<td>Port of Edmonds Marina to Point Edwards</td>
<td>900</td>
<td>3%</td>
</tr>
<tr>
<td>I</td>
<td>Lake Ballinger</td>
<td>4000</td>
<td>12%</td>
</tr>
</tbody>
</table>

\(^1\) - Does not include the length of constructed piers, jetties, breakwaters, or piers that extend waterward from shore.
Table 2. Shoreline Planning Reaches

<table>
<thead>
<tr>
<th>Reach</th>
<th>General Boundaries</th>
<th>Segment</th>
<th>Approx. Length (feet)</th>
<th>Approx. Percentage of City’s Shoreline Jurisdiction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lund’s Gulch to Caspers Street</td>
<td>A, B, C, D, north half of E</td>
<td>19,351</td>
<td>64%</td>
</tr>
<tr>
<td>2</td>
<td>Caspers Street to Main Street</td>
<td>South half of E, north half of F</td>
<td>2,253</td>
<td>7%</td>
</tr>
<tr>
<td>3</td>
<td>Main Street to Point Edwards</td>
<td>South half of F, G, H</td>
<td>4,716</td>
<td>16%</td>
</tr>
<tr>
<td>4</td>
<td>Lake Ballinger</td>
<td>I</td>
<td>3,947</td>
<td>13%</td>
</tr>
</tbody>
</table>

1 - Does not include the length of constructed piers, jetties, breakwaters, or piers that extend waterward from shore.
2. Current Regulatory Framework Summary

2.1 City of Edmonds Plans and Regulations

2.1.1 Current Shoreline Management Act Compliance

The City of Edmonds first adopted a shoreline master program in the 1970s consistent with the SMA of 1971. Over the years, the City of Edmonds made minor amendments to its Shoreline Master Program (SMP). In 1996, the City began an update of the SMP. This effort resulted in a revised SMP adopted by Edmonds City Council in 2000 in Ordinance 3318, Section 3. The adopted SMP is found in Edmonds Community Development Code (ECDC) Chapter 23.10. The SMP was adopted as both a policy plan and a regulatory program. It was developed to be consistent with the City of Edmonds Comprehensive plan and its component elements (ECDC 23.10.030.)

This chapter is divided into the following five parts, consistent with the material to be included within a master program as established in Chapter 173-26 WAC: Part I, contains basic and general information regarding the shoreline master program. Part II, contains the City’s goals and policies with respect to the seven program elements established in Chapter 173-16 WAC. Part III contains information regarding the different shoreline environments to be found within the City. Part IV contains regulations that apply to the various uses, developments, and activities that are regulated under the shoreline master program. Part V contains appendices pertaining to the shoreline master program.

Part III of the Edmonds SMP establishes the environmental designations for various shoreline areas of the state. The different environment designations are intended to provide a way to regulate shoreline use developments and activities in the different areas of the City’s shoreline. Specific use regulations found in the Edmonds SMP apply to the different environment designations. The current Edmonds SMP contains five different environment designations: Conservancy, Natural, Suburban Residential, Urban Mixed Use, and Urban Railroad. The SMP provides boundary descriptions for each of the environments. The official map of the City designating the various shoreline environments is adopted by reference in ECDC 23.10.110.

In December 2003, the state of Washington adopted new guidelines consistent with RCW 90.58.020 for development of local shoreline master programs. The 2003 legislature adopted a schedule for updating local shoreline master programs (SSB 6012). The City of Edmonds is required to adopt an amended SMP consistent with the new Guidelines by 2011. However, all jurisdictions may amend their SMP at any time before the scheduled date. Edmonds has chosen to begin its update in 2006. It applied for and was awarded a grant to complete this work by the Washington State Department of Ecology (Ecology). The City SMP update will be complete by June 2007.
2.1.2 Comprehensive Plan, Zoning, and Other City Regulations

2.1.2.1 City of Edmonds Comprehensive Plan

The City of Edmonds amended its comprehensive plan in 2004 in compliance with the Growth Management Act (GMA) (RCW 36.70A.) The comprehensive plan has the following purposes:

A. To serve as the basis for municipal policy on development and to provide guiding principles and objectives for the development of regulations.

B. To promote the public health, safety, order, convenience, prosperity, and the general welfare and values of the community.

C. To anticipate and influence the orderly and coordinated development of land and building use of the City and its environs and conserve and restore natural beauty and other natural resources.

D. To encourage coordinated development and discourage piecemeal, spot or strip zoning, and inharmonious subdividing.

E. To facilitate adequate provisions for public services (such as transportation, police and fire protection, water supply, sewage treatment, and parks).

The comprehensive plan contains land use types and compatible zoning classifications. Along the Edmonds shorelines, land is designated as Single Family, Park and Open Space, and Master Plan Development. The City designations for land use are important to the shoreline to establish the general land use pattern and provide the policy guidance for development of shoreline environment designations within the Edmonds SMP.

The Edmonds comprehensive plan contains a land use element specific to the downtown waterfront area titled Downtown Waterfront Activity Center. This element of the comprehensive plan incorporates a number of other planning efforts for the Edmonds waterfront, including the 1994 Downtown Waterfront Plan. This section of the Edmonds comprehensive plan provides policy guidance for the shoreline master program. It contains descriptions of the different waterfront areas and waterfront area policies.

2.1.2.2 City of Edmonds Zoning Code

City of Edmonds Community Development Code, Titles 16 and 17, contain the zoning ordinance for Edmonds. Title 16 contains the designations and accompanying regulations for the City of Edmonds. These designations are consistent with the Edmonds Comprehensive Plan. Title 16 contains the designations, their purposes and development standards. Title 17 contains general zoning regulations applicable to all zoning districts (Figure 3).

2.1.2.3 City of Edmonds Environmentally Critical Areas Code

Title 23.40 of the Edmonds Community Development Code (ECDC) contains the environmentally critical areas code for the City of Edmonds. This title implements the goals, policies, guidelines, and requirements of the comprehensive plan and the Washington State GMA requirements to protect critical areas of the City. These regulations are intended to protect critical areas through the application of the best available science, as determined by WAC 365-195-900 through 365-195-925 and RCW 36.70A.172. The regulations were adopted by Ordinance 3527, Section 2 in 2004. The regulations contain a critical area review process,
including mitigation planning, requirements and sequencing, allowed activities, exemptions, noncompliance penalties, and protective measures. Specific natural resources addressed in the Edmonds Community Development Code are as follow: Wetlands, ECDC 23.50; Critical Aquifer Recharge Areas (CARA), ECDC 23.60; Frequently Flooded Areas, ECDC 23.70; Geologically Hazardous Areas, ECDC 23.80; and Fish and Wildlife Habitat Conservation Areas, ECDC 23.90. These environmentally critical areas (Figure 4) apply to the City’s shoreline jurisdiction.

2.2 State and Federal Shoreline Regulations

Development in or above federally or state-designated waters generally requires permits from local, state and federal agencies. Project review and authorization, in the form of permit-applications, are usually required when changes to federally navigable waters, state waters, or fish and wildlife habitat are anticipated.

For tidal waters, construction activities are regulated by the local jurisdiction (in this case, Edmonds), Washington Department of Ecology, and the Washington State Department of Fish and Wildlife (WDFW), U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (USEPA). In addition, the National Oceanic and Atmospheric Administration’s National Marina Fisheries Service (NOAA Fisheries) and U.S. Fish and Wildlife Service (USFWS) must concur that any project requiring federal approvals (a USACE permit, for example) is consistent with the Endangered Species Act (ESA). These agencies will require that proposed projects avoid or offset project impacts on certain fish and wildlife species through design and/or environmental controls and/or restoration activities.

Each agency defines its in-water jurisdiction based on an established water elevation, which extends landward from the water to extreme high water, mean higher high water (MHHW), mean high water, or ordinary high water (OHW), depending on the agency. Permits and approvals that are typically required by agencies with regulatory authority in shoreline/shoreland areas are described below.

2.2.1 Shoreline Substantial Development Permits

The City of Edmonds is the local permit authority for construction activities waterward of OHW and within 200 feet of the OHWM for uplands. All shoreline permits are processed by the City of Edmonds pursuant to Edmonds Municipal Code, 23.10.035. The City is also responsible for State Environmental Policy Act (SEPA) compliance of a project. Following the local government decision on all permit applications, applications are sent to Ecology. Ecology must approve, approve with conditions, or deny each conditional use permits and variances. Ecology does not have direct approval authority over the more common Shoreline Substantial Development Permits (SDP) if they are found inconsistent with the local SMP and the SMA, Ecology may file an appeal with the Shorelines Hearings Board.

2.2.2 WDFW Hydraulic Project Approval (HPA)

Any form of work that uses, diverts, obstructs, or changes the natural flow or bed of any freshwater or saltwater of the state requires an HPA from WDFW. The purpose of the HPA is to address potential project impacts, through construction and operation, on state-managed fish and wildlife species in fresh and marine waters. Saltwater activities requiring an HPA include construction of bulkheads, fills, boat launches, piers, dry docks, artificial reefs, dock floats, marinas, placement of utility lines, pile driving, and dredging. The state jurisdiction for an HPA
is defined as proposed construction or work waterward of the MHHW line in saltwater and OHW in fresh water (See Chapter 220-110 WAC), for all lakes, streams, and marine waters in Edmonds.

A Joint Aquatic Resource Permit Application (JARPA) is a Washington State-designed project information form and notification document used for preparing a permit application for an HPA. Drawings of the proposed project are submitted along with the JARPA form to WDFW for review and permit issuance. The JARPA form is also submitted to other local, state, and federal agencies for their reviews and approvals.

2.2.3 Ecology Section 401 Water Quality Certification

The Federal Water Pollution Control Act (commonly referred to as the Clean Water Act [CWA]) regulates discharges of pollutants into federally designated waters, which include Lake Ballinger, Edmonds Marsh, and the marine waters along the Edmonds shoreline. Under the CWA, Ecology is authorized by USEPA to regulate and administer water quality discharge permits through the Section 401 Water Quality Certification. The Water Quality Certification includes construction-generated water discharges, including site stormwater runoff, into federally/state-designated waters. Water Quality Certification is typically issued in conjunction with the Section 404 permit process administered by USACE and described below. Upland projects outside of the shoreline jurisdiction that affect groundwater or involve discharges of sewage or stormwater, also require water quality permits from Ecology under Section 401 authorization if they discharge into waters of the state. Outfall construction for discharges within the shoreline jurisdiction also requires Section 401 Water Quality Certification.

2.2.4 USACE Clean Water Act Section 404 and Rivers and Harbors Act Section 10

USACE administers Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. Permit compliance for both acts is triggered by construction in “navigable waters,” including rivers, harbors, and marine nearshore areas designated by the federal government; a Section 404 permit is issued for dredging or filling navigable waters, including wetlands. Typical shoreline construction projects in marine waters, such as construction or maintenance of bulkheads, piers, and docks, are subject to both Sections 10 and 404 approvals and typically require individual permit applications and extensive reviews and negotiation to obtain USACE approvals; however, simple repair and maintenance activities of such structures may be allowed under a Nationwide Permit. Nationwide Permits are part of an expedited permit process that allows USACE to authorize work that falls under certain thresholds of disturbance.

The project permit application for USACE authorization consists of a JARPA (same as the one submitted for an HPA) and a set of project drawings (same as the one submitted for an HPA).

Before USACE can issue permit approvals for a project, it must obtain project review and concurrence under the ESA Section 7 for all federally designated threatened or endangered species in the project area. Section 7 and other relevant sections of the ESA are administered by the USFWS and the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS), referred to as NOAA Fisheries.
2.2.5 *NOAA Fisheries and USFWS Endangered Species Act (ESA) Section 7*

NOAA Fisheries and USFWS administered the ESA for all federally permitted, funded, or authorized projects located in areas where a federally designated threatened or endangered species is known to occur. All federal agencies, including USACE, must coordinate their construction-related authorizations with NOAA Fisheries and/or USFWS (depending on the species present in the area) to protect threatened and endangered species. Potential project effects on federally designated threatened or endangered species are addressed through a Biological Assessment (BA), following specific analytical guidelines that are described in the Endangered Species Consultation Handbook and subsequent memoranda issued by NMFS (now NOAA Fisheries). In addition, other agencies, including USACE and the Washington Department of Transportation, have interpreted and developed their own guidance requirements for making a biological evaluation. Ultimately, NOAA Fisheries and USFWS are responsible for reviewing the BA and providing a Biological Opinion that describes the conditions under which a project may proceed. They do not issue permits—they provide written authorization, so that other permits may be issued without violating provisions of the ESA.

NOAA Fisheries also requires compliance with the Magnuson-Stevens Fisheries Conservation and Management Act (MSA) for federally permitted, funded, or authorized projects in areas with designated habitat for commercial fisheries species. In Washington nearshore areas, habitat for commercial fish species often overlaps with habitat for threatened and endangered fish species protected under the ESA. An analysis of potential project effects, similar to a BA, is required for MSA commercial fisheries and designated habitat. This is called an Essential Fish Habitat (EFH) assessment. Often NOAA Fisheries will prepare the EFH assessment and provide it with a letter of concurrence or a Biological Opinion for ESA-listed species.

Numerous federally designated threatened and endangered species protected under the ESA may be found within Edmonds shoreline and shoreland areas. As of 2006, some ESA-listed species within Edmonds marine shorelines include Chinook salmon and bull trout. These species must also be evaluated if their habitat extends into fresh water streams and wetlands; however, they have no formally designated presence/habitat in Edmonds Marsh, Lake Ballinger, or other city streams and drainages. Because Chinook salmon is also a commercial fish species protected under the MSA, it would also be considered in an EFH assessment. Bald eagle may be present along freshwater, brackish, or marine shorelines in Edmonds, so a project-specific analysis is necessary to determine if ESA compliance would be triggered. Other species are proposed for listing or added to the list over time, so it is necessary for each proposed project to address the most current listing of all threatened and endangered species. The current status of every federally designated species is recorded in the Federal Register and available online.
3. Watershed Characterization

A watershed is naturally determined by topography, rainfall, vegetation, soils, and geologic conditions but is significantly affected by land use activities, including earth moving and filling, vegetation clearing, water extraction and diversion, drainage channelization and impounding, and paving. The City of Edmonds lies within multiple small watersheds and one large one. For purposes of this report, the Edmonds Watershed is defined as the small streams that flow directly to Puget Sound and discharge into the shoreline jurisdiction of the City of Edmonds. These include Lund’s Gulch Creek, Perrinville Creek, Fruitdale Creek, Northstream Creek, Unnamed Creek, Shell Creek, and Shellabarger/Willow Creek. The southeast corner of Edmonds that drains into Lake Ballinger is part of the Lake Washington watershed, identified by the state as Water Resources Inventory Area (WRIA) 8. About 13 percent of the City (808 acres) drains into WRIA 8 via Lake Ballinger and McAleer Creek.

The Edmonds Watershed consists of a series of relatively short and deeply incised drainages that have cut through the high marine bluff that characterizes much of the Central Sound western shore between Everett and Seattle. Each drainage consists of a narrow ravine, flanked by a narrow corridor of shrubs and mixed coniferous and deciduous trees, surrounded by moderate to dense residential development. The largest drainage area, occupied by the oldest part of the City, includes two convergent creeks (Willow and Shellabarger) and a broad estuarine wetland (Edmonds Marsh) that has been largely filled and channeled by decades of industrial and commercial development.

The Lake Washington watershed includes Lake Ballinger, part of which drains the southeast corner of the City. The surrounding subbasin consists of dense residential development surrounding the lake, and a narrow strip of commercial development along the I-5 corridor.

3.1 Ecosystem-wide Processes

Puget Sound is a deep, glacially carved fjord-like estuary that connects to the Strait of Juan de Fuca through Admiralty Inlet and Deception Pass. It extends approximately 140 miles in a north-south direction, reaches a maximum depth of greater than 850 feet, and is characterized by a series of relatively deep basins separated by shallower sills. The Strait of Juan de Fuca opens into the North Pacific Ocean between Washington State and Vancouver Island in Canada. The tidal pattern of Puget Sound is dominated by a mixed semidiurnal tidal cycle, characterized by two unequal high tides and two unequal low tides each day, with a large tidal exchange averaging between 12 and 14 feet. The City of Edmonds lies in the northern portion of Puget Sound’s Central Basin. This area of Puget Sound is called the Triple Junction region. In the Triple junction region, Admiralty Inlet and Possession Sound join the Central Basin at the southern end of Whidbey Island (KC DNR WTD 2003).
3.1.1 Climate
The Puget Lowland has a maritime climate with cool winters, dry summers, and a distinct rainy season. The City of Edmonds receives an average of 37.2 inches of precipitation per year, mostly as rain. Temperatures range from a mean of 40.1 degrees in January to a mean of 65.2 degrees in July, with an average high temperature of 75.2 degrees and an average low of 35.2 degrees (City of Edmonds 2005). During the latter half of the summer and early fall, the lower valleys are sometimes filled with fog or low clouds until noon, while at the same time, the higher elevations are sunny. Winds are generally from the southwest during the rainy season (early October through mid-April) and from the northwest during the dry summer months (WRCC 2006).

3.1.2 Topography
Edmonds is located in the central part of the Puget Lowland, which is bounded on the east by the Cascade Range and on the west by the Olympic Mountains. The Puget Lowland is characterized by north-south trending valleys and hills in low relief, with intervening elongated saltwater and freshwater bodies.

The City itself occupies a gently sculpted upland that ranges from 300 to 500 feet above mean sea level (MSL), with west-facing slopes that descend to Puget Sound. This area has been termed the Intercity Plateau. Creeks drain westward off of the upland into Puget Sound. A small area in the eastern part of the City is drained by heavily dissected south-flowing streams that drain directly or indirectly into Lake Washington (KC DNR WTD 2003).

The westward-flowing drainages (e.g., Lund’s Gulch Creek) typically consist of narrow, deeply incised V-shaped ravines with steep walls composed largely of glacial soils. Perennial streams drain the basins, each descending approximately 500 vertical feet over horizontal distances ranging from 0.8 to 1.5 miles (Snohomish County SWM 2002).

3.1.3 Geology and Soils
Geology and soils determine many physical characteristics of a shoreline and influence the nearshore processes that continually re-shape the shore. A shoreline’s substrate and slope are the result of geologic processes that created the underlying landforms and provide the overlying material that weathers into soils and beach substrates. In unstable, steep areas with easily eroded soils, a combination of underlying geology, slope, and soils can create “feeder bluffs”, where landslides contribute large quantities of soils to the nearshore to provide new material (sand and gravel) to eroding beaches. Not all eroding bluffs “feed” shoreline beaches—longshore currents and bathymetry may carry eroded material into deeper subtidal areas farther off shore, rather than distributing it along upper beach elevations. No specific studies were found that documented location of feeder bluffs along the city shoreline; for practical purposes, however, no feeder bluffs exist along the Edmonds shoreline because the railroad bed prevents most landslide material from reaching the beach.

The inland portions of the City of Edmonds are typically underlain by Vashon till (Qgt), a glacially-deposited, dense, compacted mixture of gravel, sand, and silt that mantles the upland regions of central Puget Sound (Figure 5). In some areas, such as near Lake Ballinger, the till is overlain by discontinuous deposits of more-recent recessional outwash (Qgo) and alluvium (Qa). Along the shore of Puget Sound, and in the stream valleys that drain to the sound, the till has been eroded exposing underlying advance outwash (Qga, Qga(t), Qcg, Qgu) and older pre-Fraser deposits (Qc(w)). A significant wetland deposit (Qa) and an area of artificial fill (Qf) occur at
Edward’s Point and the Edmonds Marina and Washington State Ferry terminal, respectively (WDNR 2005).

Most soils in the City of Edmonds belong to the Alderwood-Everett soil map unit (Figure 6). Alderwood soils are formed on the Vashon till. These soils are moderately deep and moderately well drained. The surface layer is gravelly sandy loam, and the subsoil is very gravelly sandy loam. A weakly cemented hardpan is at a depth of about 20 to 40 inches. Everett soils are formed on the advance and recessional outwash deposits. These soils are very deep and somewhat excessively drained. The surface layer is gravelly sandy loam and the subsoil is very gravelly sandy loam. The substratum to a depth of 60 inches or more is very gravelly loamy sand over extremely gravelly sand (NRCS 2006).

3.1.4 Surface Water and Groundwater

Within the City jurisdiction, most surface water within the Edmonds Watershed flows directly into Puget Sound through numerous small creeks, all exhibiting similar drainage patterns through the central Puget Sound west shoreline. In general, the headwaters of the main stems are in relatively flat, developed areas. The streams carry runoff from these areas into steep ravines before flowing into Puget Sound. The existing drainage systems in the upper watershed consist of a network of pipes and ditches, built to older design standards, which collect and convey stormwater runoff from paved and other hardened surfaces directly to streams. Over the past several decades, the volume of stormwater flowing into the main stem and tributaries has increased significantly compared to pre-development volumes. Discharge rates have also increased, causing an increase in flooding events and in erosion of the ravine channels as the stream works to adjust its size to accommodate the increased flows (Snohomish County SWM 2002).

Lund’s Gulch Creek drains an area of approximately 2.3 square miles (1,440 acres), although probably less than 5 percent lies within the City of Edmonds. The upper portion of the basin is flat with drainage systems consisting of older ditch and culvert systems that lack sufficient conveyance capacity. The upper watershed is urbanized with medium to high-density residential development. Commercial development is also located along the Highway 99 corridor. Notable hydrologic features in the basin include a 21-acre forested wetland and a regional detention facility located upstream of 52nd Avenue. Lund’s Gulch Creek flows from 52nd Avenue, through a steep forested ravine to Southwest County Park, and then to Puget Sound (Snohomish County SWM 2002).

The majority of Lake Ballinger lies within the City of Mountlake Terrace, although approximately 0.75 miles of shoreline (37 acres of surface area) are within the City of Edmonds. The lake drains into McAleer Creek, which flows into Lake Washington. The lake has an average depth of 15 feet and a maximum depth of 35 feet (Bell-McKinnon 2006). It is eutrophic, meaning that it is nutrient-rich. Within the City, the shoreline is dominated by single-family homes, with numerous docks and piers. The lake receives stormwater runoff from the Cities of Edmonds, Lynnwood, Mountlake Terrace, and Shoreline, and areas of south Snohomish and north King Counties. In addition, it receives stormwater inputs (and accompanying water quality problems) via Hall Creek, which flows into the north end of Lake Ballinger.

The groundwater system in western Snohomish County, including the Edmonds area, consists of a sequence of aquifers and confining units within the unconsolidated geologic deposits. From stratigraphically highest to lowest, the principal aquifers in the area occur in the alluvial deposits (e.g., Qa), recessional outwash (Qgo), and advance outwash (Qga, Qga(t), Qcg, Qgu). The
Vashon till (Qgt) and pre-Fraser deposits (Qcw) typically act as confining units in this area (Thomas et al. 1997).

Recharge to the groundwater system occurs primarily by infiltration and percolation of precipitation. Recharge occurs throughout upland areas of the City area, except in locations that are covered by impervious materials such as buildings or pavement. Groundwater flows from the upland recharge areas toward plateau edges or stream valleys. Groundwater discharges to surface-water bodies such as streams, lakes, and marshes to springs, and seeps along stream valleys and bluffs directly to Puget Sound (Thomas et al. 1997).

CARAs are defined by WAC 365-190-030(2) as those areas with a critical recharging effect on aquifers used for potable water. CARAs are protected as critical areas under the Washington State GMA. CARAs have prevailing geologic conditions associated with infiltration rates that create a high potential for contamination of ground water resources or contribute significantly to the replenishment of ground water. No areas meeting criteria for CARAs exist in the vicinity of the City of Edmonds (ECDC 23.60.010).

3.1.5 Coastal Processes

Steep, gradually receding bluffs commonly back the shoreline along Edmonds. In a natural system, over time, bluffs erode and recede landward, providing sediment to the shore. Prior to vegetation clearing and construction of bulkheads and other structures that protect property from wave and tidal action, natural bluff recession rates were generally quite slow in most of Puget Sound (Adolfson 2004). Vegetation reduces erosion by holding surficial soil layers in place, absorbing water, and dispersing rainfall energy and runoff. Sediment that accumulates at the base of bluffs helps to protect the bluff from further erosion and reduces the recession rate.

Under natural conditions, sediment from eroded bluffs may enter the intertidal zone within the nearshore, where it is subject to transport by waves and water currents. Along the west shore of Central Puget Sound, the BNSF railroad bed forms a nearly continuous barrier between the eroding bluffs and the intertidal zone, reducing or preventing natural sediment influx. The waterward side of the railroad bed is armored by either a sloped or vertical seawall, which extends through the commercial area and marina (Figure 7). Prevailing winds and waves cause sediment to drift along the shore, primarily within the intertidal zone. Sediment that is sufficiently small (typically sand), is suspended for short durations by wave action and is transported along the shore parallel to the beach. Gravel is transported by rolling (saltation) as a result of storm waves. The direction of drift transport is generally in the direction of prevailing winds, which may differ in the summer and winter. The predominant, or net, shore-drift direction is the most important consideration for coastal processes (Adolfson 2004). Net shore-drift is determined through geomorphologic analysis of beach sediment patterns and of coastal landforms.

Many shorelines can be divided into discrete littoral, or shore, drift cells, which are independent of one another and for which distinct sediment sources and sinks can be identified. Heightened concerns about the adverse impact of shoreline modifications on geologic processes, and consequently, on nearshore biological resources, has created a need for information on longshore sediment transport. The Net Shore-Drift in Washington State program (Ecology 2002) map coverage denotes the extent of individual drift cells and the direction of net shore-drift within the littoral zone for much of Puget Sound (see Figure 5).
3.1.6 Historic Land Use Development

According to the 1909 Sanborn map, the present location of the State Ferry terminal had been used for maritime transportation at that time. The property was then called the “City Dock,” and it contained a freight warehouse that was used for shipping. Civic improvements continued with construction of a new City wharf in 1911.

Puget Sound Navigation, commonly known as the Black Ball line, controlled most of the regional ferry routes, until cross Sound service was taken over in 1951 by the State Ferry System. Seattle-Everett electric interurban trains also served Edmonds for several decades. This service began in 1910 and reduced the market for the steamboat service of the Telegraph and City of Everett, the last two ships on the Seattle-Edmonds-Everett route. By that date the Great Northern Railroad had double-tracked its roadway through Edmonds with eight daily trains at its new depot. Later, increased competition from private vehicles resulted in reduced services (BOLA Architecture + Planning 2005).

In the 1920s, a sea dike and a sea gate were built to prevent floods of the tide flat areas southwest of downtown, near Edmonds Marsh. In 1924, a Unocal tank farm facility substation was established east of the railroad tracks near the foot of Dayton Street. Uses of the Edmonds waterfront began to shift from traditional industries to alternate commercial businesses in the 1940s and 1950s. In the 1950s, the Port of Edmonds expanded its breakwater and built a small marina on the site of former mills. Restaurants and shopping mall retailers began constructing new facilities in the marina area (BOLA Architecture + Planning 2005).

3.2 Shoreline Uses

Numerous plant and wildlife species depend on shorelines for the variety of conditions and functions that these transitional habitats provide. Competing uses are high in the shoreline jurisdiction, with human activities and structures dominating most of the shoreline jurisdiction uplands and influencing sizable areas of aquatic elevations, from the waters’ edge outward to navigable depths. Overall, regional shoreline aquatic habitat is relatively stable, due to the presence of the BNSF railroad. The effect of this significant structure dividing the upper intertidal marine shorelands from upland shorelands is discussed in greater detail in subsequent report sections. The Edmonds shoreline is an indicative example of the majority of marine shoreline in this area. To a great extent, shoreline development in this regional area is limited by the lack of marine-to-upland access due to the BNSF railroad right-of-way.

The central Puget Sound marine shoreline in the vicinity of Edmonds, between Seattle and Everett, is dominated by urban structures, including transportation-related, residential, and commercial facilities, and pavement to provide vehicle access and parking. The few areas with pedestrian beach access also feature roads, flanked by paved walkways, which further eliminate habitat in favor of vehicles and people. The railroad bed adds an additional 35- to 75-ft-wide swath of rock pavement in the upper intertidal and adjacent upland shoreland along most of the central Puget Sound west shore. Structures in marine aquatic areas include railroad bed, bulkheads, ferry docks, commercial piers, sewer and stormwater outfalls, and a few residential structures. Freshwater shoreline uses consist largely of non-native landscaping, small residential-related structures, small piers and docks, and paved roadways. There is little “passive” human use of shoreline areas along the metropolitan extent of this area of Puget Sound—even the parks are developed with pavement, roads, structures, stormwater pipes, wastewater treatment facilities, and managed (unnatural or non-native) vegetation. The steep bluffs that abut large segments of
marine shorelines are also highly influenced by human activities, through vegetation clearing for construction and “views.” The remaining small-scale, immature vegetation is inadequate for slope stabilization, contributing to erosion and landslides that regularly destabilize large areas of shoreland that would otherwise be undeveloped and available to wildlife.

Within the intertidal and subtidal portions of the central Puget Sound area, aquatic and shoreland habitats are used by fish, shellfish, and wildlife. Common wildlife species that adapt to urbanized areas, such as deer, coyote, raccoon, and opossum, are present along this regional shoreline. Because Puget Sound is a regional flyway for migratory birds, numerous birds, including rare or unusual species, are regularly observed along the shoreline. Many migratory birds congregate in the large Snohomish River estuary to the north, transiting along the Snohomish County shoreline. Port Susan, north of the Snohomish River estuary, provides critical habitat for large numbers of shorebirds during spring and fall migrations and for birds staying during winter. It is one of only four sites in Puget Sound that regularly support more than 20,000 shorebirds in a season (Seattle Audubon Society 2006). Large flocks of wintering ducks use the sloughs and sheltered bays. In winter, trumpeter and tundra swans and large numbers of snow geese forage along the shoreline and in the fields. Short-eared owls are regularly seen, as are other unusual sparrows such as Harris’s, American tree, white-throated, vesper, and clay-colored. Many species of wintering raptors, including snowy owl and bald eagle, are attracted to the area. Further south, the Seattle shoreline along Discovery Park attracts abundant and diverse migratory bird species, including western grebe, red-throated and common loons, marbled murrelet, and rhinoceros auklet. Parasitic jaeger, Bonaparte’s gull, and common tern are species present in late summer and fall. Five common species of gull use the beach all winter. Brant geese are commonly observed during spring migration foraging on eelgrass. Spring- and fall-migrating shorebirds, such as surfbird and ruddy and black turnstones, use rocky beach areas, while sanderlings use sandy beaches and remain all winter (Seattle Audubon Society 2006). Edmonds lies within the regional shoreline between these two important bird stop-over areas. The City of Edmonds sponsored an International Migratory Bird Day event in 2005 to raise awareness of the value of the shoreline and adjacent areas as migratory bird habitat.

Birds protected under the ESA that are frequently observed in this region include bald eagle and marbled murrelet.

Marine mammals, such as harbor seals and sea lions, are frequently observed in the nearshore areas. Dall’s porpoise, harbor porpoise, and killer whale also inhabit the deeper waters of this regional shoreline area. The Southern Resident population of killer whale, consisting of J, K, and L pods, is listed under the ESA as endangered. This protected population, which sometimes appears in central Puget Sound during the height of the fall Chinook and chum salmon migrations, is not present in Puget Sound from early to mid-February through May or June (Wiles 2004).

Much of the marine food web is supported by the seasonal concentrated presence of salmon and trout runs, which provide the basis for commercial, recreational, and tribal fisheries. Chinook, coho, pink, and chum salmon, steelhead, and cutthroat and bull trout stocks from the Snohomish River and southern Puget Sound rivers likely migrate along the central Puget Sound western shoreline as juveniles. Several adult bull trout, rarely caught in Puget Sound, were tagged and tracked migrating along the Snohomish County shoreline between the Stillaguamish River (north of the Snohomish River) and Seattle (Salmon Bay and Elliott Bay/Green River) in 2003 (Goetz et al. 2004). Salmonid species listed as threatened species under the ESA in Puget Sound include Chinook salmon and bull trout.
The presence of a nearly continuous band of eelgrass along the Snohomish and King County shoreline provides critical habitat for juvenile salmonids, in addition to other fish species. Forage fish (e.g., surf smelt, sand lance, and Pacific herring) forage and spawn intertidally and form the foraging base for salmon and many other species of marine fish and shorebirds.

In this central Puget Sound region near Edmonds, human use of the shoreline is primarily for transportation, with the BNSF railroad bed constituting the largest area of use and other regional transportation hubs (e.g., former Unocal pier, WSF terminal, SR-104) comprising smaller areas of use. Residential housing is the other major use of this regional shoreline area. Commercial uses, including marinas, piers and docks, restaurants, and offices, occupy a relatively small area of regional shoreline, clustered in the urban cores of cities. Passive human use, such as picnicking and beachcombing, is concentrated at the city and county parks that provide parking and public access. Small “hobo camps” of transients occur at regular intervals along the BNSF railroad, usually hidden in the lower wooded reaches of the numerous ravines along this shoreline. Recreational, tribal, and commercial fishing and shellfish harvesting constitute a major human use of aquatic resources between Everett and Seattle.

3.2.1 Tribal Fisheries

Several tribal nations recognized as “Puget Sound Treaty Tribes” have fishing rights at all “usual and accustomed grounds and stations” in Puget Sound and the Strait of Juan de Fuca. Tribes have commercial fishing rights for salmon in their usual and accustomed fishing areas and also have the legal right to harvest shellfish and bottom fish from the same areas. Management of tribal and commercial fishing is a joint effort of WDFW and the treaty tribes. Recognized tribes participating in the management of Central Puget Sound fisheries are the Lummi, Suquamish, Swinomish, and Tulalip (CH2M HILL 2004). Other tribes, including the Upper Skagit, Duwamish, and Muckleshoot, have also claimed historic use of this area.

Current commercial fisheries near Edmonds include fisheries for salmon, Dungeness crab, spot prawn, and spiny dogfish. There is a tribal shrimp harvest area located on a 200- to 300-foot depth band from Point Edwards to roughly one mile north of Picnic Point (CH2M HILL 2004).

In addition to commercial fishing, these tribes also harvest fish in their usual and accustomed areas for ceremonial and subsistence purposes. Fishing quotas and fishing open dates are negotiated from year to year, based on return projections calculated by tribal and WDFW harvest management biologists. During the past decade, because of poor salmon returns in the same years, the number of fishing days has dwindled to as few as three days each for the state and tribal fisheries in Salmon Management Area 10 (CH2M HILL 2004).

3.2.2 Commercial Fisheries

The following information was taken primarily from the Brightwater FEIS (KC DNR WTD 2003). Dungeness crab is the only commercially harvested crab species in Puget Sound, with the commercial harvest usually extending from October to April. Occasionally there are commercial harvest openings for short periods during the summer and at other times of the year.
The Edmonds shoreline falls within the WDFW Crustacean Management Region 4, Catch Area 26B and Management Region 2W, Catch Area 26A. Most of the commercial harvest for Dungeness crab occurs north of Everett; however, commercial harvesting does occur near Edmonds in Catch Area 26A. The commercial fishery in Catch Area 26B is currently closed to commercial harvest.

There is a commercial spot prawn fishery (both state and tribal) in Puget Sound, including in the vicinity of Edmonds. The management regions and catch areas are the same as those for Dungeness crab. The state commercial fishery remains open for 1 to 2 months, typically from June until the end of July. The quota is typically reached quickly and the fishery lasts approximately two weeks per season. Catch Areas 26A and 26B are two areas that open early to spot prawn fishing if test fishing shows that fewer than 2 percent of the females have eggs. Under these conditions, fishing is allowed in these two areas from approximately April 11 through October 15, or until quotas are reached.

There is currently a commercial spiny dogfish fishery in Central Puget Sound. Fishing typically occurs from Possession Bar south to Port Madison. The primary fishing gear used is long line, but set nets may also be used. While the fishery is open year-round, most fishing occurs in the spring and fall. The fishery generally occurs in water depths between -100 to -300 feet Mean Lower Low Water (MLLW).

3.2.3 Recreational Fisheries

Along the City waterfront are two WDFW management areas: Salmon Management Area 9, located north of the Edmonds Marina; and Salmon Management Area 10, located south of the marina. The coho season extends from roughly mid-September to early October, and the chum season extends from October through November. Salmon Management Area 9 is usually closed to non-treaty tribal commercial salmon fishing; therefore, the northern border of Salmon Management Area 10, located south of the Edmonds Marina, is a popular location for coho salmon fishing.

Sport fishers in Puget Sound target a wide range of salmonids, including coho salmon, king (Chinook) salmon), steelhead trout, pink salmon, cutthroat trout, and blackmouth (immature Chinook salmon). Fishing intensity is highest in the fall when salmon return to spawn in tributary streams and rivers. Sport fishing activity in the vicinity of Edmonds is generally concentrated off Point Edwards just south of the ferry terminal (Parametrix 2001a, cited in KC DNR 2003). The Edmonds fishing pier is open year-round for recreational fishing. Several species of fish are caught off the Edmonds fishing pier, including smelt, Chinook and pink salmon, rockfish, and perch (WDFW 2003). Invertebrates collected from the fishing pier include squid, shrimp, and red rock and Dungeness crabs. Clams are also collected in this area.

The central Puget Sound bottomfish sport fishery is also active. Historically, the most important fish species were rockfish, flatfish, Pacific cod, sablefish, and walleye pollock. Populations of many of these fish species have significantly declined in recent years, particularly Pacific cod, walleye pollock and Pacific whiting (hake), which have all been rated as “critical” or “depressed” by WDFW. Although not recommended by the Washington State Department of Health, because of water quality concerns, recreational shellfishing occurs along many central Puget Sound shorelines, particularly at public access beaches such as Marina Beach Park, and Meadowdale Beach Park. Harvesting for clams and crabs occurs frequently during low tides at these beaches (Parametrix 2001, cited in KC DNR 2003).
Recreational fishing for spot prawns is an active fishery that typically opens in late April and remains open for about 2 weeks. The area near the Edmonds Marina is a popular area for spot prawn fishers. There is a recreational squid fishery in the Central Basin of Puget Sound that typically occurs from late fall through March. Squid fishing frequently occurs in areas with public fishing piers.

3.3 Water Quality

There is little water quality information specific to the surface waters of the creeks and Puget Sound nearshore in the City of Edmonds. A series of studies by Snohomish County (titled Drainage Needs Reports) on similar streams near Edmonds (Report No. 11, Puget Sound Tributaries), available from online websites, offer a close approximation to stream conditions within the City. Other freshwater programs, either conducted by King County or administered by the State (such as Ecology’s Rivers and Streams Water Quality Monitoring program), tended to focus on highly urbanized areas with known pollutant sources based on current or past recent industrial activities or densely populated areas with relatively large watershed sub-basins (e.g., Thornton Creek, Lake Washington). These studies were not particularly applicable to Edmonds streams or Lake Ballinger.

Groundwater quality in the City of Edmonds is generally good and has no widespread contamination issues, as reported in a U.S. Geologic Services (USGS) study on groundwater systems and quality in western Snohomish County (Thomas et al. 1997). However, the USGS study also notes the potential for chemicals released from various human activities to locally impact groundwater quality. This would include a potential for groundwater contamination at various locations in the area from leaking underground storage tanks, which are listed by Ecology, along with the nature and extent of contamination, the affected medium (e.g., soil, surface water, or groundwater), and the status of cleanup efforts. Contaminated sites are most likely to be present in areas with commercial or industrial development. Ecology’s database was reviewed for properties within the Edmonds shoreline area listed as contaminated sites. The former Unocal site and the Chevron Richmond Beach Asphalt Terminal property were the largest industrial properties in the Edmonds area; both properties have documented or suspected soil and groundwater contamination. The Port of Edmonds includes two locations along Admiral Way listed as both groundwater and soil contaminated sites that have been undergoing cleanup actions since 1995, but are not yet de-listed. Other properties within the SMP boundary areas that were listed on Ecology’s 2006 database of contaminated sites have been reported as cleaned up.

3.3.1 Freshwater Quality

The Edmonds Watershed tributaries flow into Puget Sound, which is classified as Class AA (Extraordinary) by WAC-201A, and thus all tributaries in the study area are designated as Class AA for water quality by the State. The applicable water quality criteria for Class AA freshwater in Washington are summarized in the Snohomish County Drainage Needs Report (2002).

The Snohomish County Drainage Needs Report (2002) evaluated nearby Lund’s Gulch and Norma Creeks and concluded, “The overall water quality of Norma Creek is poor, and is typical of other well-developed urban residential watersheds. Degradation of water quality can largely be attributed to pollutants associated with the surrounding land uses, and a lack of treatment facilities. Although few water quality data are available for Lund’s Gulch Creek or Picnic Point Creek, the water quality of these creeks can be expected to be comparable to that of Norma Creek, based on the general similarities in land use, topography, and observation of stream
conditions. Norma Creek is not meeting Class AA criteria for fecal coliform and dissolved oxygen, and is on the Ecology 1998 303(d) list of impaired waterbodies for both parameters.”

Other water quality problems in adjacent area streams include elevated metals and high sediment loads. The primary sources of these water quality problems are presumed to be urban residential areas, commercial areas, roadways, and excess sediment from eroding stream banks, slopes, and construction sites.

Other water quality exceedances in Norma Creek included fecal coliform, dissolved oxygen, high sediment bed loads, and excess sedimentation in the lower reaches of both Norma Creek and Lund’s Gulch Creek. Copper, lead, and zinc, which are usually the most significant metals in urban runoff, have been detected in water samples from Norma Creek. The levels of total recoverable metals in Norma Creek are comparable to metals concentrations for other built-out urban residential areas, such as in urban King County. Long-term sampling in Norma Creek shows that the stream appears to be meeting Class AA standards for temperature and pH, and these parameters are not a problem. Temperature and pH are often measured to assess stream conditions for fish health.

Sampling of benthic invertebrate populations has been used to determine the health of streams in Snohomish County. Results indicate relatively poor biological health due to any number of factors including flow regime, sediment transport, streambed habitat, and water quality. It should be noted, however, that the sample site is in a depositional zone, in which the streambed conditions are often not conducive to a diversity of benthic invertebrates.

In summary, the predominant water quality problems likely found in Edmonds and adjacent county streams are heavy sediment loads in the lower reaches, and high bacterial concentrations and low dissolved oxygen in the upper reaches.

Ecology maintains a water quality 303(d) list, composed of waterbodies where tested pollutants have exceeded thresholds established by the state surface water quality standards (WAC 173-201A). Streams that do not appear on the 303(d) list may fall short of that pollutant threshold, but may not be free of pollutants as not all streams are tested as part of this process. Therefore, absence from the 303(d) list may not necessarily indicate that the waterbody is not impaired. No streams within Edmonds were found on the 303(d) list. The 1998 303(d) list was the last one submitted to and approved by EPA. Lake Ballinger is on the 303(d) waterbody list for total phosphorus exceedance.

Lake Ballinger water quality has been studied for more than 30 years; problems identified in the mid-1970s were partially addressed in the late 1980’s, but water quality continues to decline, despite limited efforts to reduce non-point source pollutants entering the lake. In 1977, a Phase I Federal Clean Lakes Restoration Project identified water quality degradation related to surface water and stormwater runoff from the surrounding drainage basin that caused high nutrient loads and fluctuating water levels, resulting in periodic flooding, blue-green algae blooms, hypolimnetic anoxia, high turbidity, low transparency, and sediment phosphorous recycling. In the mid-1980s, the lake was placed on the 303(d) list for failing to meet the Environmental Protection Agency (EPA) human health criteria for total phosphorous. A decade later, control measures were implemented, using stormwater diversion and structural controls, hypolimnetic injections/withdrawal (to reduce sediment phosphorous), lake level reduction, and public education. Initially, erosion stabilization efforts on Hall Creek (revegetation of streambanks and adjacent slopes) and construction of two regional sedimentation ponds resulted in reduced

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phosphorus and sediment inputs into the lake (KCM 1986). Hypolimnnetic injection and withdrawal greatly reduced internal phosphorus loading for three years. However, high phosphorus and ammonia loading, primarily from Halls Creek, increased dramatically in the third year due to deterioration of surface water quality throughout the developing Lake Ballinger basin, resulting in increased phosphorus, ammonia, and biological oxygen demand in the lake. This poor-quality surface water was injected into the lake bottom, causing the lake to become anoxic (oxygen-starved) in 1986. A series of recommendations, including more stringent controls on stormwater quality in the basin and improved maintenance of the hypolimnion injection system, have been proposed recently (City of Mountlake Terrace 2005).

In 1990, the City of Mountlake Terrace treated Lake Ballinger with alum to reduce the excessive phosphorus concentration in the lake. The clarity of the lake was increased by 40% and the phosphorus levels were reduced by 70% within 48 hours of the treatment. Although the short-term result of the alum treatment was satisfactory, the longevity of the treatment has become limited by continued external phosphorus loading. Currently, the increased external nutrient loading exceeds the internal (phosphorus) sediment component of loading and appears to be directly and indirectly (through recycling of increased productivity) driving the lake ecosystem (Bell-McKinnon 2006).

A Total Daily Maximum Load (TDML) for total phosphorous was approved by the EPA for Lake Ballinger in 1993. A TMDL of 30.0 mg/L was recommended by Ecology. In 2006, a study plan was developed by Ecology to monitor the effectiveness of the TMDL and determine if past restoration treatments had been effective in restoring Lake Ballinger to its designated uses.

Surface water quality in the Lake Ballinger basin continues to fluctuate seasonally. At times, standards for temperature, dissolved oxygen, turbidity, nitrates and phosphates, and coliform organisms are violated (City of Mountlake Terrace 2003). Residential runoff is a primary pollutant source in the spring and fall due to chemical applications to lawns and gardens. Rapid stormwater runoff from nearby urban development is another cause of seasonal water quality change. For example, stormwater runoff from large parking lots in the industrial district of the City is the major problem for the Halls Creek / Lake Ballinger drainage system (City of Mountlake Terrace 2003).

The Washington Department of Health issued a state fish advisory recommending that people limit their consumption of largemouth and smallmouth bass from fresh waterbodies in Washington State, due to various persistent and harmful chemical pollutants, such as mercury and PCBs. A recent national study on mercury deposition (USGS 2000) found mercury (presumably from air-borne deposition from an ASARCO smelter) in Lake Ballinger and Lake Washington sediment. Lake Washington sediment showed mercury concentrations increased above background in the early 20th century, leveled off between 1930 and 1970, and fell steadily through the 1960s. In a different trend, Lake Ballinger sediment data showed increases from the 1960s through the 1990s. The sources causing the increases are not currently known.

The outlet of Lake Ballinger is McAleer Creek, which flows into Lake Washington, within the WRIA 8 Cedar-Sammamish watershed. Water quality samples collected by Ecology between 1991 and 1997 were shown to have high levels of fecal coliform violating water quality criteria. High fecal coliform is typical in urbanized areas with large populations of pets and wildlife (e.g., geese, raccoons, etc.).
3.3.2 Marine Water Quality

There are few marine water quality data collected along Edmonds or in adjacent marine waters. Although numerous water quality monitoring programs have sampled central Puget Sound shorelines for decades (e.g., Ecology and WDFW’s Puget Sound Ambient Monitoring Program [PSAMP] for water and sediment, Ecology’s Beach Environmental Assessment and Communication of Health [BEACH] program, Ecology’s South Puget Sound Marine Environmental Modeling program, Ecology’s Marine Water Quality Monitoring Program) water quality sampling stations are typically located within major urban centers with known contamination, such as Seattle and Everett, or rural locations, such as Whidbey Island. Thus, few site-specific data were available and the nearest data locations, in urbanized industrial bays several miles away, were not appropriate for comparison. Applicable marine water quality data are reported below.

Table 3 shows areas on the 303(d) list for recent violations in marine water quality samples. Fecal coliform and ammonia as nitrogen (ammonia-N) are used as indicators of animal and human waste and fertilizers from landscape runoff. Landscape runoff enters the marine shoreline through creeks and numerous city stormwater drainages that discharge into Puget Sound (see Figure 7).

<table>
<thead>
<tr>
<th>Waterbody</th>
<th>Parameter</th>
<th>Year Listed</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point Edwards</td>
<td>Fecal Coliform</td>
<td>2003, 2004</td>
<td>Water</td>
</tr>
<tr>
<td>Brackett’s Landing</td>
<td>Ammonia-N</td>
<td>2002, 2004</td>
<td>Water</td>
</tr>
<tr>
<td>Brackett’s Landing</td>
<td>Fecal Coliform</td>
<td>2002, 2004</td>
<td>Water</td>
</tr>
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Through Ecology’s BEACH program, Snohomish County conducts weekly water quality monitoring of recreational areas from May through September, for bacteria that may pose a risk to people using the waterfront. Within Edmonds, water quality is monitored at Marina Beach Park (South Edmonds) and Edmonds Underwater Park. Elevated levels of *enterococcus* bacteria were found at Marina Beach Park in 2004 and 2005, but not at concentrations triggering an advisory to water users or a beach closure, although the park is closed to shellfish harvesting. The south section of Marina Beach Park is an off-leash dog park, which likely contributes substantial *enterococcus* bacteria to the area.
4. **Inventory and Land Use Patterns**

4.1 **Existing Land Use**

The City of Edmonds is located in southwest Snohomish County. Edmonds has a highly developed and well-established land use pattern (Figure 8). The Edmonds marine shoreline extends 5.2 miles from north to south. The City’s northern border is the Meadowdale Beach Park shared by unincorporated Snohomish County and Woodway to the south. Unincorporated Snohomish County, the City of Lynnwood, the City of Mountlake Terrace, and the City of Shoreline bound the rest of the City (see Figure 1).

The BNSF Railway borders a majority of the Edmonds marine shoreline. The railroad tracks form a barrier between the natural shoreline and the existing residential neighborhoods for over half the Edmonds marine shoreline. This part of the City’s marine shoreline is primarily characterized by a seawall and fill that created the BNSF railroad bed.

Approximately 2,000 feet south of the northern marine shoreline border of the City is an old pier structure once used in the fishing industry. This is commonly referred to as Laebugten’s Wharf. The pile-supported wharf structure is currently unused, except as a fish pen.

Edmonds’ southern shoreline is the current location for the Washington State Ferry (WSF) terminal to Kingston, in addition to commercial and residential properties, waterfront parks, walkways, and the Port of Edmonds Marina. On either side of the ferry terminal are two regional parks, Brackett’s Landing North and South, respectively. Collectively, these parks include public beach, picnic areas, interpretive information, public restrooms, a parking lot, and showers. Paths lead to a wheelchair-accessible jetty. On the northern side of the ferry is another regional park, Edmonds’ Underwater Park. This park was one of the first officially designated underwater parks on the West Coast. The facility includes 27 acres of tide and bottom lands and was established as a marine preserve and sanctuary in 1970.

From the ferry terminal to the Port of Edmonds Marina is a public waterfront walkway. This public facility offers wheelchair-accessible access to the waterfront while acting as a breakwater for existing residential and commercial structures within the shoreline area. At the southern portion of this walkway, at the northern edge of the marina, is a city park and public fishing pier. Olympic Beach Park is located just north of the fishing pier. The shoreline jurisdiction extends east to the vicinity of Railroad Avenue from Main Street and south to the vicinity of Dayton Street. Between Railroad Avenue and the City’s walkway are a number of commercial offices, a senior center, a parking lot, and private residential condominiums.

From Dayton Avenue south to the southern edge of the Edmonds Marina, the upland jurisdiction of the shoreline extends to the vicinity of Admiral Way, including Edmonds Marina. The Port of
Edmonds owns and operates the marina and adjacent uplands, including the Harbor Square Development and the land adjacent to the Edmonds Marsh.

The marina includes 676 wet moorage slips and 279 dry storage spaces. More than 50 guest moorage slips are available for overnight and short-term stays. The Port provides two boat haulout facilities, showers, laundry facilities, restrooms, fuel, and boat launch for both tenants and guests. A rubble mound breakwater that extends some 2,400 feet from north to south protects the marina. The marina was originally constructed in 1961 with a major reconstruction in 1998 following destruction by a major winter storm.

On Port property upland from the marina and within the shoreline jurisdiction are several businesses and restaurants with associated parking facilities. In addition, the Port Administrative offices are located on the uplands, east of the marina, within the shoreline jurisdiction.

The southern-most portion of the Edmonds marine shoreline jurisdiction ends at two beach parks, referred to collectively as Marina Beach Park. North Marina Beach, between the marina and the former Unocal pier, includes a large open grassy area with picnic and playground facilities, as well as car-top boat launch opportunities. South Marina Beach, south of the pier, is a designated off-leash dog park area maintained by volunteers.

Edmonds’ freshwater shoreline consists of the south and west shores of Lake Ballinger. The eastern half of Lake Ballinger is located in the City of Mountlake Terrace. This shoreline is zoned single family residential.

4.2 Comprehensive Plan, Zoning, and Corresponding Zoning Designations

The GMA of Washington requires that local governments must adopt comprehensive plans to provide plans and policies for orderly development of land within the local jurisdiction. The corresponding zoning (see Figure 3) must be consistent with and implement the goals and policies of the local comprehensive plan. The City of Edmonds Comprehensive Plan, adopted in 2004, contains those goals and policies that are implemented through the local zoning code found in Titles 16 and 17 of the Edmonds Community Development Code (ECDC). The two documents are now consistent in that the comprehensive plan and the zoning code support the same land uses.

The City’s comprehensive plan designates the northern portion of the City of Edmonds marine shoreline for residential use, Single Family – Resource. This corresponds to lower-density single family zoning designations such as RSW-12, RS-12, and RS-20, which allow densities of less than 4 dwelling units per acre. Due to the railroad tracks and easements located between the uplands and beach areas, there is no upland access to residential properties that would justify the development of waterfront facilities, such as piers and docks.

Between Brackett’s Landing North and South, the shoreline is designated park or open space under the City comprehensive plan. From Brackets Landing South, the shoreline jurisdiction is designated Shoreline Commercial or Master Plan Development. This entire area is part of the Downtown/Waterfront Activity Center. The Edmonds comprehensive plan contains a full description of the Downtown/Waterfront Activity Center, including a vision, goals, transportation issues related to development of the Edmonds Crossing—a multi-modal facility for ferry, bus, and commuter train facilities—and a set of downtown waterfront plan policies. This portion of the 2004 comprehensive plan also contains a detailed description for areas of the downtown waterfront area.
The southern-most portion of the Edmonds shoreline is designated master plan development, which includes the proposed Edmonds Crossing project.

Along Lake Ballinger, the comprehensive plan designation is Single Family-Urban 1. This designation corresponds to the zoning designations of RS-6 and RS-8 translating to between 5 and 8 dwelling units per acre. The Lake Ballinger shoreline is fully developed with single family residences. Almost all of these homes also have piers or docks.

4.3 Roads and Transportation Facilities

Edmonds is served by a series of State and local roads. SR 104 runs from the east at Interstate 5 through the southern part of Edmonds, ending at the State of Washington Ferry Terminal. SR 524 begins in Lynnwood at Interstate 5 and runs west through the center of Edmonds from the crest of the hill and down into the city center. Local roads provide access throughout Edmonds. These roads provide access for Community Transit, the commuter bus service for South Snohomish County. Commuter Park and Ride lots are located throughout Edmonds and are served by Community Transit bus service.

The rail lines along the Edmonds’ shoreline are primarily used by BNSF for freight service, but also provide Amtrak passenger train service through Edmonds. Sound Transit provides daily commuter service to and from Seattle.

Washington State Ferries operates ferry service from Edmonds to Kingston providing access to the Olympic Peninsula. This is one of the busiest commuter ferry terminals in Puget Sound, as well as one of the major access points from the east side of Puget Sound to the west.

4.4 Wastewater and Stormwater Utilities

The City of Edmonds operates and maintains a wastewater treatment plant on the corner of SR 104 and Dayton Street that was originally put into service in 1957 to provide primary treatment and was upgraded to secondary treatment by 1991. The current average annual flow rate is approximately 6 MGD. The plant has primary treatment and sedimentation, air-activated sludge secondary processes, and chlorine disinfection for liquid treatment (KC DNR WTD 2003).

The City of Edmonds, through agreement with King County, Ronald Wastewater District, Olympic View Water and Sewer District and the Cities of Lynnwood and Mountlake Terrace, also provides wastewater service to the Town of Woodway, the Richmond Beach service area, the City of Mountlake Terrace, the Olympic View Water and Sewer District, the Ronald Wastewater District, and areas of the City of Lynnwood (Snohomish County 2002). King County uses its Lake Ballinger pump station to pump wastewater generated in Mountlake Terrace and the Lake Ballinger area of Edmonds to either the Edmonds or West Point Treatment Plants. The Unocal site is currently serviced by a private septic system (FHWA et al. 1998).

The City of Edmonds also owns two secondary treated wastewater outfalls and a number of wastewater trunk lines. These trunk lines include two 36-inch-diameter outfalls that enter Puget Sound north of the Port of Edmonds’ breakwater. Both outfalls extend approximately 1,200 feet into the sound at a depth of about -60 feet MLLW (FHWA et al. 1998). In addition, the Lynnwood Regional Wastewater Plant, a 7.4-mgd capacity wastewater treatment plant, is located in the City of Edmonds in Segment B. The Lynnwood Treatment Plant's outfall extends.
approximately 1,000 feet into Puget Sound, near 170th Street SW. The outfall is a 36-inch high-density polyethylene (HDPE) pipe located at a depth of approximately -200 feet MLLW (Davis, personal communication 2002).

Stormwater drainage information, including locations and diameters of stormwater outfalls that pass through Edmonds’ Shoreline Master Plan jurisdictional area, is shown in Figure 7 (City of Edmonds 2003). The city provides stormwater catchment basins and maintains them by conducting regular clean-out efforts and annual inspections. Solid material is mechanically settled in the catchment basins. The city also administers a program to react and respond to illegal discharges (City of Edmonds 2006a). The area southwest of Edmonds Marsh on the former Unocal property has stormwater system separate from the City. Because it discharges through City shorelands, it is included in this inventory. The stormwater collection and treatment system that was used on the 27-acre Unocal property includes a series of catch basins connected by underground concrete pipes that served the upper and lower yards (EMCON 1994 cited in CH2M HILL 2004). Much of that system remains in place although the Unocal facility is no longer operating and site demolition and clean-up is underway. The Unocal stormwater system operates as follows:

During normal precipitation events, all of the catch basins drained into a duplex sump, and the collected stormwater was pumped into an oil/water separator in the lower yard. Any recoverable oil was skimmed from the oil/water separator, and the treated stormwater was pumped into Detention Basin 2. Flows were discharged from Detention Basin 2 into Willow Creek, in the ditch section adjacent to the BNSF tracks, via a National Pollutant Discharge Elimination System (NPDES)-permitted outfall. If this treatment system exceeded capacity, stormwater was routed from Detention Basin 2 into a larger detention basin through a spillway. The large detention basin has no outlet; therefore, after high flows subside, stormwater is pumped back through the oil/water separator and eventually into Willow Creek. During very high tides and heavy rainfall events, stormwater was discharged directly from the oil/water separator into Willow Creek via NPDES-permitted outfall 001 (EMCON 1994 cited in CH2M HILL 2004). This was estimated to occur three to four times a year.

4.5 Existing Public Access Sites

Public access to the marine shoreline is available within the City in seven areas: Meadowdale County Park (Lund’s Gulch), Southwest County Park (Perrinville Creek), Edmonds Underwater Park, Brackett’s Landing Park (north and south units), Olympic Beach Park and Fishing Pier, the Port of Edmonds Marina, and Marina Beach Park (north and south units). The BNSF railroad is privately owned, and pedestrian access across the tracks is prohibited, except at designated locations due to safety concerns. Edmonds Marsh and the adjacent Wildlife Sanctuary are also publicly accessible, with a boardwalk and viewing areas provided. Public access to Lake Ballinger within the City is located at the end of McAleer Way.

The City of Edmonds provides public access sites to the marine shoreline primarily along the southern portion of its 5.4 mile shoreline. Waterfront public parks are located along the shoreline on both sides of the Washington State Ferry Terminal at Brackett’s Landing North and South. Waterfront access is available at Olympic Beach Park and Fishing Pier where Dayton Street intersects with the water. Another major waterfront park, Marina Beach Park, is located at the southern-most portion of the Edmonds marine shoreline.
The City of Edmonds provides public access (for fishing, swimming, and hand-launching small boats) at the west side of Lake Ballinger off of McAleer Way. Other public access to Lake Ballinger located in the City of Mountlake Terrace.

4.6 Historical/Cultural Resources

The Unocal treatment plant site, Point Edwards, and the City are within territory attributed to the Snohomish, Suquamish, and Snoqualmie people. The Snoqualmie may have had a winter village or a permanent fishing camp used on an annual basis at Edmonds. The Suquamish fished for salmon in the waters off Edmonds and gathered cattails at Edmonds. (Haeberlin and Gunther 1930, Turner 1976, Tweddell 1953, Kennedy and Larson 1984, Lane 1974, Miller 1999, Snyder 1988 cited in KC DNR WTD 2003).

Edmonds lies within lands and waters once controlled by the Suquamish Tribe. At the time of historic contact, there was a large population in southern Puget Sound consisting of eight closely related tribal groupings: Twana-Skokomish, Nisqually, Puyallup, Duwamish, Suquamish, Skykomish, Snoqualmie, and Muckleshoot—all of whom spoke Coast Salish languages (Wessen and Stilson 1987 cited in CH2M HILL 2004). These peoples were skilled fishermen, hunters, and plant collectors who employed a settlement and subsistence system marked by a central base or winter village and a cycle of movements to smaller, more informal, settlements at different times of the year to exploit locally available resources. The winter village was a focal point of social and ceremonial life.

Living along the Sound, the Suquamish had direct access to intertidal and marine resources, and their principal settlements were located adjacent to or on modern saltwater beaches. The Edmonds waterfront area, with its generally flat beach and adjacent intertidal estuary/wetland marsh, is a spot that would have been most favorable for the location of one or more prehistoric or proto-historic Suquamish settlements (CH2M HILL 2004).

Suquamish subsistence patterns along the western shores of Puget Sound are similar to those reported for the nearby Duwamish who inhabited the Seattle waterfront area. The Duwamish and their neighbors (Suquamish) practiced a seasonal round that consisted of spring, summer, and fall migrations to fishing grounds, berry and root patches, and shellfishing areas, with retirement to a sedentary lifestyle in the winter longhouses. The fall fisheries were crucial to their subsistence because they provided dried or smoked food for the winter months.

In 1841, Lt. Charles Wilkes USN of the U.S. Exploring Expedition named Point Edwards ‘Point Edmund,’ presumably in honor of his son. Early city history recounts the pioneering settlement by George and Etta Brackett in 1870, followed by the City’s destination as a Mosquito Fleet stop, a logging community, and the home of 11 shingle mills. The first cedar shingle mill was built near 220 Railroad Avenue about 1890, at the time the City of Edmonds incorporated.

Between 1889 and 1891, a seawall and associated backfill were constructed into the upper foreshore by the Seattle & Montana Railroad (later part of the Great Northern) to Edmonds. The fill was constructed to defend the overlying railroad from wave erosion and burial by landslide colluvium from adjacent receding bluffs. By 1910, eight trains stopped daily and a depot was built. The present station was built in 1956.

The number of mills grew rapidly because of the availability of quality timber close at hand, unlimited source of water power, and good transportation. At the height of the shingle industry,
mills stretched along the Edmonds waterfront. The remains of a later (1930’s-era) mill are still visible in the upper reach of Fruitdale Creek.

Brackett’s Landing is on the Washington Historical Register as an Exploration/Settlement site in recognition of Etta and William Brackett, the first European-American settlers in the area that would become Edmonds (WDAHP 2006). Early inhabitants, numbering about one thousand, were mostly loggers, shingle sawyers, boom-men, kneebolters, and shingle weavers who were dependent on the mills. Rail spurs served the mills and cargoes were also shipped by coastwise steamers. In 1902, Allen Yost and family formed the Edmonds Spring Water Company, dammed upper Shell Creek, and piped the retained water into the town for consumption. Remnants of these dams and settling tanks are visible along the Shell Creek and Weir park trails (City of Edmonds 2006b).

Along the waterfront, a shingle mill in operation in 1907 continued production until the early 1950’s. Receding forests and competition eventually forced its closure in 1951. An auto ferry began operating between Edmonds and Kingston in 1923, and later to Port Townsend, Port Ludlow, and Victoria.

The Washington Information System for Architectural and Archaeological Records Data (WISAARD) database was searched for State and National Register listed properties within Edmonds. This comprehensive database provides information available for over 1800 registered historical sites including images of the property, a short summary description about the significance of each resource and a link to the nomination document as a PDF file. Archeological sites that are National Register listed are included. As of 2006, there were no nationally registered historic places within the Edmonds shorelands. The Edmonds Crossing project area (former Unocal site, partially bordering Willow Creek and Edmonds Marsh) contains no prehistoric or historic archaeological sites that are currently listed on, nominated to, or determined eligible for the National Register of Historic Places (CH2M HILL 2004). A prehistoric archaeological site was discovered on May 3, 1995, during field reconnaissance along the small access road to the Deer Creek Fish Hatchery. The site was named the Deer Creek Hatchery Shell Scatter and was designated as site 45-SN-310 by OAHP. It is located about 50 feet or more north of the present access road, northwest of the hatchery building and stock pond (CH2M HILL 2004). This site is not within the SMP area.

4.7 Toxic or Hazardous Material Clean-up Sites and Dredge Material Disposal Sites

According to the federal and state environmental agency databases reviewed, the WSF terminal is a Resource Conservation and Recovery Act (RCRA) small-quantity generator of hazardous waste (less than 2.2 pounds of acute hazardous waste or 220 pounds of other hazardous waste per month) (CH2M HILL 2004).

The areas north and south of the ferry terminal have had industrial uses in the past dating back to at least 1909. The primary industries in the immediate vicinity were shingle mills. The shingle mill south of the dock is noted as destroyed by fire in the 1926 Sanborn map. The 1955 aerial photograph and later photographs suggest that the area south of the terminal was used as a boatyard (CH2M HILL 2004).

The SR-104/Edmonds Crossing FEIS (CH2M HILL 2004) reviewed numerous databases for hazardous waste information in the downtown Edmonds area, including the EPA National Priority List, Resource Conservation Recovery Information System, Comprehensive
Environmental Response, Compensation, and Liability Information System, Corrective Action Report, Emergency Response Notification System, Facility Index System, and Toxic Substance Control Act; the USDOT Hazardous Material Information Reporting System; and the Washington Department of Ecology (DOE) Leaking Storage Tanks Site List, Confirmed and Suspected Contaminated Sites List, Statewide Underground Storage Tank Site Report, and Solid Waste Facilities Handbook. The FEIS documented the locations of historic or potential current hazardous waste. For this report, the locations were screened for their proximity to the shoreline area. The following sites within the shoreline area were associated with known or suspected chemical contaminants, including total petroleum hydrocarbons (TPH), semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), and metals:

- WSF ferry terminal (current RCRA Small Quantity Generator (SQG), former freight operations; with SVOCs, metals)
- Anderson Marine (former shingle mill, leaking underground storage tank, reported cleaned up in Ecology’s LUST database)
- Commercial buildings north of marina (former shingle mill, lumber yard, paint warehouse; with TPH, SVOCs, metals)
- Boat storage and maintenance area (former general location of Washington Steel and Bolt Company, BNSF railway maintenance facility; with possible dredge spoil fill, with TPH, SVOCs, polychlorinated biphenols or PCBs, metals)
- Port of Edmonds Furbreeders Building (leaking underground storage tanks)
- Port of Edmonds underground storage tanks (new), possible dredged spoils fill, marine fueling facility (with TPH, SVOCs, metals)
- Former area of Willow Creek/Unocal/Port of Edmonds Dry Storage discharge (water discharge, possible dredge spoil fill, with SVOCs, metals, and TPH contamination in soil and groundwater)

In addition, marine sediment north of the marina was reported to be adversely affected by historic operations and discharges (CH2M HILL 2004); however, sediment investigations in the Edwards Point area did not find evidence of contamination (KC DNR WTD 2003).

The largest potential hazardous waste facility in the Edmonds area is the Unocal site. The facility was constructed and operated along the top, side, and base of a hill in an area bordered by Puget Sound marine shorelands, Willow Creek, and Edmonds marsh (partially filled during the many phases of facility construction). Although the site is outside the city of Edmonds and its SMP boundaries, the facility partially drains into Edmonds and adjacent SMP areas. The following detailed description of the facility is taken from the SR-104/Edmonds Crossing FEIS (CH2M HILL 2004).

“The Unocal Point Edwards facility was constructed and put in operation in the early 1920s. The site is approximately 44 acres (EMCON 1994; 1995; 1996a). The facility was used as a bulk fuel terminal for storage and distribution of fuel from approximately 1923 until 1991 and would be categorized as a “substantially contaminated site” using FHWA terminology (FHWA 1997). The...29-acre lower yard was used for other operations including dock operations, railcar unloading, truck loading, laboratory operations, warehousing, and other facility maintenance and support activities. In
addition, an asphalt refinery, constructed in about 1953 and dismantled around 1980 (EMCON 1995), operated in the lower yard. A total of 10 underground storage tanks (USTs) were located at the facility. According to EMCON (1994, 1995), six of the USTs have been removed... Two detention basins are located in the lower yard along with two oil/water separators. Surface water runoff from the site was once directed to the detention basins and discharged to a tidal basin that empties to Puget Sound. Discharge from this area was easily observed in early aerial photographs. In the 1960s, when the Port of Edmonds Marina was constructed, the discharge stream was covered and rerouted through culverts.

A number of petroleum product releases to the environment have been reported for the facility, including nine spills recorded between 1954 and 1990. According to EMCON (1994), the spills ranged from a few gallons to 80,000 gallons and involved fuel oils, heavy fuel oils, gasoline, off-specification emulsified asphalt, and diesel. Other minor releases have occurred on land, but have not entered water. EMCON (1994) reports that periodic product releases have occurred within the tank farm, loading facilities, and piping systems, but complete records of these events are not available. EMCON (1994) also provides information on a diesel release to Puget Sound that occurred from a 1971 derailment on the BNSF tracks immediately south of the Unocal pier approach trestle, and a spill of asphalt cutter stock to the Sound in 1990 from the Chevron facility 1 mile south of Point Edwards.

According to the environmental agency databases reviewed, the site is reported to be on EPA and Ecology contaminated sites lists, as an UST and LUST site, and as a RCRA large-quantity generator of hazardous waste. Ecology and Unocal have entered into an Agreed Order for conducting the site RI and FS under MTCA. Before entering into the Agreed Order, a number of voluntary site investigations and environmental clean-ups were conducted at the site. An RI was conducted by Unocal in compliance with the Agreed Order with Ecology. The RI was conducted between October 1994 and August 1996. Additional quarterly and annual groundwater monitoring and product recovery has continued through 2002 (Brearley, pers. comm., 2003). According to the Ecology Site Manager, the current schedule is to finalize the RI and issue a supplemental RI/FS by the fall of 2003. These documents will be released for public comment at that time (South, personal communication, 2003).

According to the draft RI report, the primary environmental impacts at the existing Unocal property include free product on the groundwater table, related petroleum hydrocarbon chemicals in subsurface soil and groundwater, and paint/sand blast grit-related metals in the surface soil. Free product has been found in six plumes in the lower yard: the railroad spur plume, truck loading rack plume, asphalt plant plume, RW-2 plume, office plume, and Detention Basin No. 1 plume. These plumes are the result of releases during former Unocal operations. Recovered product results indicate that the free product consists of gasoline-range, diesel-range, and oil-range hydrocarbons. Field observations made during the RI have been interpreted by EMCON (1996a) to indicate that much of the free product may be heavier-end hydrocarbons. Based on product thickness measurements over the last 10 years, product migration rates are estimated by EMCON (1996a) at less than 6 feet per year.

Groundwater at the existing Unocal property generally flows to the northwest toward Puget Sound. The groundwater table is present within 4 to 8 feet below the ground.
surface in most areas. Petroleum hydrocarbon constituents dissolved in groundwater were primarily found near free product plumes and in areas with free-phase product trapped in the vadose zone near the water table. These chemicals were found at or above MTCA clean-up levels for TPH and benzene, ethylbenzene, toluene, or total xylenes (BETX) in site shallow wells (EMCON, 1996a). Except for zinc, metals concentrations in groundwater were generally low, with the highest concentrations found in isolated locations around the terminal. Zinc was the most frequently detected metal in groundwater, with the highest concentrations found in wells along the perimeter of the site. Non-BETX volatile organic compounds were not found in groundwater at the terminal (EMCON, 1996a).

EMCON reports that high concentrations of petroleum hydrocarbons in soil were primarily found near free product plumes and in areas with free-phase product trapped in the vadose zone. High concentrations of petroleum hydrocarbons were also found in the material within Detention Basin No. 1. Elevated metals concentrations were found in surface soil in areas of sand-blast grit and paint chips that occur under pipe runs and manifolds, in isolated grit piles, and in certain tank basins. Leachable metals concentrations were low, indicating that leaching of metals from surface soil is not likely. Additionally, metals were not found in substantial concentrations in subsurface soil.

Petroleum-related chemicals were detected in on-site stormwater, primarily from the lower yard. Non-BETX volatile organic compounds, and oil and grease were not found in stormwater. Similarly, these constituents were also not detected in surface water in the drainage ditch and tidal basin adjacent to the site, nor were TPHs in the gas, diesel, or oil ranges. The highest metals concentrations, and elevated PAH concentrations, were found in surface water upgradient of the site. Biotoxicity testing results for sediments collected in the drainage ditch along the existing Unocal property boundaries exceeded clean-up screening level criteria at five of 15 sample locations. No discernible pattern was identified by EMCON (1996a) that would point to a single sediment toxicity source. However, the draft RI report concluded that the potential was low for toxic effects further downgradient from the upland tidal basin in the drainage ditch. No sampling and analysis of offshore marine sediments was performed for the RI.”

Since the draft RI was submitted, Unocal has begun interim clean-up actions at the site under the supervision of Ecology. The following clean-up actions have occurred or are ongoing:

“Lower yard interim remedial action 2001-2003. Free petroleum product and associated petroleum-contaminated soil were removed from four areas of the lower yard east of Willow Creek/drainage ditch and shipped off site for thermal treatment. The excavations extended vertically to between 6.5 and 10.5 feet below grade and extended laterally until product-saturated soil was not observed in the excavation side walls (or until structural concerns made it prudent to cease excavation). Additionally, the excavation was kept open for several weeks to allow for removal of floating product from the groundwater surface. This work was performed primarily between August 28 and November 7, 2001. A final interim action as-built report was submitted to Ecology in November 2002 (Maul Foster & Alongi, November 30, 2002). According to Unocal, no free product has been observed in monitoring wells in the area since the action was completed (Brearley, pers. comm., 2003). A second lower yard interim remedial action was completed in December 2003 that included excavation of contaminated materials from Detention Basin No. 1 and the southwest lower yard. The excavated materials were transported and
disposed of at an offsite landfill (Brearley, pers. comm., 2004; South, pers. comm., 2004).

The FS for clean-up alternatives for contaminated soils and groundwater at the existing Unocal property has not been completed. A draft FS report was submitted to Ecology in 2004, but the agency was notified that the document is to be replaced with a revised version. Ecology is deferring review of the FS until receipt of the revised document (South, pers. comm., 2004).

Environmental clean-ups at the Unocal property that have occurred at the lower yard (adjacent to Edmonds and near SMP boundaries) include an interim action to remove free product from groundwater and petroleum contaminated from four areas was completed in 2002. Contaminated materials from Detention Basin No. 1 and the southwest lower yard were excavated and disposed of offsite during an interim action completed in December 2003.”

Studies were conducted at the Point Edwards site, west of the BNSF right-of-way, including the Marina Beach Park and subtidal areas in the vicinity of the Unocal pier and the two stormwater outfalls and the Port of Edmonds South Marina dry storage area. Soil and groundwater samples from Marina Beach Park were analyzed for TPH as gasoline, diesel, and heavy oil, and metals. Although TPH (as heavy oil) was detected in soil, concentrations were substantially below MTCA Method A clean-up levels for unrestricted land use and as such do not represent a threat to human health or the environment. Groundwater samples collected from the boreholes were analyzed for TPH as gasoline, diesel, and heavy oil, and volatile organic compounds. These contaminants were not detected in groundwater.

A subsurface investigation at the Port of Edmonds’ South Marina, north of Marina Beach Park, confirmed the presence of TPH in soil and groundwater. The source of the petroleum hydrocarbons was not established. Ecology’s Hazardous Site List ranked this site “5” (lowest potential threat to human health and the environment) and is awaiting remedial action (as of February 2003).

A sediment investigation was conducted at the Point Edwards site in accordance with a sampling and analysis plan approved by Ecology. Sediment samples were collected from 15 stations offshore of Marina Beach Park between the inner and outer harbor lines and in the DNR lease areas. Sample stations included five in the vicinity of the Willow Creek drain and Edmonds Way drain located south of the Port of Edmonds breakwater. The chemical analytical results showed compliance with the Washington State Sediment Quality Standards (SQS) [WAC 173-204-320], and as such the marine sediments were found to be uncontaminated (CH2M HILL, 2000d).

The area west of the railroad tracks between Point Edwards and Dayton Street has been used historically by various industries, wood shingle mills, a steel and bolt manufacturing facility, a lumberyard with a paint and oil warehouse, and a boat maintenance facility. Most of these industrial facilities had docks or piers. In addition, various residences were located here. Possible onshore or offshore contaminants that could have resulted from operation, storage, and maintenance activities at these facilities include petroleum products, semivolatile organic compounds (including PAHs), volatile organic compounds, and metals. Ecology's sediment database indicates that sediments in the vicinity of the proposed pier under this alternative have concentrations of PAHs elevated above Puget Sound Marine Sediment Clean-Up Screening
Levels (WAC) 173-204-520 (including fluorene, indeno (1,2,3-cd) pyrene, and phenanthrene, Washington Sediment Management Standards).

Since the 1960s, the area has been managed and operated by the Port of Edmonds Marina. The marina was dredged in the early 1960s and early 1970s in conjunction with construction projects; no maintenance dredging was performed. According to Port of Edmonds staff, the marina was last dredged about 1987 and the sediments were transported to an upland site for a parking lot project. Some of the marina dredge spoils were used as fill at the Harbor Square business park. Sediment testing data are not available. According to historical aerial photographs, surface water discharge from the existing Unocal property previously entered Puget Sound within the area now used by the marina. As such, it is possible that the dredged sediments may have been contaminated from boat maintenance and repair operations, as well as possible industrial discharges from adjacent sites (e.g., Unocal).

According to the environmental agency database search, the Port of Edmonds has removed old USTs and replaced them with new tanks. In 1985, the tanks were located close to the water near the marina fuel dock. Ecology’s database also indicates that one or more leaking USTs have been reported and that clean-up of soil and groundwater was initiated in 1995. In addition, the database search indicated that the Port is a RCRA small-quantity generator of hazardous waste.

According to staff at the Port of Edmonds, two Northwest Farm Food Co-op tanks were acquired by the Port and were replaced, along with two tanks previously owned by the Port, in June 1995. The exact location of these tanks was not identified during the database search (Howard, pers. comm., 1995). In addition to fueling activities at the marina, some boat maintenance activities appear to take place in the upland storage areas immediately west of the BNSF right-of-way. At least one boat was observed being prepared for painting during the site visit on June 2, 1995. A subsurface investigation conducted to collect geotechnical information for design of a dry stacked storage area of the south marina of the Port of Edmonds detected petroleum in soils. The Port of Edmonds initiated a focused environmental investigation to confirm the presence of petroleum in the subsurface and to help determine the origin of the petroleum. Background information in the investigation report stated that the south marina site was filled in 1962 using dredged sediments from what is now the marina basin (Landau, 1998). Subsurface soil samples contained concentrations of TPH (as diesel and oil) that exceeded MTCA Method A clean-up levels at five locations. Groundwater samples were reported to contain concentrations at or above MTCA Method A clean-up (1 milligram per liter) at two locations. The report recommended additional investigation to assess the presence of other petroleum constituents and to further evaluate the source(s) of contamination.

Unocal was contacted regarding the potential that the Edmonds Bulk Terminal may have been the source of the contamination. Unocal responded by installing a single monitoring well (MW-301) in the right-of-way area immediately north of Shellabarger Creek (Brearley, pers. com., 2000). The purpose of the well was to evaluate whether the backfill and storm drain might have presented a preferred path of flow for petroleum hydrocarbons from the Unocal property onto the Port’s property. It is not clear from the report whether the well was installed in the backfill of the Shellabarger/Willow Creek culvert (48-inch diameter) or in the backfill of the Edmonds Way storm drain (72-inch diameter). Testing of soils and groundwater collected from MW-301 did not reveal contamination. Other commercial facilities exist adjacent to the rights-of way, including restaurants, retail, and professional offices. Some private residences were also observed. It is not known whether these structures have any heating oil USTs or any building materials with asbestos-containing materials or lead-based paint.
BNSF maintains a railroad maintenance area within the railroad right-of-way immediately south of the Dayton Street crossing. According to historical aerial photographs, it appears that this maintenance area has been in existence since at least the late 1940s. During the site visit on June 2, 1995, a maintenance building, a diesel aboveground storage tank, a flammable gas tank (propane), and several 55-gallon drums of what appeared to be lubricating oils were observed. The drums were outside and directly on the ground. They were corroded, and one had visible oil leakage on the top. Stained soils were also observed in the area. Currently, there is a railroad spur to the west of the tracks where rail cars were stored. Historically, as evidenced from aerial photographs, there was also a rail spur on the east side of the tracks under what is now the Harbor Square business park. Potential contaminants in this area could include petroleum products, semivolatile organic compounds, volatile organic compounds, PCBs, and metals. Insufficient information is available to classify the site as “reasonably predictable” or “substantially contaminated” in accordance with FHWA terminology (FHWA, 1997).

Other hazardous material clean-up sites were identified by searches through state and federal databases. Ecology’s Toxics Cleanup Program database, including the LUST database was searched in 2006 for site addresses within the shoreline jurisdiction. Sites within the SMP shoreline jurisdiction were reviewed for their material and clean-up orders. The LUST list indicated that all potential clean-up sites within the shoreline jurisdiction were either completed (i.e., cleaned up) or, in the case of the former Unocal site and two Port of Edmonds properties, undergoing remedial action.

The Dredged Material Management Program (DMMP) represents a coordinated multi-agency approach to management of dredged materials in the state of Washington. The cooperating agencies include the U.S. Army Corps of Engineers - Seattle District, U.S. Environmental Protection Agency - Region 10, and the Washington Departments of Ecology and Natural Resources. The Washington State Department of Natural Resources (DNR), through its DMMP office, provides oversight of all disposal activities occurring on the public’s state-owned aquatic lands. The Puget Sound Dredged Disposal Analysis Program (PSDDA) manages disposal within Puget Sound and the Strait of Juan de Fuca. There are no recognized dredge material disposal sites in the Edmonds shoreline jurisdiction. The closest site is in Port Susan, west of Everett, at 47°58.85'N 122°16.74'W (NAD83) or 47°58.86'N 122°16.57'W (NAD27) (USACE et al. 2002).
5. **Nearshore Physical Characterization**

The City of Edmonds abuts the eastern shore of Central Puget Sound and contains 5.2 miles of sand, gravel, and cobble beach, mostly backed by moderate to high bluffs. Natural beach area and beach replenishment material has been limited by the topography of the area (bluffs predominate), the BNSF railroad bed and right-of-way, seawalls and other structures in the intertidal zone, and the loss of sediment sources that replenish beach substrate under natural conditions. Data from the Snohomish County database (2001) indicate that most of the shoreline is bordered by armored slopes or vertical seawalls (see Figure 7). Most of the upper intertidal zone has been armored and filled, and additional areas of the lower intertidal beach have been covered by boulders dislodged from the armored face of the railroad bed.

Edmonds beaches are typical of sediment-starved beaches, indicated by a relatively narrow and steep beach profile and coarser-grained sediment. Puget Sound beaches that have limited replenishment typically have a narrow, steep foreshore in the upper intertidal areas with an intertidal/shallow subtidal bench adjacent to the upper beach. The beach material may vary seasonally, but is typically coarse-grained (coarse sand, gravel, or cobble) (Downing 1983). Exceptions are the low-gradient beach south of the marina breakwater (Marina Beach Park), where a large sand flat was constructed, and the Brackett’s Landing beaches, which capture some finer material between the fishing pier, the WSF ferry pier, and the groin at Edmonds’ Underwater Park. Sediment-starved beaches gradually lose their intertidal fine material to subtidal depths, resulting in continued steepening of increasingly coarser-grained nearshore slopes until equilibrium is reached. These conditions affect beach function both physically and biologically. Physically, the intertidal beaches begin to disappear in most areas. A few areas (e.g., the groin at Edmonds Underwater Park) may actually accumulate sand that normally would have been deposited along a longer stretch of beach.

Adjacent marine shorelands and upland areas consist primarily of steep slopes and moderate to high bluffs, ranging in height from 15 to 100 ft above sea level. The high shoreland is crossed by deeply incised ravines with perennial streams and a few riparian wetlands. In the downtown area of Edmonds, the shorelands drop to sea level in a broad bowl that contains the largest wetland (Edmonds Marsh) and two additional streams.

Small deltas have formed at the mouths of most creek drainages in Edmonds, particularly at Shell Creek (Pentec Environmental 2001). Stream discharges are not sufficient to significantly alter the salinity at these locations, although they may serve as a source of organic material to the local estuarine environment. These small deltas tend to be composed of sand and gravel and provide a lower gradient habitat relative to the adjacent fringing beach. In general, they do not provide enough sediment to supply a significant source of sand and gravel to adjacent beaches.
5.1 Geologic Units

Recessional outwash deposits (Qgo), Vashon till (Qgt), and pre-Fraser deposits [Qc(w)] are exposed in shoreline Segments A through E. Advance outwash (Qcg, Qgu) is extensively exposed in incised stream channels above the shoreline in these segments. Segments E, F, G, and H contain artificial fill (Qf).

Advance outwash (Qga, Qga(t), Qcg, Qgu) is extensively exposed in incised stream channels above the shoreline area in these segments. Segments F, G, and H contain a combination of artificial fill and alluvial deposits (Qf and Qa). Segment I (Lake Ballinger) is underlain predominantly by outwash deposits (Qga and Qgo). These geologic units were described in more detail in Section 3.1.4 and shown on Figure 5. Table 4 summarizes the surficial geologic units present along each shoreline segment.

5.2 Soils

With the exception of Segments F, G, and H, which are mapped as urban land, soils along Edmonds’ Puget Sound shoreline are all mapped as various members of the Alderwood-Everett soil unit (NRCS 2006). These soils are described in more detail in Section 3.1.4. The south and west shores of Lake Ballinger (Segment I) are mapped as Mukilteo Muck (a very deep, very poorly drained organic soil that occurs in depressional areas) and Alderwood soil, respectively. Table 4 summarizes the soil types that are present along each shoreline segment (Figure 6).

Table 4. Soil Types and Surficial Geologic Units Present at Each Shoreline Segment

<table>
<thead>
<tr>
<th>Shoreline Segment</th>
<th>Soil Type (NRCS 2006)</th>
<th>Surficial Geologic Unit (DNR 2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Alderwood-Everett Gravelly Sandy Loams, 25 to 70 % slopes and 2 to 8 % slopes</td>
<td>Qc(w)</td>
</tr>
<tr>
<td>B</td>
<td>Alderwood-Urban Land Complex, 8 to 15 % slopes</td>
<td>Qgt</td>
</tr>
<tr>
<td>C</td>
<td>Alderwood-Everett Gravelly Sandy Loams, 25 to 70 % slopes and 2 to 8 % slopes</td>
<td>Qgo, Qgu, Qcg</td>
</tr>
<tr>
<td>D</td>
<td>Everett Gravelly Sandy Loam, 0 to 8 % slopes and 8 to 15 % slopes</td>
<td>Qc(w)</td>
</tr>
<tr>
<td>E</td>
<td>Alderwood-Urban Land Complex, 2 to 8 % slopes except in the center of the segment Custer Fine Sandy Loam</td>
<td>Qc(w), Qf</td>
</tr>
<tr>
<td>F</td>
<td>Urban land</td>
<td>Qf</td>
</tr>
<tr>
<td>G</td>
<td>Urban land</td>
<td>Qf</td>
</tr>
<tr>
<td>H</td>
<td>Urban land</td>
<td>Qf</td>
</tr>
<tr>
<td>I</td>
<td>West side of lake is Alderwood-Urban Land Complex, 8 to 15 % slopes. South side of lake is Mukilteo Muck.</td>
<td>Qgo, Qga, Qa</td>
</tr>
</tbody>
</table>
5.3 Landslide Hazard Areas

Landslide hazard areas, as discussed in this inventory, are areas that have been given landslide hazard designation by the City of Edmonds. Per ECDC Chapter 23.80.020, landslide hazard areas are areas potentially subject to landslides based on a combination of geologic, topographic, and hydrologic factors. Susceptibility is based on any combination of bedrock, soil, slope (gradient), slope aspect, structure, hydrology, or other factors that are prone to failure. Within the City of Edmonds, landslide hazard areas specifically include:

1. Areas of ancient or historic failures in Edmonds which include all areas within the Earth Subsidence and Landslide Hazard Area as identified in the 1979 report of Robert Lowe Associates and amended by the 1985 report of GeoEngineers, Inc.

2. Any area with a slope of forty percent (40%) or steeper and a vertical relief of ten (10) or more feet, except areas composed of consolidated rock.

3. Any area potentially unstable as a result of rapid stream incision or stream bank erosion.

4. Any area located on an alluvial fan, presently subject to, or potentially subject to, inundation by debris flow or deposition of stream-transported sediments.

Along the City’s shorelines, only the northern two-thirds of Segment A, predominantly along Browns Bay, is presently mapped by the City of Edmonds as a landslide hazard area (Figure 9), based on geologic conditions and analysis conducted in 1979 and 1985. The City data agree with the Coastal Zone Atlas (Ecology 2001), which depicts Browns Bay as unstable, with recent landslides; however, the landslide dataset was based on information collected in the mid-1970s (Ecology) to mid-1980s (GeoEngineers, Inc.), which omits the other city shoreline areas that have had recent slides.

5.4 Seismic Hazards

Per ECDC Chapter 23.80.020, Designation of Specific Hazard Area, seismic hazard areas are areas subject to severe risk of damage as a result of earthquake induced ground shaking, slope failure, settlement, soil liquefaction, lateral spreading, or surface faulting.

The most damaging effect of an earthquake is shaking at the ground surface. Ground shaking during an earthquake is strongest in areas of soft soils, such as in river valleys or along the shorelines of bays and lakes. In addition, ground shaking in areas of soft soils underlain by stiffer soils or rock is generally stronger than in areas where there is little or no variation between the surface and substratum.

Liquefaction is a phenomenon in which strong earthquake shaking causes a soil to rapidly lose its strength and behave like quicksand. Liquefaction typically occurs in artificial fills and in areas of loose sandy soils that are saturated with water, such as low-lying coastal areas, lakeshores, and river valleys. The northwest shoreline of Lake Ballinger contains areas of moderate and high soil liquefaction risk.

Along the City shorelines, landslide hazard areas and areas of moderate to high risk of soil liquefaction are shown in Figure 9 and Figure 10, respectively. These hazard areas contain some of the elements that define a seismic hazard area. Further definition of seismic hazard areas is provided by the City on a case-by-case basis.
5.5 Shoreline Slope Stability

For the purposes of this inventory, shoreline slope stability refers to the relative stability of coastal slopes as portrayed in the Washington State Department of Ecology Coastal Zone Atlas (Ecology 2001). This determination refers to the relative stability of coastal slopes as interpreted by geologists based on aerial photographs, geological mapping, topography, and field observations. This mapping was digitized from the Department of Ecology Coastal Zone Atlas and represents conditions observed in the early and mid-1970s.

Along the Edmonds Puget Sound shoreline, the northern two-thirds of Segment A is mostly mapped as “unstable” (i.e., slopes generally are greater than 15 percent in areas underlain by weak, unstable materials in which old or recently active landslides have occurred) with some areas mapped as “unstable old landslides” (i.e., former landslide areas, generally located within areas underlain by weak, unstable materials. Slopes generally are greater than 15 percent.), and some mapped as “modified” areas (i.e., highly modified by human activities and considered unpredictable). The southern one-third of Segment A is mapped as “intermediate” (i.e., believed to be stable under natural conditions; may become unstable if disturbed. Slopes generally greater than 15 percent, but may be less in areas with less stable geologic materials.). Segment B is mostly mapped as “stable” (i.e., well-drained permeable layers with slopes less than 15 percent). Segment C is mapped as “unstable.” The northern portion of Segment D is mapped as “intermediate,” while the southern portion is mapped as “stable.” Segments E through H are mapped as modified and stable.

Segment I (Lake Ballinger) is not addressed by the Coastal Zone Atlas; however, the available geology and soils data indicate that the northwestern shoreline of the lake contains areas with unconsolidated soils (Alderwood-Urban Land complex and Mukilteo Muck), moderate slopes approaching 15 percent, high erosion potential, and moderate to high soil liquefaction potential. These factors indicate probable slope instability along part of Segment I. There are some potential indications this may also increase seismic risks.

5.6 Erosion Hazard Areas

In this inventory, erosion hazard areas are areas determined by the City of Edmonds to be erosion hazards. Per ECDC Chapter 23.80.020, erosion hazard areas are at least those areas identified by the U.S. Department of Agriculture’s Natural Resources Conservation Service as having a “moderate to severe,” “severe,” or “very severe” rill and inter-rill erosion hazard. Erosion hazard areas are also those areas impacted by shoreland and/or stream bank erosion. Erosion hazard areas include:

1. Those areas of the City of Edmonds containing soils that may experience severe to very severe erosion hazard. This group of soils includes, but is not limited to, the following when they occur on slopes of 15 percent or greater:
   a. Alderwood Soils (15 to 25 percent slopes);
   b. Alderwood/Everett Series (25 to 70 percent slopes);
   c. Everett Series (15 to 25 percent slopes);
2. Any area with slopes of 15 percent or greater and impermeable soils interbedded with granular soils and springs or groundwater seepage; and
3. Areas with significant visible evidence of groundwater seepage, and which also include existing landslide deposits regardless of slope.

Erosion hazard areas are shown on Figure 9. All shoreline segments of the City, except Segment F (between the ferry terminal and the marina) contain hillsides mapped as erosion hazard areas. In addition, all streams within the City, included in the SMP Update because of their hydraulic connection to shorelines of the state, are mapped with extensive erosion hazard areas along their banks.

In urban areas, erosion hazard areas are important considerations along waterways where soil deposition can harm wetlands, streams, and lakes by excessive accumulation. Clearing (vegetation removal) and grading (earthmoving) are the first steps toward destabilization of slopes (Canning 2001). Soil protection provided by vegetation is especially important in erosion hazard areas in Edmonds to prevent soil compaction and erosion on ravine slopes and lake shorelines, thereby limiting turbidity and sedimentation in waters that harbor fish and aquatic invertebrates.

5.7 Aquifer Recharge Areas

As described in Section 3.1.5, groundwater in the Edmonds area is recharged in upland areas and discharged along streams, lakes, and the Puget Sound shoreline. No significant recharge areas are expected to exist in the shoreline area. Additionally, no CARAs have been identified anywhere in the City (ECDC 23.60.010).

5.8 Lakes and Streams

Within the City limits, numerous surface water drainages flow into Puget Sound through gorges downcut in the steep bluffs. The Edmonds Critical Areas Ordinance (CAO) defines streams as “areas where surface waters produce a defined channel or bed which demonstrates clear evidence, such as the sorting of sediments, of the passage of water. The channel or bed need not contain water year round.” From north to south, the following perennial streams were identified along the marine shoreline: Lund’s (Gulch) Creek and Meadowdale Creek in Segment A; Perrinville Creek in Segment B; one unnamed creek in Segment C; Fruitdale Creek, Northstream Creek, and Shell Creek (with tributary Hindley Creek) in Segment D; and Shellabarger (various spellings)/Willow Creek in Segment H. Willow Creek, which lies mostly within Woodway, flows into the Edmonds Marsh along the base of the hillside of the former Unocal site where it mixes with flows from Shellabarger Creek before flowing through a series of ditches and culverts into Puget Sound near the Unocal Pier at Point Edwards. Shellabarger Creek, situated along the western bluff abutting Puget Sound, represents the intersection of the land surface with the Vashon advanced outwash aquifer water table. The Edmonds CAO recognizes the six named creeks south of Lund’s Creek as Category 2 streams.

None of the streams included on the 2004 CAO inventory within the City of Edmonds meet the criteria for “shorelines of the state,” but all contain potential or actual fish habitat and, thus, meet designation criteria for Type F waters pursuant to WAC 222-16-030. The only lake within City limits is Lake Ballinger in Segment I. Neither the inlet source (Hall Creek) nor the outlet (McAleer Creek) of Lake Ballinger flow within the City, although small areas of the City drain into them.

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5.9 Flood Hazard Areas

Aside from the shoreline of Puget Sound itself, the Federal Emergency Management Agency (FEMA) 100-year floodplain only includes the Edmonds Marsh, a small portion of the Shell Creek drainage extending about one-quarter-mile upstream from the stream outfall, and shoreline areas of Lake Ballinger located within the City limits. In total, these areas include only 84 acres or 0.67 percent of Edmonds’ total jurisdictional area (EDAW 2004).

Although the flood hazard areas in the City of Edmonds are defined on the FEMA maps, a better way to describe them is by referring to their base (100-year) flood elevations. For the coastline this elevation is 10 feet National Geodetic Vertical Datum (NGVD) or 14 feet North American Vertical Datum (NAVD). For Lake Ballinger this is elevation is 282.5 feet NGVD or 286.1 feet NAVD. Some flooding has occurred along the coast, but more serious flooding has occurred in areas adjacent to the Edmonds Marsh/Shelleberger Creek and on Lake Ballinger in recent years.

5.10 Nearshore Processes

The Net Shore-Drift in Washington State program (Ecology 2002) map coverage denotes the extent of individual drift cells and the direction of net shore-drift within the littoral zone for the City shoreline, based on a shoreline study conducted in the early 1990s by Jim Johannessen. The Edmonds shoreline littoral drift zone consists of two large partial drift cells separated by an area of no appreciable net drift (see Figure 5). No clear net-shore drift pattern was observed from Ecology’s 2001 aerial photos taken of the Edmonds shoreline.

A large drift cell (SN-3) extends north from King County and terminates at the south end of the marina, contributing sand and drift logs to Marina Beach Park. SN-3 measures approximately 6.2 miles. Accretion shoreforms in this drift cell were found in relatively close proximity to Point Wells and the King-Snohomish county line. Historically, about 66 percent of this drift cell actively contributed slide material to the nearshore; following the railroad construction, little material currently reaches the shore (Johannessen et al., 2005).

Between the park and the downtown area is a 1.6-mile-long area of no appreciable net drift (SN-2/SN-3 NAD), which terminates at a latitude roughly even with Caspers Street. The ferry terminal and southern breakwater of the Edmonds Marina impede net shore-drift in this shore segment. The southern breakwater of the Edmonds Marina prevents northward sediment transport, resulting in accretion and progradation of the South Marina Beach (Johannessen et al., 2005); however, the beach was initially constructed along with the marina breakwater and may not receive enough nearshore drift sediment to be self-maintaining. North of the ferry terminal at Brackett’s Landing (north unit) is a constructed rock groin and beach area that may function as a potential accretion shoreform. The beach was artificially nourished in 1989 with several different sizes of gravel (Shipman in prep). Results of historic accretion shoreform mapping indicated that 58 percent of the historic accretionary beaches in this drift cell have been lost due to anthropogenic alterations to the nearshore (Johannessen et al., 2005).

North of the “no drift” area, another large drift cell (SN-2) moves sediment northerly along the city shoreline and beyond the city limits. SN-2 originates approximately 1,000 ft north of the ferry terminal and extends approximately 10.7 miles to just beyond Elliott Point in Mukilteo. Eighty-nine percent of the shores of this drift cell are modified by the Burlington Northern Santa Fe (BNSF) seawall. Landslides delivered sediment over the top of the BNSF railroad in three percent of the drift cell. The remaining 11 percent consisted of small accretion shoreforms typically formed from sediment derived from nearby streams (Johannessen et al., 2005). The few
small deltas along the shoreline are symmetrical and give little visual indication of a predominant drift direction. Currently there are no intact bluff sediment sources in this drift cell; however, historic mapping and analysis shows that at least 74 percent of this cell was an active sediment source prior to construction of the BNSF seawall (Johannessen et al., 2005).

Today, intermittent landslides continue to occur along bluff shores, but sediments loads rarely reach the water, due to the presence of the BNSF railroad bed and land use restrictions by State agencies that prevent the timely transfer of slide material onto the beach. Obstructions to beach re-nourishment and net shore drift, such as bulkheads, breakwaters, groins, docks, and boat ramps, block the redistribution of upland sediment onto the nearshore and result in increased erosion in areas where the beach is depleted. Hardened surfaces also deflect waves and concentrate wave energy onto adjacent properties, leading to increased beach erosion and a restructuring of shoreline substrate slope and particle size, which in turn alters biological composition from sandy beach communities (e.g., eelgrass, littleneck clam, Dungeness crab, surf smelt) toward gravel and cobble beach communities (e.g., kelp, butter clam, red rock crab) (Williams and Thom 2001).

5.11 Shoreline Modifications

Shoreline modifications refer to features or structures added to or removed from a shoreline that alters the shoreline’s natural function, typically resulting in changes to wave energy dissipation, erosion, and sediment transport. Examples of modifications include armored intertidal slopes (e.g., bulkheads, riprap armoring, etc.), overwater structures (e.g., dock and piers), cleared vegetation (commonly done to improve views), channelized stream outlets (confining streams to channels or culverts that discharge at a point, instead of across a broad area), dredging, and filling.

Visible shoreline modifications along the City’s waterfront within 200 feet of OHW were recorded using a GPS during a shoreline inventory and transferred into a GIS database (Snohomish County 2001). Figure 7 depicts the primary shoreland modification, bulkhead/seawall, and locations of armoring and overwater structures that affect marine habitat. No corresponding data were available for Lake Ballinger, although aerial photos reveal numerous piers and floats along the entire Edmonds shoreline.

In general, the Edmonds marine shoreline is defined by the steep shoreline bluffs and the BNSF railroad bed along the northern two-thirds of its length. The western edge of the rail bed fill covers the intertidal and transitional upland zones along the beach, with either a vertical seawall or a steep armored slope composed of large boulders or granite block. The remaining third of the shoreline, adjacent to the downtown area and south to the county border, is characterized by low or no banks; however, the low banks have been bulkheaded or armored and filled by buildings and road. These structures have likely been constructed on historic backshore habitat, which formerly allowed a slow and widespread re-distribution of erodable bluff material along the shoreline. Today, only infrequent and severe landslides are able, at few locations, to contribute “pulses” of sediment to the nearshore.

Intertidal structures have also eliminated most nearshore riparian vegetation and limited marine life to those species adapted to hard, nearly vertical substrates. Shoreline hydrology along the southern third of the city is further modified by a rock groin, a ferry terminal, a parking lot, a fishing pier, a marina, and a commercial pier. Nearshore drift is interrupted, reduced, or shifted seaward by these structures, causing drift sediment and organic material to drop into subtidal, rather than intertidal areas. What once had been a broad sandy gravel intertidal slope with a
width of hundreds of feet is now, in numerous areas, a narrow intertidal gravel and cobble beach with a width of 50 feet or less. Considering that many marine invertebrates, fish, and plants are adapted specifically to a narrow range of intertidal elevations, the reduction of intertidal habitat represents a significant loss of habitat area for those species along the Edmonds shore.

5.11.1 Shoreline Armoring

Shoreline armoring typically refers to the placement of hard structures, such as rock-covered slopes and bulkheads, to deflect wave energy away from a location perceived as vulnerable to erosion. Armoring is also done to stabilize an area from normal changes in sediment transport (e.g., to reduce shoaling at a marina entrance or encourage sand deposition along beach). Shoreline armoring has adverse effects on the nearshore physical processes necessary to maintain native species habitats and shoreline functions. These effects include the loss of beach areas, impoundment of sediment, modification of groundwater regimes, lowering of beach elevations, concentration and redirection of wave energy to adjacent areas, alteration of substrate, and loss of riparian vegetation and associated functions (KC DNR WTD 2003).

With the exceptions of Lund’s Creek estuary, Edmonds Underwater Park, Brackett’s Landing, and part of Marina Beach Park, the entire Edmonds shoreline (more than 90 percent) is armored by the BNSF railroad bed and bulkheads. Most of the BNSF rail bed along the Edmonds shoreline consists of an armored berm with two sets of parallel tracks on top, comprising a top width of at least 24 feet or more and a wider base width. The waterward side of the berm is typically armored with large rock or granite blocks, placed vertically or on a 2:1 slope. Concrete or wood bulkheads comprise the upper intertidal shoreline of the marina, adjacent commercial and residential buildings, and parking areas (see Figure 7). Many of these structures are probably reconstructions of old timber mill structures that date back to the late1800s, when Edmonds was established specifically because of the potential for waterfront access to transport lumber by steamship and rail (BOLA Architecture + Planning 2005). The railroad tracks were constructed along the shoreline, and mills and docks were built waterward, on planks and fill placed on the beach. A new city wharf was built in 1911 near the WSF ferry terminal, and a sea dike and sea gate were built around the same time to prevent floods of the tide flats areas southwest of downtown in the area of the Edmonds Marina.

Impacts to coastal processes from the extensive armoring of upper intertidal habitat along the Edmonds shoreline have affected the area for over a hundred years. Historic records of site-specific shoreline natural conditions are generally either unavailable or not quantifiable, so it is difficult to ascertain pre-development shore features and derive subsequent changes to nearshore conditions and processes. However, one potentially useful historic record in this regard is the United States Coast Survey’s topographic sheet (“T-sheet”) for the Edmonds’ area, which is shown in Figure 11. T-sheets are comprehensive and detailed early map representations of nearshore conditions in the second half of the 19th century, and are generally quite accurate, with some limitations.

The most obvious impact is the conversion of intertidal sand and gravel beach habitat into steep-walled, armored upland slopes and structures with little or no habitat value.

A second impact to shoreline function from armoring is the isolation of landslide material from the beach and adjacent shoreline areas. In many Puget Sound areas, landslide material is the sediment source that replenishes beaches from erosion by waves and currents; drift cell studies indicate that 66 to 74 percent of nearshore sediment sources from bluffs between Shoreline and
Mukilteo have been eliminated by the railroad (see Section 5.10). The stream deltas north of downtown Edmonds shore contribute small volumes of nearshore sediment (about 11 percent in Drift Cell SN-2) to the beach. The loss of historic sources of beach sediment caused by the construction of rail bed and other bulkheads, and the interruption of shoreline drift at other structures, such as the marina, ferry terminal, and the spit north of the Edmonds Underwater Park, further limit sediment replenishment. These modifications may be responsible for the relatively steep and narrow beach along this shoreline, and a possible shift from sandier substrate to gravelly cobble substrate in some areas.

Another impact to shoreline function from armoring and filling is the loss of nutrients from beach wrack that normally accumulates in broad bands along upper intertidal elevations. Beach wrack, consisting of decomposing marine and terrestrial shoreline vegetation, is a significant source of nutrients to the nearshore and a habitat upon which many aquatic vertebrates and invertebrates thrive (Sobocinski 2003). Beach wrack also provides shelter, food, and protection from solar energy and desiccation over intertidal sediment that is used as spawning and foraging substrate for several species of forage fish (e.g., sand lance and surf smelt) and shellfish (e.g., crabs, snails, gastropods).

The sea dike and sea gate would have stopped the natural tidal inundation of the Edmonds Marsh, shifting water quality to a less-saline, more stagnant brackish wetland, and shifting vegetation to species that are tolerant of lower salinity, warmer temperatures, and eutrophic water conditions. About three-quarters of the former marsh was subsequently filled for development of the marina, Harbor Square development complex, Edmonds sewage treatment plant, SR-104, and a City park. These changes have likely eliminated most sediment input to the intertidal nearshore.

It is possible that the shoreward extent of eelgrass has been reduced by the presumed steepening of the shoreline caused by armoring and fill. The addition of such marine structures and the resulting elimination of beach vegetation and possible coarsening of beach substrate may have reduced or eliminated forage fish spawning areas along most of the Edmonds shoreline.

5.11.2 Docks, Piers, and Over/In-water Structures

Overwater and in-water structures in Edmonds include docks, piers, ramps, wharves, and a marina. Over/in-water structures change the levels of light, shoreline energy regimes, substrate type and stability, and water quality along shorelines (Nightingale and Simenstad 2001). These changes result in alterations in the presence, abundance, and diversity of plant and animal species in the nearshore, including eelgrass, algae, fish, and wildlife. The physical supports that hold up overwater structures, such as bulkheads and piling, alter wave energy and sediment dynamics that affect plant propagation, fish foraging, spawning and migration, and shellfish settlement and rearing. In addition, construction materials associated with overwater structures can leach contaminants (e.g., creosote, metals from paint) into the nearshore environment.

The most significant over/in-water structures within the City’s shorelands are the Port of Edmonds Marina and the Washington State Ferry terminal. The marina covers about 617,000 square feet, and the ferry terminal covers about 24,700 square feet (CH2M HILL 2004). Other overwater coverage includes Laebugten’s Wharf (about 70,300 square feet, including the ramp, pier, and wharf structure), the former Unocal fuel pier (about 23,500 square feet), the City and Port of Edmonds fishing pier, and a small concrete ramp in Segment F.
In the locations of overwater piers, aerial photographs and hydroacoustic surveys reveal the fragmentation of an otherwise continuous band of eelgrass paralleling the shore. Eelgrass is absent from under-pier areas probably due to shading and erosion from boat propeller wash and current/wave refraction around pier piles.

Although these structures appear to cover large areas of the shallow nearshore marine waterfront, they are probably less extensive than the historic boardwalks, beach mills, and numerous steamship docks that covered the waterfront in the late 1800s and early 1900s.

Along the Lake Ballinger shoreline, docks and piers were noted at almost every parcel. Aerial photos revealed about 47 structures that extend into the lake. These structures alter freshwater shoreline physical and ecology characteristics, although the effects are difficult to estimate because the lake itself is a highly modified wetland that was converted into a lake by damming the outlet to McAleer Creek.
6.  Nearshore Biological Characterization

Physical shoreline conditions and processes described in Section 5 determine the biological species, conditions, and processes of the nearshore. Within the Edmonds SMP area, the marine shoreline is dominated by seawalls and fill, with the exception of three small beach parks. Waterward of the seawalls is a short, steep beach that ranges from sandy gravel to gravelly cobble. Landward of the seawall are moderate to tall (greater than 70 ft) bluffs, except in the commercial waterfront area. In addition to the seawalls within the intertidal zone, five additional in-water structures extend into the subtidal: the former Unocal pier, the Edmonds marina, the WSF pier, the rubble mound groin north of the ferry terminal, and Laebugten’s Wharf. These structures all affect the physical characteristics of the shoreline, which influence or determine the biological characteristics. The effects of in-water structures on longshore currents, sediment and nutrient transport, light (photosynthetic active radiation), and substrate largely determine the habitats available for aquatic plants and animals.

The seawalls and fill for the railroad, marina, and commercial district occupy much of the intertidal zone, eliminating habitat for plants and animals that depend on those limited elevations between aquatic and terrestrial conditions. This includes the loss of upper intertidal and backshore vegetation, such as pickleweed, saltgrass, dune grass, driftwood, and beach wrack. Beach wrack, which consists of accumulations of aquatic and terrestrial plants and animals, provides nutrients and minerals to the shoreline and food and habitat to a community of resident and migratory species, including insects, fish, birds, and mammals. Recent studies of Pacific Coast and Puget Sound beaches have shown that the loss of beach wrack results in the absence of critical food resources for marine and terrestrial communities, and migrating shorebirds (Orr et al., 2005, Sobocinski 2003). Shoreline armoring eliminates beach wrack and decreases abundance and species diversity in both benthic infaunal invertebrate and insect assemblages in the upper intertidal zone. The impacts of shoreline modifications are most profound when they are installed below MHHW and where backshore vegetation has been removed (Sobocinski 2003), which is the condition of most of Edmonds’ marine shoreline.

The numerous streams along this Central Puget Sound shoreline continue to contribute nutrients, insects, and terrestrial plant detritus to the marine nearshore via culverts under the BNSF railroad bed. These streams are unlikely to have ever been a significant source of driftwood or log debris, although landslides along the eroding bluffs would have regularly contributed logs to the marine nearshore. Currently, the BNSF railroad, the marina and WSF ferry terminal, and commercial seawalls occupy the zone in which drift logs and beach wrack would have accumulated.

Mid- and upper intertidal beach elevations provide spawning habitat for forage fish, such as surf smelt and sand lance, which form a critical base of the Puget Sound food web for birds, fish, and marine mammals. Although a few spawning areas for forage fish occur between Seattle and
Edmonds, none has been identified by WDFW in the Edmonds area, possibly due to intertidal beach alterations and habitat loss due to seawalls and fill.

Shoreline armoring, backshore fill, and in-water structures affect sediment transport and deposition as described in the previous section. The results of a shift in the physical shoreline conditions affects beach biological function in several ways. Structures deflect energy from waves and currents into unarmored areas, resulting in small areas of sediment accumulation (e.g., Underwater Marine Park spit) at the expense of larger areas of beach erosion, slope steepening, and substrate coarsening. The rate of erosion or sedimentation is too extreme for most plants and animals to adapt to, so these continually disturbed areas soon favor large numbers of a few species that thrive in unstable habitats. The result of sediment coarsening is often seen in a shift to larger, hardier bivalves (e.g., horse clams instead of Manila clams) and the loss of eelgrass at intertidal elevations.

In both freshwater and marine ecosystems, structures such as bulkheads, docks, and piers create a physical barrier between upland and aquatic biological communities, in addition to eliminating critical habitat features (especially vegetation), that forms important transitional habitat between the upland fresh-water ecosystem and the marine ecosystem.

6.1 Wetland Habitat

The City has four areas with potential wetlands that may be associated with the draft shoreline jurisdiction (Figure 12). Areas with potential wetlands are located in the vicinity of the following surface water features: Shellabarger Creek, Willow Creek, Shell Creek, Hindley Creek, Perrinville Creek, and Lake Ballinger.

The City has one wetland (the 23-acre Edmonds Marsh), designated as a Category 1 wetland (highest quality), in addition to a Wildlife Habitat and Natural Resource Sanctuary. It is classified by the State as a priority habitat. Edmonds Marsh has been filled on the east by SR 104, the Harbor Square commercial area to the north, the BNSF tracks and the Port of Edmonds to the west, and the historical Unocal facility and Deer Creek Fish Hatchery to the south. The isolated remnant of Edmonds Marsh east of SR104 is hydraulically connected with the main marsh via a culvert under SR 104 that also conveys Shellabarger Creek. Portions of the marsh are seasonally flooded from discharges from Willow and Shellabarger Creeks. For the purpose of this inventory, both sections are treated as the Edmonds Marsh.

A series of ditches, pipes, and a culvert under the railroad tracks convey flows from the wetland under Admiral Way into Puget Sound.

The Edmonds Marsh receives water from approximately 900 acres, including Willow and Shellabarger Creeks, as well as runoff from surrounding properties. Adjacent property on the former Unocal site includes two stormwater detention ponds that were created from diking and filling the south portion of the wetland. During certain storm conditions, stormwater overflows from the ponds currently discharge into Willow Creek, which flows through the marsh. The marsh (including flows from Shellabarger Creek) drains to Puget Sound via a channelized portion of Willow Creek. The creek passes through a tide gate into a 48-inch pipe, which extends 1,275 feet into the lower intertidal portion of the beach south of the Edmonds Marina breakwater. The tide gate is kept closed from October through March (although there is some leakage); during the spring and summer months the marsh is tidally influenced.
The marsh tends to be brackish in the winter months and saline in the summer, once the tide gate is opened. The upgradient (eastern) portion of the marsh nearest the fish hatchery is primarily freshwater and is dominated by cattails, hard-stem bulrush, common velvet grass, water parsley, climbing nightshade and redbud. The overstory consists of alder, black cottonwood, Scouler’s willow, Western red cedar, Douglas fir, and bigleaf maple. The shrub and herb layers include beaked hazelnut, salmonberry, red elderberry, skunk cabbage, horsetail, fringecup, and creeping buttercup. The western, estuarine portion of the marsh is dominated by American three-square, fleshy jaumea, Pacific silverweed, seacoast bulrush, salt grass, brass button, and soft rush. Invasive species are present throughout the marsh (and may be dominant) and include Himalayan blackberry, Japanese knotweed, Scot’s broom, purple loosestrife, and reed Canary grass (CH2MILL 2004).

The marsh is used by a wide variety of bird species (over 225 species), including the great blue heron (a State monitor species), which nests near the marsh (WDFW 2006a).

The presence of some other potential wetlands outside of shoreline jurisdiction was noted as part of the Edmonds Stream Inventory and Assessment (Pentec Environmental 2002), based on the Snohomish County Critical Areas 1991, but little information is available regarding these features. Vegetation is anticipated to be similar to that observed in the freshwater portion of Edmonds Marsh. Wildlife use is likely to be less, because of the smaller size of these other potential wetland areas.

### 6.2 Fish and Wildlife

None of the streams included on the 2004 CAO inventory within the City of Edmonds meet the criteria for “shorelines of the state,” but all contain potential or actual fish habitat and, thus, meet designation criteria for Type F waters pursuant to WAC 222-16-030. As of 2004, Edmonds anadromous fishbearing streams are known to include Willow Creek, Shellabarger Creek, Shell Creek, Hindley Creek (a tributary of Shell Creek), Perrinville Creek, and Lund’s Creek (ECDC 23.90.010).

Numerous fish and wildlife species depend on the Edmonds shoreline and adjacent shoreland habitats for either part or all of a life stage. Certain species and habitats are therefore recognized by state and federal agencies because of their special values. Special values are often associated with consumptive use by people representing commercial, recreational, or tribal interests. In some cases, special value is assigned because of rarity (e.g., killer whale) or ecological importance (e.g., forage fish). These species and associated habitats are typically documented and protected by WDFW, at the state level, and several federal agencies. Government agencies may assign variable levels of value and protection to a species or its habitat, based on numerous factors. This is collectively referred to as a species’ “status.” General fish and wildlife species and their status are discussed below.

Under the state’s SMA, the City of Edmonds is also responsible for identifying critical habitats within its boundaries for the protection of natural resources under their jurisdiction. The Potential Fish and Wildlife Conservation Areas identified in the CAO are shown in Figure 4. Edmonds Underwater Park is a portion of the area owned or controlled by the City of Edmonds designated as Brackett's Landing Shoreline Sanctuary. Brackett's Landing Shoreline Sanctuary includes intertidal areas owned or under the control of the City in addition to the underwater park area. The City has designated additional critical habitats that include Edmonds Marsh.
6.2.1  State Priority Habitats and Species

WDFW has identified priority habitats for shellfish, salmonids, eagle, great blue heron, California sea lion, and harbor seal in the wetland, riparian, and estuarine habitats along the Edmonds shoreline (see Figure 12). State special status species that may occur in nearshore areas include peregrine falcon, pileated woodpecker, Vaux’s swift, merlin, purple martin, great blue heron, green heron, western big-eared bat, Keen’s myotis bat, long-eared bat, and longlegged bat.

6.2.1.1 Shellfish

Shellfish resources include clams, mussels, crab, and shrimp. Species representing all of these groups are found in the marine waters of the City (Table 5).

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dungeness crab</td>
<td>Cancer magister</td>
</tr>
<tr>
<td>Red rock crab</td>
<td>Cancer productus</td>
</tr>
<tr>
<td>Bay mussel</td>
<td>Mytilus edulis</td>
</tr>
<tr>
<td>Small clam</td>
<td>Macoma charlottensis</td>
</tr>
<tr>
<td>Native littleneck clam</td>
<td>Protothaca staminea</td>
</tr>
<tr>
<td>Manila clam</td>
<td>Tapes japonica or Venerupis philippinarum</td>
</tr>
<tr>
<td>Bentnose clam</td>
<td>Macoma nasuta</td>
</tr>
<tr>
<td>Butter clam</td>
<td>Saxidomus gigantea</td>
</tr>
<tr>
<td>Heart cockle</td>
<td>Clinocardium nutalli</td>
</tr>
<tr>
<td>Horse clam</td>
<td>Tresus capex</td>
</tr>
<tr>
<td>Geoduck clam</td>
<td>Panopea abrupta</td>
</tr>
<tr>
<td>Spot prawn</td>
<td>Pandalus platyceros</td>
</tr>
<tr>
<td>Broken-back shrimps</td>
<td>Heptacarpus spp.</td>
</tr>
<tr>
<td>Dock (coon-stripe) shrimp</td>
<td>Pandalus danae</td>
</tr>
</tbody>
</table>

Information from KC DNR WTD 2003, WDFW 2006a, Kozloff 1993, Golder and Parametrix 2002

Several clam species inhabit Puget Sound waters in the vicinity of Edmonds, including horse or gaper, manila, native littleneck, butter, cockle, and geoduck clams. Clams have planktonic larvae that settle onto the bottom and crawl until they find a suitable habitat. They then attach themselves by a filament and burrow into the substrate after reaching sufficient size. Manila, native littleneck, butter, and horse clams, and heart cockle are found in intertidal sand and in sand-gravel substrates; butter and horse clams are the most abundant. Manila clams are typically found in intertidal habitat, whereas native littlenecks can occur from the mid-intertidal down to shallow subtidal areas. Butter clams can inhabit low intertidal down to subtidal areas (Harbo...
Horse and geoduck clams are found in both intertidal and subtidal zones but can occur in deeper waters than other clam species. Geoduck clams can occur from low intertidal areas down to a depth of over 300 feet (KC DNR WTD 2003). The small clam Macoma charlottensis dominates deeper subtidal areas.

Hardshell clams, such as littleneck and butter clams, may be in sufficient densities to support recreational harvest, in those intertidal beach areas characterized as gravelly or cobbly. Geoduck are harvested both recreationally and commercially in Puget Sound. Geoduck beds were identified by WDFW along the entire Edmonds shoreline, from the marina north to the City boundary. The Edmonds beds range in depth from about -20 to -120 feet MLLW (KC DNR WTD 2003). A recent geoduck survey (Golder and Parametrix 2002) confirmed the range of geoduck beds along the City and recorded mean densities between 0.4 and 2.5 geoducks per square meter, with greater densities at increasing depth. A commercial geoduck harvest area occurs along the entire City nearshore, from the north end of the Edmonds marina to Picnic Point and north.

Dungeness crab in Puget Sound prefer sandy bottom habitats or those with sandy-muddy substrates that support eelgrass, typically in waters ranging from approximately -9 to –185 feet MLLW. Dungeness crab can be expected to occur in the marine zones adjacent to the City at depths typically seen in other parts of the Central Basin of Puget Sound over similar substrate. They have also been harvested commercially and recreationally near the City of Edmonds (KC DNR WTD 2003). A juvenile Dungeness crab study, sponsored by the Snohomish County Marine Resources Committee, is currently being conducted in the North Marina Beach area (Lider 2006 personal communication).

Red rock crab is more abundant in intertidal areas than Dungeness crab and is commonly associated with rock/gravel substrates, although they may also occur in sandy and muddy areas containing eelgrass. Red rock crab preys and scavenges on a variety of benthic species, including clams, mussels, snails, and other crabs. Like Dungeness crab, this species also has planktonic larvae that settle out as juveniles in intertidal to shallow subtidal areas. Red rock crabs are expected to occur along the Edmonds shoreline and have been harvested recreationally near Edmonds.

Several species of shrimp inhabit Puget Sound waters, including pink, humpback, and coonstripe shrimp, as well as spot prawns (also known as spot shrimp). Spot prawn, the largest of the pandalid shrimps, is the most important commercially and recreationally harvested shrimp species in Puget Sound. Adult spot prawns inhabit discrete areas called beds and are typically found in waters between depths of -185 to -285 feet MLLW in central Puget Sound. Spot prawn habitat requirements depend on the developmental stage of the animal. Adults occupy deeper waters, while juveniles use shallower waters where vegetation is present. Spot prawns exhibit seasonal migrations from deep to shallow waters; they can also migrate vertically in the water column. There are commercial, tribal, and recreational spot prawn fisheries in or near Point Edwards (KC DNR WTD 2003).

6.2.1.2 Salmonids

Eight species of salmonids use nearshore areas of Puget Sound at some point in their life cycle. These include Chinook, chum, coho, sockeye, and pink salmon and sea-run cutthroat, steelhead, and bull trout (Striplin and Battelle 2001).
Table 6. Salmonids Found within the Edmonds Shoreline Jurisdiction

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinook salmon (also called king, blackmouth)</td>
<td><em>Oncorhynchus tshawytscha</em></td>
</tr>
<tr>
<td>Coho salmon (also called red)</td>
<td><em>O. kisutch</em></td>
</tr>
<tr>
<td>Sockeye salmon</td>
<td><em>O. nerka</em></td>
</tr>
<tr>
<td>Chum salmon (also called dog, fall, calico)</td>
<td><em>O. keta</em></td>
</tr>
<tr>
<td>Steelhead (same as rainbow trout)</td>
<td><em>O. mykiss</em></td>
</tr>
<tr>
<td>Pink salmon (also called humpback)</td>
<td><em>O. gorbuscha</em></td>
</tr>
<tr>
<td>Bull trout</td>
<td><em>Salvelinus confluentus</em></td>
</tr>
<tr>
<td>Cutthroat trout</td>
<td><em>O. clarki</em></td>
</tr>
</tbody>
</table>

Salmonids use nearshore areas for adapting from freshwater to saltwater, for migration, as nursery areas for juveniles (Striplin and Battelle 2001). Nearshore area surveys conducted in 2001 found juvenile coho, Chinook, sockeye, and chum salmon, along with cutthroat and steelhead trout at several locations in the Edmonds vicinity.

Deeper water provides habitat for adult salmonids. Salmonid stocks that may be present near Edmonds include runs from the Skagit and Stillaguamish Rivers, but mostly from the Snohomish, Green, Puyallup, and Nisqually Rivers and smaller drainages in central and southern Puget Sound.

All streams within the City of Edmonds discharge either directly or indirectly to Puget Sound. However, anadromous salmon use (primarily chum and coho) has only been documented in three drainages (Lund’s, Shell, and Willow Creeks), although natural spawning may be limited to Lund’s and Shell Creek (accidental releases from the Deer Creek Hatchery are presumed to account for adults in Willow Creek). Juvenile chum salmon have been released in Perrinville Creek as part of a class project at Seaview Elementary School; however, no adult returns to this stream have been reported (Pentec Environmental 2002). In general, high sediment loads and impassable fish barriers have limited the use of potential spawning and rearing habitat that may be present. Native cutthroat trout are present in Perrinville, Northstream, Shell, Hindley, Shellabarger, and Willow Creeks. No bull trout have been observed in any of the drainages within the City (Pentec Environmental 2002).

6.2.1.3 Forage Fish

Forage fish include those species that are preyed upon by species of concern. Forage fish include herring, surf smelt, and sand lance.

Sand lance (*Ammodytes hexapterus*) and surf smelt (*Hypomesus pretiosus*) are generally found in nearshore areas. Both species are a prey item for seabirds, marine mammals, and a variety of fishes. From November 2000 to February 2001 and again from November 2001 to
February 2002, King County conducted sand lance and surf smelt spawning surveys on beaches in the vicinity of Edmonds. Documented sand lance spawning habitat was found at Brackett’s Landing and along Ocean Avenue. Documented surf smelt spawning habitat was found at Point Edwards (KC DNR WTD 2003). Although there are Pacific herring spawning grounds in the central basin of Puget Sound, none are within the City’s shoreline.

6.2.1.4 Shorebirds and Upland Birds

Birds with priority habitats that occur within the City include bald eagle, purple martin, and great blue heron.

The bald eagle is listed as a federal and state threatened species. The following paragraph was taken from the Brightwater FEIS (KC DNR WTD 2003). Bald eagles are both residents in and migrants through the Puget Sound region. Eagle populations are usually highest in the region in the winter months, when both resident birds and winter migrants are present due to the mild winter climate and abundant fall salmon runs. Bald eagles generally perch, roost, and build nests in mature trees near water bodies and available prey, usually away from intense human activity. They prey on a variety of foods, including fish, birds, mammals, carrion, and invertebrates. In the Puget Sound region, waterfowl and fish are generally the most common food for eagles. Bald eagles typically return to one of several nests located within an established nesting territory. Their seasonal home range for foraging and nesting averages 1.8 square miles in this region.

WDFW priority habitat map (2006a) notes nesting bald eagles at two locations within the City limits. It is not known if these nests are occupied every year, although nesting has been noted over the last 10 years (since 1997).

Great blue heron have nested in the woods surrounding the Edmonds marsh. Up to 17 birds have been observed in the marsh in recent years (WDFW 2006a). The WDFW Priority Habitat and Species map (2006) noted the presence of a seabird colony (glaucous-winged gull) near the Edmonds Underwater Park. In April 2004, gourds were installed on a group of pilings south of the Edmonds ferry dock by volunteers, with the approval of the Edmonds Parks and Recreation Director. Prior to that time purple martin, a priority species, had not been nesting on the Edmonds waterfront due to lack of nesting habitat. Since the artificial nest sites were provided, Martins have successfully nested in 2004 and 2005, and nesting activity has been observed recently (Lider 2006 personal communication).

6.2.1.5 Marine Mammals

A Priority Haulout Area has been identified by WDFW (2006a) within the Edmonds Underwater Park for harbor seals and California sea lions. These pinnipeds, along with the endangered Steller sea lion, will use beaches or structures near beaches as haulout areas. In the past, floats installed for divers at the Edmonds Underwater Park were taken over by sea lions. Because the sea lions rendered the floats unusable by divers, the floats were eventually removed, so this haulout designation may no longer be relevant; however, the adjacent beaches are frequently used by harbor seals (Lider 2006 personal communication).

6.2.2 Federal Threatened and Endangered Species

Several federally listed threatened or endangered species that may inhabit marine waters or adjacent habitats within the City are identified in the State database (WDFW 2006a). Threatened birds include the bald eagle (Haliaeetus leucocephalus) and marbled murrelet (Brachyramphus
Bald eagles are known to be present in nearshore areas of the Central Basin of Puget Sound, and there are documented eagle nests and breeding areas within the City (Figure 12). Marbled murrelets are observed intermittently in inland Puget Sound waters; winter and summer surveys by WDFW conducted near Edmonds found no murrelets in winter and only a few birds in the Edmonds area in summer (Striplin and Battelle 2001).

Federally listed threatened fish species that may occur in or in the vicinity of Edmonds, including Puget Sound Chinook salmon and bull trout. Puget Sound steelhead are currently proposed for federal listing as a threatened species. All three salmonids require varied habitats during different phases of their lives. Adults use nearshore areas as migration corridors when returning from the oceanic life stage, while juveniles reside in the nearshore prior during their outmigration from freshwater to the ocean. Bull trout adults also use shallow nearshore marine and estuarine areas as foraging grounds and migration corridors.

Federally listed marine mammals may be present in the Edmonds shoreline jurisdiction, but are not commonly observed. Steller sea lion (*Eumetopius jubatus*), listed as endangered, is not commonly observed in the Central Basin of Puget Sound, although the area beaches and large fish diversity at the Edmonds Underwater Park would provide attractive habitat. The southern Puget Sound resident population of killer whale (*Orcinus orca*), listed as threatened, is also an uncommon visitor to central Puget Sound. Because the City of Edmonds’ shoreline jurisdiction extends far offshore, it is likely that killer whales could transit through the area; however, extensive shoreline development, ferry traffic, and the absence of salmon-bearing streams makes it unlikely that they would be attracted to the nearshore.

Critical habitat is designated by the federal government as part of its management of threatened and endangered species under the ESA. Critical habitats with the City of Edmonds include those for Chinook salmon and bull trout. Chinook salmon are not known to have used any of the small creeks within the City; critical habitat includes only the marine nearshore, from extreme high tide to a depth of 30 meters (FR Vol. 70, No. 170, September 2, 2005). Likewise, bull trout habitat is not recognized within any of the City creeks; critical habitat includes the marine nearshore, from MHHW to -10 meter MLLW, and any tidally influenced freshwater heads of estuaries (FR Vol. 70, September 26, 2005). Chinook salmon habitat use along the Edmonds shoreline would be during periods of juvenile foraging and juvenile and adult migration. The eelgrass beds along the shoreline provide high quality foraging habitat for juveniles. Bull trout habitat use along the Edmonds shoreline would be during periods of adult foraging and migration. Bull trout display wide-ranging foraging habits and are known to consume juvenile salmon (including Chinook) that inhabit shallow nearshore areas.

### 6.3 Riparian Zones

Riparian habitats are those habitats that border streams, lakes, and marine beaches. All habitat types occur with the City. Figure 12 shows the location of both freshwater and marine riparian habitats.

#### 6.3.1 Freshwater

Two major drainages have been identified by the State as having priority riparian habitats; Lund’s Creek and Perrinville Creek. Additional riparian habitat is associated with Shell, Hindley (a tributary of Shell), Shellabarger and Willow Creeks and parts of the shoreline of Lake Ballinger.
Riparian habitat within the City is typically characterized by western red cedar, red alder, willow, bigleaf maple and Douglas fir, depending on the degree of flooding and gradient with the corridor. Characteristic understory vegetation includes Indian plum, salmonberry, thimbleberry and elderberry, with an herbaceous layer consisting of curly dock, skunk cabbage, salal, Oregon grape, stinging nettle, sword and lady fern, horsetail, and piggy-back plants. Invasive (e.g., Himalayan blackberry, ivy) or introduced plant species (e.g., holly, grasses, morning glory) may also be present, depending on the degree of disturbance or cultivation along the stream corridors.

Riparian corridors support a variety of wildlife, including birds (such as song birds, owls, flickers, and pileated woodpeckers) and mammals (such as beaver, otter, and deer).

6.3.2 Marine
The City’s marine riparian zone is the narrow shoreline adjacent to the Sound, extending 5.2 miles from Point Edwards to the mouth of Lund’s Gulch. This zone has been highly modified by development, including fill associated with the Burlington Northern Santa Fe (BNSF) railroad bed and the Port of Edmonds Marina, construction of piers and wharfs to support industrial/commercial facilities in the downtown area (including the former Unocal facility), and bulkheads and seawalls for shoreline protection. These developments have replaced native vegetation, such as salt-tolerant plants found on less developed sites, which would otherwise grow at the highest tide elevations and in adjacent upland areas.

Marine riparian vegetation, when present along the Edmonds shoreline, is characterized by a mix of native and invasive species (including dune wildrye, white sweet clover, yarrow, Puget Sound gumweed, oceanspray, English plantain, and Scot’s broom). Near the shoreline, at the base of the small streams that flow through ravines, vegetation is a combination of non-native herbs and shrubs, and fast-growing deciduous trees that have established on the steep slopes following logging, clearing, and landslides. Plant species are described in more detail for each segment in Section 7.

Native vegetation is mostly absent from the shoreline because of urban development in the downtown Edmonds area and the BNSF railroad in other areas. Native trees and shrubs that would have dominated this Puget Sound lowland forest shoreline include western hemlock, western red cedar, Sitka spruce, Douglas fir, bigleaf maple, red alder, madrona, and black cottonwood (Kruckeberg 1995). Common shrubs associated with lowland coastal forest would be Scouler’s willow, vine maple, salal, red huckleberry, Oregon grape, and devil’s club (Kruckeberg 1995). A few native trees, such as bigleaf maple and red alder, and many native shrubs are present in the ravines and along the estuarine edges, but no longer along the shoreline edges. Besides providing essential wildlife habitat for native animal species, the dense native forest that would be present along the shoreline (and overhanging the upper intertidal beach) provides an important source of terrestrial insects for shoreline-oriented migratory animals, including shorebirds and juvenile salmonids (Brennan et al. 2004, Sobocinski 2003). Shade from vegetation also plays an important role in sheltering the eggs of beach-spawning forage fish from ultraviolet light and desiccation (Pentilla 2001). The elimination of fringing shoreline vegetation decreases food, shelter, and habitat value for all animals that use the shoreline.

6.4 Beaches and Backshore Flats
No undeveloped areas of natural backshore flats remain along the Edmonds shoreline. Backshore flats would likely have been common along the southern third of Edmonds, in the...
locations of the existing marina, waterfront commercial buildings, ferry terminal, and parks. Additional areas of backshore flats were likely common at the base of the bluffs, where the BNSF railroad bed was constructed. The areas without natural backshore flats were likely those areas where the BNSF railroad bed was constructed with vertical walls in the lower intertidal zone.

Edmonds beaches are typical of sediment-starved beaches. Along most of the armored shoreline, steep, narrow beaches composed of gravelly cobble have replaced broad, sand and gravel beaches. The current sandy beaches at Marina Park and Brackett’s Landing were constructed and have been artificially re-supplied with sand and gravel brought from upland sources. Little vegetation is typically present in the intertidal zone, with the exception of rockweed (Fucus spp.), sea lettuce (Ulva spp.) and the low-salinity tolerant Enteromorpha sp. (in cases where there are freshwater seeps). However, many burrowing organisms use the intertidal area, particularly from the mid-tidal elevations and deeper. Typical sandy beach communities are characterized by cockles, clams, moon snails, isopods, burrowing worms, nudibranchs, sea cucumbers, and sea stars. In addition to those species, periwinkles, drills and other snails, barnacles, mussels, hermit crab, shore crab, errantiate (not confined to tubes or burrows), and tube-dwelling worms, anemones, tunicates, and sponges will also be present if the beach contains some gravel or cobble. Small fish (gunnels, blennies, and sculpin) may also be present in small depressions or under rocks. More stable, hard substrate (e.g., consolidated clay or rock) will encourage the presence of urchins. At high tide, larger organisms will be move into the beach areas, including Dungeness and red rock crab, juvenile salmon and other fishes (Kozloff 1993).

6.5 Sub-Estuaries (Stream Mouths and Deltas)

The Edmonds Critical Areas Ordinance (CAO) recognizes six Edmonds creeks as Category 2 streams. Streams are defined in the CAO as “areas where surface waters produce a defined channel or bed which demonstrates clear evidence, such as the sorting of sediments, of the passage of water. The channel or bed need not contain water year round.” None of the streams included on the 2004 CAO inventory within the City of Edmonds meets the criteria for “shorelines of the state,” but all contain potential or actual fish habitat and, thus, meet designation criteria for Type F waters pursuant to WAC 222-16-030. Among these streams are “Anadromous Fishbearing Streams” (streams existing in whole or in part within the City of Edmonds in which anadromous fish are known to occur). As of 2004, Edmonds fishbearing streams are known to include Willow Creek, Shellabarger Creek, Shell Creek, Hindley Creek (a tributary of Shell Creek), Perrinville Creek, and Lund’s Creek (ECDC 23.90.010).

Due to the location of the BNSF rail bed, sub-estuary habitat along Edmonds’ shoreline has been significantly reduced by fill and further constricted by culverts. The sub-estuaries now occur shoreward/upgradient of the tracks, separated from Puget Sound by 50- to 150-ft-long culverts—except at Edmonds Marsh, where the culvert is about 800 ft long. These inland sub-estuaries receive relatively high volumes of stormwater runoff from the backshore drainage ditch that parallels the rail bed. All stormwater runoff from all upland areas along the tracks flows toward the tracks and into the ditch, and then it is conveyed into the stream sub-estuaries. Because the steep slopes along the tracks are frequently denuded by slides and vegetation removal, unusually high sediment inputs are conveyed into the ditch and into the sub-estuaries, further degrading water quality. It is likely that the sub-estuaries support an altered benthic and epibenthic invertebrate community that favors large numbers of a few species that are tolerant of high siltation and small volumes of pollutants released by train traffic (e.g., oil and grease).
Small deltas have formed at the outlets of most sub-estuaries in Edmonds, particularly at Shell Creek (Pentec Environmental 2001). Stream discharges are not sufficient to significantly alter the salinity at these locations, although they may serve as a source of organic material to the local estuarine environment. These small deltas tend to be composed of sand and gravel and provide a lower gradient habitat relative to the adjacent fringing beach.

Small deltas are fairly productive and will be inhabited by worms, clams, mussels, snails, barnacles, amphipods, and other small crustaceans, anemones, red rock crab, sea stars, and small fish. The gravel and cobble that may be present can serve as holdfasts for smaller algae and kelp at the lower beach elevations. These stream deltas serve as foraging areas for diving ducks, shorebirds, fish-eating birds (such as herons and kingfisher), river otter, and fish. This habitat also provides spawning and rearing areas for many marine species that live out their lives in deeper water (e.g., midshipman fish).

The small deltas along the marine shore also provide critical migration corridors for wildlife and anadromous fish between the marine shore and upland freshwater riparian habitat. Access to and from the marine shore is largely limited to the stream corridors and culverts at sub-estuaries. Large animals, such as raccoons and deer, may climb the railroad embankment, but face lethal train traffic. Urban development, including housing, parks, the ferry terminal, and the railroad bed has eliminated virtually all overhanging marine shoreline vegetation in Edmonds; thus terrestrial wildlife foraging in the intertidal beach habitat has no shelter or cover to avoid predation or adverse weather, other than at the sub-estuaries.

Aquatic species are also dependent on sub-estuaries as migration corridors. Both juvenile and adult salmonids migrate through sub-estuaries to and from the ocean. The variable salinity within sub-estuaries provides juveniles with a relatively sheltered area and abundant food in which to adjust from freshwater to salt water (osmoregulation) during their migration to the ocean; adults returning to spawn depend on sub-estuaries for holding until stream flows adjust to acceptable volumes and temperatures for upstream migration.

6.6 Eelgrass Meadows

Eelgrass is distributed in patchy narrow bands along the City waterfront south of the marina to Point Wells, and north of Shell Creek to Picnic Point (KC DNR WTD 2003) (Figure 13). Dense patches are present in some areas, including north and south of the Lynnwood outfall (near Meadowdale Creek), and north and south of Laebugten’s Wharf. Although the WDNR ShoreZone inventory in 2001 depicted eelgrass between the ferry terminal and the north side of the marina, the recent Battelle Nearshore Survey (KC DNR WTD 2003) did not show eelgrass in that area.

At its shallowest extent, the eelgrass starts 10 feet waterward of the shore, at about -2 feet MLLW. The deepest extent is probably about 200 feet offshore, to a maximum depth of about -20 feet MLLW, based on the depth of nearby eelgrass beds that were mapped south of the marina for a recent eelgrass survey (Parametrix, reported in KC DNR WTD 2003). The density of the mapped eelgrass beds is variable, ranging from a few shoots per square meter, to several hundred per square meter.

Eelgrass beds provide foraging and refuge habitat for many species, including juvenile fish and Dungeness crab. Many diving ducks and other seabirds will also forage in the eelgrass beds. By late spring and summer, there is usually a well-developed invertebrate community inhabiting the beds, including small algae (attached to the eelgrass blades), flatworms, small crustaceans...
including copepods, amphipods, isopods, hydroids, jellyfish, snails, nudibranchs, six-rayed seastars, spider crabs, and many others (Kozloff 1993).

### 6.7 Kelp Beds

Bull kelp (*Nereocystis luetkeana*) and sugar kelp (*Laminaria saccharina*) are the most common types of kelp in central Puget Sound. Distribution of kelp, especially bull kelp, varies over time (Shaffer 1998 in KC DNR WTD 2003, see Figure 13). In general, kelp beds are found offshore of eelgrass beds, in deeper water, in areas of higher currents and rocky substrates that provide stable platforms for holdfast attachment. A dense band of kelp was recently mapped off the mouth of Shell Creek, extending about 1,000 feet to the north and south. Six smaller kelp beds were identified offshore in the general area of Perrinville Creek. One small kelp bed was mapped south of Laebugten’s Wharf (KC DNR WTD 2003). The DNR ShoreZone Inventory indicates that an area of bull kelp was observed north of the Edmonds Underwater Park for about 2,000 feet, and between Perrinville and Fruitdale Creeks for about 3,000 feet.

Kelp beds provide habitat for a variety of fish species, herring spawning substrate, and refuge for a variety of crabs and shrimps. Young rockfish common to the Central Basin of Puget Sound (brown, copper, and quillback) are typically found in kelp beds prior to moving to more typical adult rocky reef habitat.

### 6.8 Habitat Conservation Areas

Brackett's Landing Shoreline Sanctuary Conservation Area is defined in WAC 220-16-720 as those bed lands and tidelands owned by the City of Edmonds at Brackett's Landing Shoreline Sanctuary, and the water column above these bed lands and tidelands including all of the area known as Edmonds Underwater Park. Established in 1970, this is the oldest marine conservation area in Puget Sound, serving as a reference area for research into long-term marine conservation and ecological adaptation and recovery (WDFW 2006b).

According to WDFW (2006b), the park’s predominant fishes include copper rockfish (*Sebastes caurinus*), quillback rockfish (*S. maliger*), lingcod (*Ophiodon elongatus*), and cabezon (*Scorpaenichthys marmoratus*). Kelp greenling (*Hexagrammos decagrammus*), painted greenling (*Oxylebius pictus*), surferperches (*Embiotocidae*), and black rockfish (*S. melanops*) are also common in the park, although they are associated with artificial rocky reef habitats that are atypical of the natural nearshore habitat of this locale. Flatfishes are often found on the sand and mud habitats away from the artificial structures, and the eelgrass beds support many small fishes such as bay pipefish (*Sygnathus leptorhynchus*), juvenile codfishes (*Gadidae*), and shiner perch (*Cymatogaster aggregata*). Pelagic schooling fishes may be seen in the park such as juvenile and adult salmon, tubesnouts (*Aulorhynchus flavidus*), and juvenile herring (*Clupea harengus pallasi*).

Predominant macro-invertebrates include giant anemones (*Metridium senile*) that cover much of the artificial structures.

Marine mammals frequent the site, including harbor seals and sea lions. Diving ducks, such as surf and white-winged scoters and red-breasted mergansers, can be observed during the winter at the park. Red-necked grebes (*Podiceps grisegena*), Western grebes (*Aechmophorus occidentalis*), and horned grebes (*Podiceps auritus*) also occur in the reserve, as do seabirds such as marbled murrelets (*Brachyramphus marmoratus*) (WDFW 2006b).
7. Segment Summaries and Assessment

The marine shoreline was divided into segments (see Figure 2) based on a habitat assessment (Pentec Environmental 2001) that considered numerous environmental factors favorable to salmonids. The segmentation was determined by biologists based on shoreline physical characteristics identified through field surveys and hydrological, chemical, geomorphologic, biological, and landscape features identified from natural resource maps and reports, and a review of aerial photographs. Lake Ballinger was assigned a separate segment from the marine shoreline because of its physical separation and unique lacustrine characteristic.

Detailed information about the habitat features within each segment were obtained from literature cited in this inventory, including a shoreline inventory conducted along the marine shore in 2001-2002 (Snohomish County 2001). The marine shore inventory consisted of teams of biologists carrying global positioning system (GPS) receivers who walked along the shoreline in two tracks parallel to OHW and recorded the type and location of numerous physical and biological features within 200 feet of OHW (Table 7). This dataset provides the most comprehensive documentation of shoreline marine features, although continuing development at certain locations (e.g., the former Unocal site, the waterfront commercial district) has undoubtedly changed some conditions since 2000.

Table 7. Marine Shore Inventory Habitat Features recorded for Snohomish County 2001

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7.1 Segment A—Lund’s Gulch to Perrinville Creek

7.1.1 Marine Shoreland

Segment A, from the northern edge of Edmonds to the mouth of Perrinville Creek, is about 7,100 feet long. The segment includes part of Lund’s Creek estuary, although most of the creek and estuary is outside of Edmonds’ city limits. The segment also includes Meadowdale Creek. The segment forms a broad arc along the shoreline, referred to as Browns Bay.

The BNSF railroad track bed fills the transition zone between the upper intertidal zone and the upland slope. Along this segment, the waterward side of the railroad bed consists of a rock-armored, steep slope (about 1:1). Some of the armoring is in good condition, but a length of about 4,000 feet is failing, as evidenced by deep holes in the waterward face and large rocks that have tumbled into the intertidal zone. At the top of the bed, the track(s) and adjacent fill width varies between 10 and 15 feet. Throughout the segment are numerous small pipes and culverts that convey creeks and stormwater drainages under the BNSF railroad. At least 34 pipes, ranging in diameter from 4 inches to 3 feet, cross through the railroad bed and discharge into Puget Sound. Within the shoreline jurisdiction, most of Segment A is devoid of riparian vegetation, except for about 400 feet of upland shoreline, immediately south of Lund’s Creek estuary, where the forested ravine meets the water. The forest is separated from the intertidal beach by the railroad bed, and trees have been cleared to improve water views in front of several residences so the (lack of) riparian vegetation offers diminished value to the marine shoreline.

Near Laebugten’s Wharf, the railroad bed moves inland, and an area of low bank stretches for about 230 feet along the shoreline, waterward of the tracks. Low-growing vegetation, consisting of grasses, forbs, and weedy shrubs, covers this “no bank” area just upland of the shoreland.

Laebugten’s Wharf covers about 200 square feet of intertidal habitat near the middle of Segment A, between Lund’s and Meadowdale Creeks. At the wharf, a 20-foot-wide wood ramp crosses the shoreland and extends about 200 feet across the intertidal to the wharf, all on creosote-treated wood supports.

Attached to the wharf is a salmon-rearing net pen, about 20 x 20 x 12 ft in size. Since 1990, the net pen has been used by WDFW to rear hatchery coho salmon smolts for release into Puget Sound as a supplement to recreational and commercial fisheries. About 27,000 fish are released annually into the Edmonds Marina Boat Basin between May and June (WDFW 2006c). The Northwest Salmon and Steelheaders Council (NWSSC), Laebugten Chapter, maintains the net pen, and feeds and releases the penned fish.

South of Laebugten’s Wharf is Meadowdale Creek. The railroad fill has largely eliminated the estuary, and a culvert concentrates creek flows into a narrow band that discharges as a point in the lower intertidal, instead of a broad arc across the upper intertidal. Consequently, this special aquatic habitat is greatly reduced in both area and function.

South of Meadowdale Creek is a roughly 1,000-foot-long segment of shoreline that belongs to the City of Lynnwood. The property includes a sewage treatment plant and outfall. Near the south end of Segment A, nine derelict wood piles were observed in the intertidal zone.

Segment A is rated as providing moderate quality habitat for juvenile Chinook salmon and bull trout. Although eelgrass is present along the nearshore, the armored and filled intertidal zone and lack of riparian vegetation within the 200-foot shoreland decrease habitat value. Lund’s Creek
estuary provides a small section of high quality habitat, but Meadowdale Creek’s estuary has been filled by the railroad bed. Dense urban development in the upland areas adjacent to the shoreland further reduces habitat value and function along this segment.

7.1.2  **Lund’s Gulch Creek**

Lund’s Gulch Creek subbasin drains an area of approximately 2.3 square miles (1,440 acres), of which only a small fraction, probably less than five percent, lies within the City of Edmonds. West of 52nd Avenue W, including the area within the City of Edmonds, the creek and its tributaries are contained within a deeply incised ravine with sloping sidewalls steeper than 40 percent. The creek and ravine are part of Meadowdale County Park.

A significant part of the estuary has been filled by the BNSF railroad bed; the creek passes through a 36-inch-diameter culvert before entering Puget Sound. Shrubs and small trees on the east side of the railroad bed extend about 200 feet south of the estuary, except in front of several houses where vegetation has been cleared for unobstructed water views. Within the city limits, the ravine is mostly forested, except for a small area at the top of the hillside that contains medium-density residential housing. The upper portion of the basin is flat with drainage systems consisting of older ditch and culvert systems that lack sufficient conveyance capacity.

The upper watershed, east of Edmonds, is urbanized with development consisting of medium to high-density residential development. Commercial development is also located along the Highway 99 corridor. Notable hydrologic features in the basin include a 21-acre forested wetland and a regional detention facility located upstream of 52nd Avenue (Snohomish County SWM 2002).

Snohomish County SWM (Snohomish County SWM 2002) modeled hydrologic conditions for the entire Lund’s Gulch Creek subbasin to determine stormwater runoff volumes that would be generated at different locations for both existing and future land use conditions. The county also modeled hydraulic conditions to evaluate the conveyance capacity of portions of Lund’s Gulch Creek, as well as the primary drainage system, to determine water levels and evaluate backwater conditions that occur when downstream flow restrictions, such as an undersized culvert, cause high upstream water levels (Snohomish County SWM 2002). Geomorphic analyses were conducted to evaluate erosion and sediment deposition problems within or affecting the study area. The geomorphic field investigation included portions of the main stem for Lund’s Gulch Creek, and detailed geomorphic analyses were also conducted to assess the stability of the stream channel and its tendency to erode and deposit sediment. The results of the studies, models, and analyses were presented in a Drainage Needs Report and appendices available through Snohomish County. The report identified 19 specific locations within the Lunds Gulch Creek subbasin with drainage problems. Most problems were related to inadequate stormwater conveyance and subsequent flooding of roads and private property outside of the creek corridor. Two undersized culverts within the creek channel were identified as blocking or restricting fish access and impounding creek flows, resulting in channel erosion and unnatural drainage patterns that further impacted the creek. The culverts were identified as Washington Department of Fish and Wildlife’s priority replacement projects. One section of creek was recommended for “tightlining,” in which 300 feet of channel would be removed and water would be conveyed in a pipe. Although tightlining may simplify a drainage conveyance problem, it accomplishes one objective—water conveyance—by eliminating all other physical and biological functions from a creek system, resulting in practically complete habitat loss. Several other drainage erosion problems (related to flooding and erosion) that occurred on private property were not
recommended for correction because the costs were not justified by the limited scope of property damage; however, the analysis did not consider the cumulative impacts from these small-scale, but numerous and frequent sediment inputs into the creek channel. Ironically, this type of small-scale degradation, on a single-lot basis, is now recognized as the primary factor contributing to the degradation of Halls Creek. Coho and chum salmon and cutthroat trout are the predominant salmonid species that use Lund’s Gulch Creek (Snohomish County SWM 2002). The creek is neither known nor presumed to support Chinook salmon, bull trout, rainbow trout, or steelhead, although one steelhead was reportedly seen in the creek in 1978 (Kerwin 2001). Lund’s Gulch Creek may support a small population of resident cutthroat trout. Anadromous fish entering Lund’s Gulch Creek pass through a culvert under the railroad tracks that occasionally clogs with sediment and sometimes limits access. The condition of fish habitat in the creek is fair to poor. The creek appears to have good spawning gravels in the first kilometer upstream of saltwater; however, active transport of bedload material from upstream sources and inputs of sediment likely limit egg survival in the spawning gravels. No study on the survival rate of eggs laid in these habitats was available. In addition to stream channel erosion problems, there are also side ravine sediment discharges throughout the creek.

Little information regarding the salmonid population is available, except for WDFW (Pfeifer 1979, in WDFW 2003), of which all accounts are anecdotal. Coho and chum in Lund’s Gulch Creek have been sighted consistently for the past decade or more, through 2001, by the park ranger. In 2001, about 100 coho and 100 chum salmon spawned in Lund’s Gulch Creek. Local high schools and the Brackett’s Landing Foundation are also reported to participate in off-site chum salmon rearing for release in Lund’s Gulch Creek. The Brackett’s Landing Foundation maintains a small hatchery in the large wetland complex at the headwaters of Lund’s Gulch Creek. The Foundation rears and releases fry and smolts resulting from 10,000 chum and 500 coho eggs per year (CH2M HILL 2004). Local anglers have reported sea-run cutthroat use of Lund’s Gulch Creek.

The lower reaches of Lund’s Gulch Creek provide a low-gradient spawning area without fish passage barriers as far upstream as 52nd Avenue W. Above 52nd Avenue W., the naturally low baseflow and moderate to steep gradient limits the area useable for salmonids and further upstream passage. In the midsection of Lund Gulch Creek, water velocity preferences for most anadromous species are exceeded due to high gradients. Historical distribution of salmon in Lund’s Gulch Creek probably limited to the lower reaches.

7.1.3 Meadowdale Creek

No information specific to Meadowdale Creek was found during a literature search. References to a drainage basin study of Meadowdale Creek by R.W. Beck in 1991 were reported in the Edmonds Stream Inventory and Assessment (Pentec Environmental 2002), but no details were provided. Based on the Snohomish County marine shore inventory, USGS topographic maps, and aerial photographs, Meadowdale Creek characteristics and conditions appear to closely resemble the other short-length, deeply incised urbanized creeks that flow through the City.

The outlet of Meadowdale Creek consists of a 30-inch-diameter culvert that passes under the BNSF railroad bed and discharges directly onto intertidal beach. No delta or defined estuary is present in aerial photos near the creek outlet. The gradient of the lower reaches of Meadowdale Creek closely resembles Perrinville Creek, which is moderately steep, but still allows anadromous fish passage. There are no records by WDFW of anadromous fish using the creek.
7.2 Segment B—Perrinville Creek to Southwest County Park

7.2.1 Marine Shoreland

Segment B, from the mouth of Perrinville Creek to a latitude even with 176th Street SW, is about 2,100 feet long. This segment, rated as having low quality shoreline habitat for salmonids, lies between two adjacent areas of moderate quality habitat, as identified in the Edmonds Shoreline Habitat Assessment (Pentec Environmental 2001).

The BNSF railroad track bed fills the transition zone between the lower intertidal zone and the upland slope. Along this segment, the waterward side of the railroad bed consists of a rock-armored slope, ranging from 20 to 30 feet high. Little of the armoring is in good condition—a length of about 1,200 feet is failing, as evidenced by deep holes in the waterward face and large rocks that have tumbled out into the lower intertidal and shallow subtidal zones. At the top of the bed, the double tracks and adjacent fill width is about 15 feet.

Near the northern end of this segment is Perrinville Creek. The creek passes through a 36-inch-diameter concrete culvert under the railroad bed and discharges directly onto the lower intertidal, where a large delta is forming. Along the rest of the segment, five small plastic pipes, ranging in diameter from 4 to 6 inches, convey stormwater drainage under the BNSF railroad into Puget Sound.

A backshore wetland is found within this segment, formed by water impounded along the railroad bed. The wetland is about 150 feet long and 35 feet wide.

Moderate banks, less than 50 feet high, cover the backshore transition into upland habitat, except for a 300-feet-long section of low bank on both sides of Perrinville Creek. The upper riparian slopes along Segment A are mostly devoid of trees and other significant riparian vegetation. A narrow band of brambles and shrubs separates the rest of the shoreland from lawns and dense residential housing. Parts of the adjacent hillsides appear to have been cleared about the time of the 2002 shoreline survey.

The shoreline segment is within a bald eagle breeding territory (WDFW 2006a).

7.2.2 Perrinville Creek

Perrinville Creek is classified by the City of Edmonds as a Category 2 stream. The Perrinville Creek drainage basin was studied extensively in 1991 (R.W. Beck), 1998 (Pentec and Shannon & Wilson), and 2002 (Pentec Environmental). This creek closely resembles other creeks within the City, which are similar in topography, gradient, soils, vegetation, and channel modifications resulting from the railroad and surrounding urban development. The Perrinville Creek outlet is a 36-inch-diameter concrete culvert that discharges onto lower intertidal beach habitat that is heavily armored with boulders that have rolled off the BNSF railroad bed. A noticeable delta is accreting at the culvert outlet, indicating high sediment volumes are likely eroding from the upstream riparian corridor. The creek slopes moderately (less than 5 percent) for about 500 feet through residential properties west of Talbot Road. The gradient (and erosion-related problems) increases upstream of Talbot Road.

Information about fish use of Perrinville Creek is limited. WDFW (1991, 2006a) reported resident cutthroat trout in the lower reaches and accessible, good quality spawning and rearing habitat in the lower and middle reaches for anadromous salmonids. Since 1994, juvenile chum salmon have been released annually in Perrinville Creek as part of a class project at Seaview
Elementary School; however, no adult returns to this stream have been reported (Pentec Environmental 2002). In general, high sediment loads and impassable fish barriers upstream of the culvert at Talbot Road have limited the use of potential spawning and rearing habitat that may be present. No bull trout have been observed in any of the drainages within the City (Pentec Environmental 2002).

The lower riparian zone is within a bald eagle breeding territory (WDFW 2006a).

7.3 Segment C—Southwest County Park to Fruitdale Creek

7.3.1 Marine Shoreland

Segment C, from Southwest County Park to Fruitdale Creek, is about 5,300 feet long. The segment coincides with a habitat segment assessed as moderate quality in the Edmonds Marine Shore Habitat Assessment (Pentec Environmental 2002). This segment includes one unnamed creek. Most of this segment is defined by the vertical rock wall along the BNSF railroad bed.

The BNSF railroad track bed fills the transition zone between the mid-intertidal zone and the upland slope. Along this segment, the waterward side of the railroad bed consists of 3,700 feet of rock-armored, steep slope (about 1:1) and 1,600 feet of vertical rock wall, about 15 feet high. Most of the armoring is in good condition; a length of only about 200 feet is failing, as evidenced by deep holes in the waterward face and large rocks that have tumbled out into the subtidal zone. At the top of the bed, the double tracks and adjacent fill are about 15 feet wide. At the northern end of the segment is a 24-inch-diameter concrete culvert that carries stormwater flows under the railroad bed. Further south along the shoreline, a 36-inch-diameter plastic pipe also conveys stormwater flows under the railroad bed. Along the rest of the segment, ten small plastic pipes, ranging in diameter from 4 to 6 inches, convey stormwater drainage under the BNSF railroad into Puget Sound. A freshwater seep is also located along this segment.

The entire segment consists of a continuous, moderately high bank that appears to have been cleared of vegetation in patches prior to the survey in 2002. Scattered trees (alder) were present along some of the slope uphill of the shoreland; however, no significant riparian tree or shrub layer was present within the shoreland. No vegetation was present from the intertidal zone to the landward edge of the railroad bed. Along the shallow subtidal zone, extensive eelgrass beds are visible in aerial photos and in maps of sonar surveys.

This segment is within a bald eagle breeding territory (WDFW 2006a).

7.4 Segment D—Fruitdale Creek to Shell Creek

7.4.1 Marine Shoreland

Segment D, from the mouth of Fruitdale Creek to a point south of Shell Creek, is about 3,300 feet long. This segment, rated as having moderate quality shoreline habitat for salmonids, lies between two adjacent areas of moderate quality habitat, as identified in the Edmonds Shoreline Habitat Assessment (Pentec Environmental 2001).

The BNSF railroad track bed fills the transition zone between the mid-intertidal zone and the upland slope. Along this segment, the waterward side of the railroad bed consists of a rock-armored slope, ranging from 10 to 20 feet high. Most of the armoring is in good condition, with
only a short span (about 560 feet) failing, as evidenced by deep holes in the waterward face and large rocks that have tumbled into the lower intertidal and shallow subtidal zones. At the top of the bed, the double tracks and adjacent fill width is about 15 feet.

At the northern end of the segment, Fruitdale Creek passes through a 30-inch-diameter concrete culvert under the railroad bed and discharges directly onto the lower intertidal, where a small delta has formed. A narrow backshore wetland, about 230 feet long, was formed by drainage impounded along the railroad bed. A large seep area is also located in this segment. This segment also includes Northstream Creek and Shell Creek.

Low banks cover the backshore transition into upland habitat. About 1,000 feet of upper riparian slopes along Segment D contain riparian vegetation; the remainder is mostly landscaped residential yards devoid of trees and other significant riparian vegetation. No specific data on vegetation species and composition is available. A narrow band of brambles and shrubs separates the rest of the shoreland from lawns and dense residential housing.

The shoreline segment is within a bald eagle breeding territory (WDFW 2006a)

7.4.2 Fruitdale Creek

Fruitdale Creek is an Edmonds Category 2 stream, about 0.75 miles long, that drains 143 acres of the Talbot Park basin. Little information is available for Fruitdale Creek apart from a drainage study by URS in 1989 and a recent habitat survey (Pentec Environmental 2002). The creek outlet consists of a 30-inch-diameter concrete culvert under the BNSF railroad bed. During the 2002 survey, the culvert was about 40 percent filled with gravel. The creek channel flows through a series of pipes, incised channels, debris, and a flood-control structure.

The WDFW (2006a) Priority Species database contains no fisheries information for Fruitdale Creek. An unspecified fish habitat survey conducted in 1985 (no other information available) found no fish present. A 2002 habitat survey (Pentec Environmental) verified the lack of salmonid spawning and rearing habitat in the creek and concluded current fish use of the creek was unlikely.

7.4.3 Northstream Creek

Northstream Creek is classified by the City of Edmonds as a Category 2 stream that drains the 248-acre Northstream drainage basin (URS 1989). The creek is about 0.75 miles in length and drops about 400 feet in elevation from the top of the basin to the outlet, through a 24-inch-diameter culvert under the BNSF railroad bed (Pentec Environmental 2002; Snohomish County database 2001). In 1989, Northstream Creek was determined to have erosion and water capacity problems due to stormwater runoff (URS 1989). The stream channel has been confined to a narrow, concrete-lined ditch between several residential properties; all vegetation has been removed. Further upstream, the creek regains its natural channel and riparian vegetation.

Information on fish use of Northstream Creek is limited. As of 2002, WDFW had not conducted fish surveys in the creek, although Pentec Environmental (2002) biologists observed fish, presumed to be cutthroat trout, downstream of an impassible fish barrier at the site of a 1920’s era shingle mill water diversion structure. Residents along the creek reported that great blue heron and river otter were present in the basin.
Shell Creek is classified as a Category 2 stream by the City of Edmonds. The creek drains an 806-acre basin, which includes Hindley Creek. A significant part of the estuary has been filled by the BNSF railroad bed; the creek passes through a 36-inch-diameter culvert before entering Puget Sound, where a large delta has formed. The lower reaches of the creek are relatively undeveloped and provide good-quality shoreline habitat, including a rare Category 2 riparian wetland along the backshore. Within the shoreland, the wetland is about 100 feet wide and 230 feet long. It extends about a quarter-mile upstream from the railroad, out of the shoreland boundary.

A short distance upstream of the BNSF culvert, Hindley Creek joins Shell Creek. Gradients are low in both channels and below the confluence, and spawning gravels are abundant. The middle and upper reaches of Shell and Hindley Creeks are described in detail in the Edmonds Stream Inventory and Assessment (Pentec Environmental 2002). Both creeks pass through urbanized areas, where habitat is degraded by obstructions, culverts, riparian clearing, urban landscaping, stormwater inputs, and erosion/sedimentation.

A large city park, Yost Park, protects part of the upper watershed from the impacts of dense urban development. The park includes upland forest and mature second growth riparian vegetation dominated by mature red alder trees as tall as 90 feet. The dense canopy and poorly drained soils limit the diversity of understory, which is dominated by salmonberry. Also present are red huckleberry, salal, sword fern, and elderberry, along with other shrubs, grasses, and herbaceous plants. The Yost Park red alder forest, meandering stream, and surrounding conifer forest offers critical refuge to wildlife in an increasingly urban environment (City of Edmonds 2006b).

The park was originally the site of the first Edmonds community water supply; remains of dams built by the Edmonds Spring Water Company are still visible in Yost Park. Dozens of large old western red cedar stumps are found throughout the park as well as “nurse logs.” As stumps and logs decay, their nutrients replenish the soil, and encourage smaller plants to grow upon them. Huckleberry, salal, salmonberry, ferns, moss, lichen and fungi all benefit from the decomposing wood in the park.

Yost Park provides a habitat for numerous species of resident and migratory birds including barred owls, pileated woodpeckers, northern flickers, rufus-sided towhees, and Cooper’s hawks. Black-capped chickadee, Swainson’s thrush, olive-sided flycatcher, and winter wren are some of the more common small birds found in the park. Mammals include the nocturnal mountain beaver, opossum, raccoon, shrew mole, and a few types of bats. Giant pacific salamanders are sometimes found in the creek, and tree frogs can sometimes be heard singing in the wetlands surrounding the boardwalk (City of Edmonds 2006b). Although WDFW has not conducted any recent fish surveys on the Shell Creek system, biologists counted six chum salmon carcasses in the lower reach of Shell Creek during November 2002 survey, and other Pentec Environmental biologists reported seeing both coho and chum salmon spawning in lower Shell Creek in 2000 and 2001 (Pentec Environmental 2002). Resident cutthroat trout are likely distributed throughout many sections of the creek system (Pentec Environmental 2002). The state has designated lower Shell Creek as habitat for priority anadromous fish species (chum and coho salmon), and priority resident fish species (cutthroat trout).
7.5 Segment E—Shell Creek to Edmonds Underwater Park

7.5.1 Marine Shoreland

Segment E, south of Shell Creek to the Edmonds Underwater Park, is about 3,300 feet long. This segment, rated as having moderate quality shoreline habitat for salmonids, lies between adjacent areas of moderate and low quality habitat, as identified in the Edmonds Shoreline Habitat Assessment (Pentec Environmental 2001).

The BNSF railroad track bed fills the transition zone between the lower intertidal zone and the upland slope. Along this segment, the waterward side of the railroad bed consists of a rock- armored slope or vertical rock bulkhead, ranging from 10 to 20 feet high. Most of the armoring is in good condition, with only a short span (about 200 feet) failing, as evidenced by deep holes in the waterward face and large rocks that have tumbled out into the lower intertidal and shallow subtidal zones. At the top of the bed, the double tracks and adjacent fill width is about 15 feet. Near the south end of the segment, the double tracks converge into one track, the gradient drops slightly, and the shoreline extends waterward against a large rock- armored groin. Along this segment, the bank transitions from steep high bank to moderate bank along most of the tracks, and then drops to low or no-bank slopes for the southernmost 700 feet.

Along this segment are two 24-inch-diameter concrete pipes and one 24-inch-diameter corrugated metal pipe that provide stormwater drainage under the BNSF railroad bed.

Riparian vegetation is largely absent from Segment E. No riparian vegetation occurs between the railroad bed and adjacent shoreland along about 2,400 feet of the segment. Near the underwater park, a small area of low-growing vegetation (grasses, weeds) and a narrow band of blackberries, Scot’s broom and other non-native shrubs separate the shoreland from streets, lawns, and residential housing.

No streams occur in this segment.

7.6 Segment F—Edmonds Underwater Park to Port of Edmonds

7.6.1 Marine Shoreland

Segment F, from the Edmonds Underwater Park to the Port of Edmonds Marina, is about 1,850 feet long. This segment, rated as having low quality shoreline habitat for salmonids, lies between two adjacent areas of low quality habitat, as identified in the Edmonds Shoreline Habitat Assessment (Pentec Environmental 2001). A Washington State Ferry terminal is in middle of this segment. The ferry car ramp and access pier is about 75 feet wide. It is supported by a combination of older creosote-treated piles and newer steel piles.

Segment F is one of three marine segments whose shoreland is not defined (and filled) by the BNSF railroad bed. The shoreland transition into the upland consists of low or no bank. The upper intertidal shoreline is entirely armored with rock, wood, and concrete, except for a 250-foot section of natural beach and restored native vegetation at Brackett’s Landing. About 1,300 linear feet of this segment consists of a vertical bulkhead; the remaining 250 feet is sloped rock and concrete armoring. A wood bulkhead, about 75 feet in length, projects about 25 feet into the intertidal beach area to provide parking for a commercial building. Most of the bulkheads extend into middle or lower intertidal elevations.
The dominant feature of this segment is the ferry terminal, which covers about 24,700 square feet over aquatic nearshore habitat (CH2M HILL 2004). In addition, support piling and associated “halos” cover about 5,868 square feet of substrate. (A “halo” refers to accumulation of shell debris at the base of a piling from barnacle shell fallout and other debris from the invertebrate community encrusting on the piling surfaces above. This forms a ring at the pile base and limits the use of the area by clams and other non-mobile benthic infauna in this zone. The calculated area assumes that the ring extends outward 18 inches from each piling around the entire perimeter.) Impacts to benthos, eelgrass, and macroalgae beds occurred when the terminal was built 50 years ago. Over time, the approach to the pier was dredged to a depth of about 40 feet. Propeller wash-caused scour eliminated a much larger footprint of eelgrass and macroalgae beds, in addition to the dredged beds. Eelgrass loss from shading, scour, and dredging was estimated to be approximately 112,033 square feet or 2.6 acres. Macroalgae losses from these same factors were estimated to be approximately 165,020 square feet or 3.8 acres. Together, this represents about 6.4 acres of historical eelgrass and macroalgae loss at the existing Edmonds ferry terminal (CH2M HILL 2004).

Recently, substrate composition in the scour trough was described as rocky, incised in till, supporting a community of fish and invertebrates characteristic of rocky environments. Aquatic substrate prior to the building of the terminal was almost certainly fine to medium sand, as it is on either side of the terminal today (CH2M HILL 2004). It is likely that the eelgrass beds to the north and south of the existing terminal were once a continuous bed, although smaller ferry vessel propeller scour may have disturbed the eelgrass beds decades earlier.

Little or no riparian vegetation characterizes most of the shoreland area, except for restored native vegetation mixed with ornamental landscaping at Brackett’s Landing and ornamental (grass) landscaping along several commercial buildings. A 10-foot-diameter patch of invasive Japanese knotweed, observed in 2001, continues to flourish in Brackett’s Landing Park.

The nearshore subtidal area between the existing ferry terminal and the Port of Edmonds Marina is mostly sand. There are areas of artificial reef materials and rock at depths of -15 to -90 feet MLLW and some mixed sand/gravel at +5 to -15 feet MLLW. The marina breakwater consists of large rock riprap. A public fishing pier built on concrete piles extends beyond the breakwater. There is a band of sand/shell substrate at the base of the breakwater.

The area near the existing ferry terminal and Dayton Street has expansive macroalgae and eelgrass beds. Macroalgae, including Laminaria and Nereocystis, are nearly continuous from the -5-foot contour to the -60-foot MLLW contour. The area directly offshore of and including the docking area of the existing ferry terminal is conspicuously devoid of macroalgae, probably as a result of propeller-induced turbulence. Eelgrass beds are continuous from the marina to the ferry pier and from the ferry pier north through the underwater park and beyond. Depths range from about -2 feet to -20 feet MLLW. The green algae, Ulva lactuca, and the red algae, Gracilaria sjoestedtii, are also common (CH2M HILL 2004).

A narrow sand and gravel beach extends north and south of the ferry terminal and provides habitat for surf smelt and sand lance spawning, according to WDFW records. Surf smelt spawn between 7 feet and MHHW and sand lance spawn between 5 feet and MHHW; these elevations comprise most of the publicly accessible beach along the Edmonds Underwater and Brackett’s Landing parks. Heavy public use of these two beaches and the Edmonds Underwater Park (with over 20,000 diver visits annually) (City of Edmonds 2006c), plus strong propeller wash from the regular ferry service, probably decrease the habitat value for juvenile salmon, forage fish,
wildlife, and aquatic vegetation; however, the area is also a state-designated Marine Protected Area, which prohibits the collection or removal of plants and animals. This sanctuary is the oldest in Puget Sound, and its longevity has resulted in a succession of marine plants and animals of unusual size for Puget Sound.

The Edmonds Underwater Park includes 27 acres of tide and bottom lands and was established as a marine preserve and sanctuary in 1970 (City of Edmonds 2006). The shore consists of sandy beaches recessed in two small coves to the north of the WSF pier. A jetty consisting of revetment rock juts into the water, splitting the conservation area. The primary subtidal habitat of the underwater park is a wide, sand flat gently sloping from the shore seaward. The maximum depth at the offshore extent of the park is approximately -40 feet MLLW. At the nearshore edge of the sand flats, healthy beds of eelgrass separate the intertidal zone from the deeper subtidal habitats. This habitat contains many artificial structures that attract fishes normally associated with rocky habitats (WDFW 2006b).

The area within Edmonds Underwater Park is recognized as a fish haven for numerous large commercial species that face high fishing pressure in unprotected areas of Puget Sound. Exceptionally large lingcod and rockfish are associated with the park (G. Broadhurst 2005; Seattle Post-Intelligencer 2002.) Floats anchored within the park provided haulout platforms for California sea lions and harbor seals (WDFW 2006b), but they were subsequently removed to avoid conflicts with divers. In October 2004, the invasive tunicate Didemnum lahillei was identified in the Edmonds Underwater Park growing on a submerged ship hull. An eradication effort using bleach was attempted in 2005. The park continues to be monitored for reoccurrence.

In April 2004, gourds were installed on a group of pilings south of the Edmonds ferry dock by volunteers, with the approval of the Edmonds Parks and Recreation Director. Since the artificial nest sites were provided, martins have successfully nested in 2004 and 2005, and nesting activity has been observed recently (Lider 2006 personal communication).

Along the bulkheads, five drainage pipes, ranging from 3 to 12 inches in diameter, discharge into the intertidal zone.

No streams occur in this segment.

### 7.7 Segment G—Port of Edmonds Marina

#### 7.7.1 Marine Shoreland

Segment G consists of the Port of Edmonds Marina, Edmonds Marsh, and Shellabarger Creek. The marine portion of this segment is about 3,200 feet long. It is rated as having low quality shoreline habitat for salmonids, but Edmonds Marsh is rated as having high quality habitat, as identified in the Edmonds Shoreline Habitat Assessment (Pentec Environmental 2001). The marine segment consists of a steeply sloped rock breakwater surrounding the marina basin and a vertical concrete bulkhead along the shoreline. The shoreland consists of drives and paved parking for the marine, with a few port offices and workshops. The only vegetation in this segment consists of small strips of ornamental landscaping that line the sidewalk between the parking lot and the marina access street.

The marina extends 500 feet westward into Puget Sound and is dredged to a depth of minus 13 feet (Port of Edmonds 2006). The marina breakwater extends approximately 2,400 feet from north to south along the shoreline. The marina footprint covers about 617,000 square feet of
intertidal and subtidal habitat with fill, armored breakwaters, piers, ramps, and docks. The shoreline is armored with a concrete bulkhead and backfilled to provide an area for port offices, parking, workshops, and commercial businesses. Although construction of the original marina was completed as early as 1961, most of the marina’s piers, floats, and covered docks were destroyed in 1996 during a major storm. Reconstruction was completed in 1998 using concrete and steel materials (Port of Edmonds 2006).

Adjacent to the marina basin is the Olympic Beach Park and Fishing Pier, which includes a developed urban park with amenities on the shoreline and a public fishing and viewing pier extending over the marina breakwater to the waterward edge of the marina.

The Port property once included a fur breeding business; as of 1995, the site has been under a State cleanup order for a leaking underground storage tank that contaminated groundwater (Ecology 2006).

7.7.2 Edmonds Marsh and Shellabarger and Willow Creeks

Edmonds Marsh and its associated streams (Shellabarger and Willow Creeks) are part of the SMP jurisdictional shoreland area. Within this segment, Willow Creek flows parallel to the BNSF railroad tracks in a ditch, continues under the tracks and marina parking lot, and accesses the street through several hundred feet of culvert. Contrary to old maps and reports, the creek discharges subtidally at Point Edwards near the oil pier, not in the marina.

Edmonds Marsh has been altered extensively by filling and creek re-channelization during the previous decades; about 22 acres remain of the original 40-acre estuarine wetland. It consists of a primarily freshwater wetland with a small area of saltmarsh along the western edge near the tide gate.

The Shellabarger Creek drainage basin includes about 354 acres (Pentec Environmental 2002). A drainage study by URS (1989) identified numerous problems, including stream erosion, inadequate culvert capacity, nutrient loading from overuse of fertilizers, and oil pollution from road runoff and illegal dumping. These impacts indicate that the many ecological functions of Shellabarger Creek are impaired or subsumed by the overwhelming use of the creek as a surface water conveyance channel, with the primary function of moving excess water and contaminants off private property and into Edmonds Marsh and Puget Sound. Information on fish use of Shellabarger Creek is limited. As of 2002, WDFW had not conducted fish surveys in the creek, although resident cutthroat are likely present, and the creek is accessible to anadromous fish that use Edmonds Marsh. Steep slopes, lack of suitable spawning gravel, migration barriers (e.g., an impassible culvert at Third Avenue), lack of riparian vegetation and shade, and poor water quality probably prevent use by anadromous fish.

Willow Creek, an anadromous fish-bearing Category 2 stream, drains about 343 acres within the Edmonds Way Basin (Pentec Environmental 2002). Willow Creek flows from a low-density residential area in the town of Woodway just south of the project area and above the existing Unocal property. The creek culvert runs under Pine Street near its intersection with SR 104 and flows past the Deer Creek Fish Hatchery to Edmonds Marsh. The Willow Creek riparian corridor south of Pine Street and through the Deer Creek Fish Hatchery is a narrow, shaded corridor with gently sloping banks. Vegetation along the creek includes western red cedar, red alder, bigleaf maple, and Douglas fir in the overstory; salmonberry, Indian plum, salal, and
Oregon grape in the shrub layer; and sword and lady fern, pig-a-back, bentgrass, reed canarygrass, and mannagrass in the herb layer (CH2M HILL 2004).

The downstream area of Edmonds Marsh includes a channelized section of Willow Creek. The channel, as it approaches the culvert under the BNSF railroad bed, is characterized as a ditch with a bottom composed entirely of silt. The ditch passes through an area of contaminated groundwater that is presently in contact with the stream and has been for many decades. The ditch is connected to a 48-inch-diameter culvert, about 1,275 feet in length, that passes under the road, parking areas, and beach before discharging into the subtidal zone off Marina Beach Park. The existing culvert is considered a partial block to migrating adult salmon, because it is so long and its outlet is frequently blocked by sand. Gradient is not a migratory barrier, because the slope of the culvert is very low (CH2M HILL 2004).

Willow Creek is known to contain coho salmon, resident and sea-run cutthroat trout, and, historically, chum salmon. Electrofishing efforts on June 28, 1995 confirmed use by coho salmon and cutthroat trout. Other fish species observed include sculpins (Cottus sp.) and three-spined stickleback (Gasterosteous aculeatus) (CH2M HILL 2004).

### 7.8 Segment H—Port of Edmonds Marina to Point Edwards

This segment consists of the beach south of the marina breakwater to the City limits at Point Edwards, including the Unocal pier. The segment is about 1,650 feet long, of which 900 feet is the rock-armored marina breakwater. The shoreland consists of a natural-appearing sand and gravel, low-gradient beach. The backshore consists of the south breakwater rock wall, a grassy open space, a narrow parking lot, a section of BNSF railroad bed, fragments of upland vegetation (shrubs and trees) on the hillside, and a small area of naturalized shoreline with beach logs along the upper intertidal zone. North of the Unocal pier, North Marine Beach Park is designated as a marine sanctuary, where beach collecting and shellfish harvesting are prohibited. The southernmost portion of the segment, south of the Unocal pier, includes a mixed area of riparian vegetation; including shrubs and small trees, and the BNSF railroad bed. This area is South Beach Park, which features an off-leash dog area on the beach.

The Point Edwards area has been surveyed extensively for several large infrastructure projects, including the Brightwater sewage treatment plant and the Edmonds Crossing multimodal transportation center. The following information about this segment, including the Unocal pier, was taken from the SR 104, Edmonds Crossing FEIS (CH2M HILL 2004).

The nearshore area just south in the vicinity of the Unocal pier includes a broad shallow bench to the south that is intertidal to about two-thirds of the distance to the end of the Unocal pier. Water depths drop off rapidly at that point (at about -10 feet MLLW). The intertidal area is mostly mixed gravel and small gravel, with some scattered areas of cobble and rocks. Some areas of medium sand are also present. Shallow subtidal areas are mostly sand with areas of mixed sand/gravel, sand/shell, and rock from the 8-foot contour and higher. The Edmonds Way stormwater drainage outfall (between the Unocal pier and the marina breakwater) is supported and surrounded by riprap materials.

Habitat in the vicinity of the southeast corner of the Edmonds Marina Park breakwater is similar to that described for the Unocal pier, at least offshore of the zero tide elevation (MLLW). The marina breakwater is composed of large riprap boulders. Substrates are composed of sand, mixed sand and gravel, and shell fragments at depths between 0.0 and -10 feet MLLW at the foot of the breakwater.
of the breakwater. Further offshore, substrates are composed of medium to fine sand. These habitats are used by flatfish and sculpins for the most part.

Eelgrass beds are small, patchy, and sparse in the vicinity of the Unocal pier (11). Macroalgae, primarily *Ulva* and *Enteromorpha* species, are abundant in large patches adjacent to the Unocal pier on both sides. Geoduck clams were found in low densities in the area as a whole (<0.1/square yard) but were relatively abundant in a few restricted areas (such as between the Unocal pier and the marina breakwater (2.6/square meter)). Ten to fifteen crabs were found buried in the sand at about -10 feet MLLW. Most had soft shells, indicating that they had just molted. Hardshell clams are abundant in the intertidal and shallow subtidal areas surrounding the Unocal pier (CH2M HILL 2004).

7.9 Segment I—Lake Ballinger

Little specific shoreline information is available for the Lake Ballinger Segment I. The portion of shoreline with the City of Edmonds is about 4,000 feet. The lake shoreland consists of single-family homes with docks and piers. In 2006, at least 42 docks and piers were visible in aerial photos—roughly one structure per waterfront lot. Within this segment, riparian vegetation consists almost entirely of lawns and a few scattered ornamental plantings. No other vegetation data were available along the Edmonds shoreline. Habitat value is likely low, due to the extensive shoreline alteration and the conversion of what was formerly a large wetland into a small lake and stormwater detention basin.

The lake-level/stormwater control outlet structure is considered a barrier to anadromous fish, although resident fish have been stocked in the lake. Lake Ballinger is stocked with rainbow and cutthroat trout, catfish, yellow perch, and largemouth bass (City of Mountlake Terrace 2005). WDFW releases about 5,000 rainbow trout in the lake each spring for a recreational fishery (WDFW 2006c). Outside the Edmonds’ city limits, the lake discharges into McAleer Creek, which has anadromous salmonid populations that travel through the Lake Washington system (WDFW 2003).

Water quality studies of Lake Ballinger indicate that the lake is adversely affected by urban residential and commercial development, including increasing areas of pavement, high nutrient loading from surrounding lawns, golf courses, and gardens, and contaminant loading from roads and parking areas that are conveyed by Halls Creek into the lake. Runoff from the surrounding sub-basin carries high concentrations of nutrients into the lake, resulting in nuisance algae blooms and high biological and chemical oxygen demand, which is exacerbated by phosphorus cycling between lake water and sediment. Water quality conditions are no longer capable of supporting reproducing populations of cool-water adapted fish, although non-native warm-water adapted fish are flourishing. There are ongoing efforts by the surrounding jurisdictions, including Edmonds and the City of Mountlake Terrace, to control flooding and nutrient loading (especially phosphorous). Efforts to address water quality degradation from the 1950s to present include: transferal of homes from private septic systems to a public sewer system, stabilization of Hall Creek banks, construction of sedimentation ponds in Hall Creek, phosphorus control through alum treatment, hypolimnion “treatment” by injection of Hall Creek water and withdrawal of low-dissolved oxygen/high phosphorus lake water, and adjustments to lake inlet and outlet structures (City of Mountlake Terrace 2005, KCM 1986).

Although the many water quality control efforts were initially effective, increasing urban development and population density within the Halls Creek and Lake Ballinger sub-basins have
exceeded design capacity and largely overwhelmed many of the water quality controls. For example, the sewage conveyance system initially reduced nutrient loads and fecal coliform contamination in the lake, but high density urban development has increased inputs from other non-point sources, such as animals (primarily geese, secondarily dogs and cats) and lawn runoff. The sediment control projects initially designed to limit sediment and phosphorus loading into the lake have been overwhelmed by Halls Creek sub-basin development and stormwater management within the lake. The hypolimnetic injection system, although initially successful, was found after several years to be detrimental to the lake because it relied on the quality of Halls Creek water, which had become increasingly degraded. In addition, the lack of effective lake-level management at the outlet weir also results in flooding throughout the surrounding areas of urban lawns, roads, driveways, sewer connections, and golf courses, all of which contribute nutrients, sewage, and pollutants to the lake. In terms of ecosystem function, Lake Ballinger’s biological functions have been minimized or eliminated and its hydrologic and hyporheic functions maximized, resulting in a transformation from a lake into a regional stormwater detention pond that serves as an ( unmaintained) collection basin for nutrients and waste. Although this functional shift is detrimental to Lake Ballinger’s biology and chemistry, it likely benefits McAleer Creek and Lake Washington by retaining pollutants and controlling stormwater flows downstream.
8. Shoreline Planning Reaches

The shoreline segments described in the previous section were initially developed for a biological survey that focused on fisheries and related marine and freshwater habitats, using a detailed level of characterization and analysis. For the purposes of this shoreline characterization document, shoreline segments were then examined with adjacent shorelands and upland areas on a broader scale, considering zoning and land use. The shoreline segments were consolidated into four shoreline planning reaches, based on ecological similarities within a zoning and land-use context that would be useful for planning purposes (see Table 2).

This section lists the ecosystem factures or functions within each reach that have been affected or impaired by land use. It also identifies opportunities for restoration within each reach. Potential restoration projects and shoreline locations are shown in Figure 14. These will be further evaluated as part of the preparation of the Edmonds Restoration Plan, a future element of the Edmonds SMP Update.

8.1 Reach 1

Biological functions or features that have been impaired in Reach 1 (Segments A through E) include:

- Fish and wildlife accessibility between the marine nearshore and the terrestrial backshore: blocked by the BNSF railroad bed and restricted to a few small culverts.

- Nutrient transport and cycling: reduced by clearing vegetation from the backshore and bulkheading/filling of the upper intertidal zone and backshore, and further reduced by restricting the estuarine transitional area to small-diameter culverts that impound creek flows and block detritus and woody debris from moving between the ravine and the beach.

- Estuarine and creek-mouth habitat area: significantly reduced, and habitat function, significantly impaired.

- Marine riparian vegetation: eliminated by railroad fill or cleared for right-of-way maintenance and upland residential views.

- Beach substrate composition and slope: coarsened and steepened by erosion and lack of replenishment from upland or aquatic sources.

- Longshore drift: altered by in-water structures (seawalls, bulkheads, culverts, and a pier) that prevent sediment from naturally recruiting to the beach.
Restoration opportunities (numbered according to Figure 14) include:

1. Replace railroad crossing over Lunds Creek with wider box culvert or trestle.
2. Enhance riparian vegetation along Lunds Creek.
3. Create an off-channel pond for fish and wildlife in lower Lunds Creek.
4. Add woody debris to off-channel pond.
5. Enhance marine riparian vegetation on lower Lunds Creek and along backshore between bluffs and BNSF railroad.
6. Conduct beach nourishment activities at Lunds Creek outlet.
7. Remove existing pier, piles, and overwater structures near Meadowdale Creek.
8. Conduct beach nourishment activities at Shell Creek outlet.
9. Replace railroad crossing over Shell Creek with trestle.

8.2 Reach 2
Biological functions or features that have been impaired in Reach 2 (Segments E and F) include:

- Fish and wildlife accessibility between the marine nearshore and the terrestrial backshore: blocked by the BNSF railroad bed and urban development.
- Upper intertidal and adjacent terrestrial habitat: degraded or lost due to urban development.
- Nutrient transport and cycling: reduced by clearing vegetation from the backshore and bulkheading/filling of the upper intertidal zone and backshore.
- Marine riparian vegetation: eliminated by railroad fill or cleared for right-of-way maintenance and upland residential views.
- Longshore drift: altered by in-water structures (WSF pier and seawall, groin at Edmonds Underwater Park) that prevent sediment from naturally recruiting to the beach.

Restoration opportunities (numbered according to Figure 14) include:

10. Further enhance marine riparian vegetation along Bracketts Landing Park: remove invasive species (e.g., Japanese knotweed, blackberries), and extend vegetation enhancement north to Edmonds Underwater Park parking lot and BNSF railroad.
8.3 Reach 3

Biological functions or features that have been impaired in Reach 3 (Segments F, G, and H) include:

- fish and wildlife accessibility between the marine nearshore, Edmonds Marsh, and the terrestrial backshore: blocked by the BNSF railroad bed, Edmonds Marina, and commercial waterfront development, restricted to a paved corridor and culvert between Edmonds Marsh and South Marina Park.

- Nutrient transport and cycling: significantly reduced by clearing vegetation from the backshore and bulkheading/filling of the upper intertidal zone and backshore, and further reduced by restricting the estuarine transitional area to a small-diameter culvert and tide gate on Willow Creek that impounds creek flows and blocks detritus and woody debris between the marsh and the beach.

- Estuarine and creek-mouth habitat area: significantly altered and reduced, and habitat function, significantly impaired.

- Marine riparian vegetation: eliminated by port development, commercial development, and railroad fill, and cleared for right-of-way maintenance and upland residential/commercial views.

- Beach substrate composition and slope: coarsened and steepened by erosion and lack of replenishment from upland or aquatic sources.

- Longshore drift: altered by in-water structures (seawalls, bulkheads, culverts, and the former Unocal pier) that prevent sediment from naturally recruiting to the beach.

Restoration opportunities (numbered according to Figure 14) include:

11. Restore Willow Creek by removing most or all of the outlet culvert, planting native riparian vegetation, and addressing soil and groundwater contamination issues through ongoing site cleanup activities.

12. Remove former Unocal pier: restore marine aquatic vegetation (e.g., eelgrass and kelp) in former pier footprint. Enhance marine riparian vegetation along South Marina Park, remove non-native vegetation (e.g. grass) and replace with native vegetation.

8.4 Reach 4

Biological functions or features that have been impaired in Reach 4 (Segment I) include:

- hydrologic function of the lake outlet, which is currently managed as a stormwater catchbasin control

- hyporheic function, which has reached its capacity as a nutrient sink for nitrogen and phosphorus

- nutrient transport and cycling, significantly reduced by increasing sediment and nutrient loading from watershed development, stormwater runoff, and former
septic/sewage inputs; replacing native wetland and riparian vegetation with ornamental vegetation (e.g., grass) and adding bulkheads, docks, and piers to the shoreline

- lake inlet and outlet deltas, significantly altered or eliminated by control structures.
- fish and wildlife accessibility between the lake and McAleer Creek, blocked by the outlet control structure.
- fish and wildlife biological communities, significantly altered by habitat alteration (i.e., conversion of a wetland into a lake) and introduction of non-native species (e.g., catfish, yellow perch, and largemouth bass).
- lake sediment, significantly altered by substantial sediment inputs from urban development within the Hall Creek and Lake Ballinger drainage sub-basins.

Restoration opportunities (numbered according to Figure 14) include:

13. Control quantity and quality of surface water runoff entering lake.
14. Revise outlet control structure.

Restoration opportunities are discussed in greater detail in a separate restoration document.
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