Inventory and Characterization Report

Shoreline Master Program Update City of Long Beach November 2014

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Inventory and Characterization Report

Long Beach Shoreline Master Program Update

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Acronyms & Abbreviations

The first appearance in the text of each of the following acronyms and abbreviations is marked with the ⌖ symbol.

CAA: Clean Air Act

CFR: Code of Federal Regulations

cfs: cubic feet per second

CO_2: carbon dioxide

Corps: United States Army Corps of Engineers

CSZ: Cascadia Subduction Zone

CWA: Clean Water Act

CZMA: Coastal Zone Management Act

DFW: Washington State Department of Fish & Wildlife

DNR: Washington State Department of Natural Resources

Ecology: Washington State Department of Ecology

EPA: United States Environmental Protection Agency

ESA: Endangered Species Act

FRHA: Federal Rivers and Harbors Act of 1899

g: Ground acceleration due to gravity

GMA: Washington State Growth Management Act

km: kilometer

MHW or MHT: Mean High Water or Mean High Tide

MBTA: Migratory Bird Treaty Act

NAVD88: North American Vertical Datum of 1988

NEPA: National Environmental Policy Act

NGVD29: National Geodetic Vertical Datum of 1929

NOAA: United States National Oceanic and Atmospheric Administration

NPDES: National Pollutant Discharge Elimination System

NWI: National Wetland Inventory

OFM: Washington State Department of Financial; Management

OHWM: Ordinary high water mark

RCW: Revised Code of Washington

SCA: Seashore Conservation Area

SCL: Seashore Conservation Line

SED: Shoreline Environment Designation

SEPA: Washington State Environmental Policy Act

SMA: Washington State Shoreline Management Act

SMP: Shoreline Master Program

SR: State Route

SSWS: Shorelines of Statewide Significance

UGA: Urban Growth Area

USC: United States Code

USFWS: United States Fish & Wildlife Service

WAC: Washington Administrative Code

WRIA: Water Resources Inventory Area

Glossary

The first appearance in the text of each of the following words or phrases is marked with the ⌖ symbol.

1889 GOVERNMENT MEANDER LINE: The western limit of privately-owned beach property, the approximate location of mean high tide, at the time Washington achieved statehood in 1889. Also termed The 1889 Line or the Western Upland Boundary.

ACCRETION: A gradual process in which layers of a material are formed as small amounts are added over time.

ASSOCIATED WETLANDS: wetlands which are in proximity to and either influence or are influenced by tidal waters or a lake or stream subject to the SMA.

BLOW OUT: Sandy depressions in a dune system caused by the removal of sediments by wind.

CONTINENTAL SHELF: An underwater landmass which extends from a continent, resulting in an area of relatively shallow water.

DEFLATION PLAIN: The low area between the foredune and old dune ridge, where the foredune blocks the deposition of new sand and wind scours and erodes the surface, often down to the water table.

DUNE RIDGE: The historic foredune, there are a parallel rows of dune ridges on the Long Beach Peninsula, with deflation planes between them. Also called a “sand ridge”.

FAN VALLEY: Underwater geological structures associated with large-scale sediment deposition and formed by turbidity currents.

FLOODWAY: The area, as identified in a master program, that either:

1. Has been established in federal emergency management agency flood insurance rate maps or floodway maps, or
2. Those portions of a river valley lying streamward from the outer limits of a watercourse upon which flood waters are carried during periods of flooding that occur with reasonable regularity, although not necessarily annually.

FOREDUNE: The large, currently developing primary dune, closest to the ocean.

INTERDUNAL WETLAND: Wetlands located in small interdunal depressions to extensive deflation plains behind stabilized foredunes. IN Long Beach, these wetlands are created by shallow groundwater.

LITTORAL CELL: A complete cycle of ocean sedimentation including sources, transport paths, and sinks.

LONGSHORE CURRENT: An ocean current that moves parallel to shore. It is caused by large swells sweeping into the shoreline at an angle and pushing water down the length of the beach in one direction.

(M): A measurement of the size, or magnitude of an earthquake; an estimate of the energy released during a seismic event.

MARINE ENVIRONMENT:

BENTHIC: The ocean bottom, comprising the gently sloping continental shelf from shore to a depth of 200 meters, the mesobenthal at the upper portion of the steeper slope face of the outer shelf at depths of 200 to 500 meters, the bathybenthal mid-slope at depths of 500 to 1,000 meters, and the depths beyond.

PELAGIC: The open waters of the ocean, comprising the neritic waters over the continental shelf, and oceanic waters over the slope face and depths.

MEAN HIGH WATER: The average of all the high water heights observed over a specific 19-year period (currently 1983 through 2001) called the National Tidal Datum Epoch. Also termed Mean High Tide.

MEGATHRUST FAULT: The boundary (fault) between a subducting and an overriding plate. A megathrust earthquake is produced by a sudden slip along this boundary.

NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29): Originally the Sea Level Datum of 1929, the vertical control datum established for vertical control surveying in the United States of America by the General Adjustment of 1929. The datum was used to measure elevation (altitude) above, and depression (depth) below, mean sea level (MSL). Superseded by the North American Vertical Datum of 1988 (NAVD88).

NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88): The vertical control datum of orthometric height established for vertical control surveying in the United States of America based upon the General Adjustment of the North American Datum of 1988. Supersedes the National Geodetic Vertical Datum of 1929 (NGVD29).

ORDINARY HIGH WATER MARK (OHWM): On lakes, streams, and tidal water, that mark that will be found by examining the bed and banks and ascertaining where the presence and action of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland, in respect to vegetation as that condition exists on June 1, 1971, as it may naturally change thereafter, or as it may change thereafter in accordance with permits issued by a local government or the department; provided that in any area where the ordinary high water mark cannot be found, the ordinary high water mark adjoining salt water shall be the line of mean higher high tide and the ordinary high water mark adjoining fresh water shall be the line of mean high water.

PACIFIC FLYWAY: A major north-south bird migration route for migratory birds in America, extending from Alaska to Patagonia.

SAND HUMMOCK: Small wind-created dunes or humps formed by sand deposition in and around pioneer plants.

SEASHORE CONSERVATION AREA (SCA): The area west of the SCL (see below), or lands west of the 1889 Government Meander Line deeded to the state of Washington, and under the control of the state of Washington to be used for recreational activities.

SEASHORE CONSERVATION LINE (SCL): Originally, a line established in 1968 approximately one hundred feet (100') east of the vegetation line; the area west of the SCL is included in the Seashore Conservation Area. Now, a moveable line reviewed and re-established by the Washington State Parks & Recreation Commission every 10 years, starting in 1980. There are now 1980, 1990, 2000, and 2010 SCLs. The 1980 SCL is the current building setback line in Long Beach, and private construction may not occur west of the 1980 SCL.

SHORELANDS: those lands extending landward 200 feet in all directions as measured on a horizontal plane from the ordinary high water mark (OHWM)

SHORELINES OF STATEWIDE SIGNIFICANCE (SSWS): The following shoreline of the state, among others: The area between the ordinary high water mark and the western boundary of the state from Cape Disappointment on the south to Cape Flattery on the north, including harbors, bays, estuaries, and inlets; therefore, the Long Beach shoreline is a SSWS. The Washington legislature has determined and declared that the interest of all of the people shall be paramount in the management of shorelines of statewide significance.

SHORELINE MASTER PROGRAM (SMP): Local land use policies and regulations designed to manage shoreline use. An SMP is intended to protect natural resources for future generations, provide for public access to public waters and shores, and plan for water-dependent uses. SMPs are created by an Ecology-local community partnership, and must comply with the Shoreline Management Act and Shoreline Master Program Guidelines.

SHORELINE MASTER PROGRAM GUIDELINES: Shoreline Master Program (SMP) Guidelines are state standards that local governments must follow in drafting their shoreline master programs. The Guidelines translate the broad policies of the Shoreline Management Act (RCW 90.58.020) into standards for regulation of shoreline uses.

STAKEHOLDER: A party or entity (person, organization, group, etc.) who has an interest in the SMP update.

SUBDUCTION: The process that takes place where two tectonic plate meet whereby one plate moves under another plate and sinks into the mantle as the plates converge. Regions where this process occurs are known as subduction zones.

SUBMARINE CANYON: A steep-sided valley cut into the sea floor of the continental slope, sometimes extending well onto the continental shelf.

SWALE: A low place, especially a marshy depression between ridges.

TAKE (as has meaning under the ESA): To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

WATER-DEPENDENT USE: A use or portion of a use which cannot exist in a location that is not adjacent to the water and which is dependent on the water by reason of the intrinsic nature of its operations.

WATER-ENJOYMENT USE: A recreational use or other use that facilitates public access to the shoreline as a primary characteristic of the use; or a use that provides for recreational use or aesthetic enjoyment of the shoreline for a substantial number of people as a general characteristic of the use and which through location, design, and operation ensures the public's ability to enjoy the physical and aesthetic qualities of the shoreline. In order to qualify as a water-enjoyment use, the use must be open to the general public and the shoreline-oriented space within the project must be devoted to the specific aspects of the use that fosters shoreline enjoyment.

WATER-ORIENTED USE: A use that is water-dependent, water-related, or water-enjoyment, or a combination of such uses.

WATER-RELATED USE: A use or portion of a use which is not intrinsically dependent on a waterfront location but whose economic viability is dependent upon a waterfront location because:

WETLAND(S): Those areas that are inundated or saturated by ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Executive Summary

The city of Long Beach is preparing this Inventory and Characterization Report in accordance with terms and conditions of Grant Agreement No. G1400375 with the Washington State Department of Ecology (Ecology)[1]. The current Shoreline Master Program (SMP) update, including this document, is intended to provide environmental protection for the area designated as "shoreline", to preserve and enhance public access to the shoreline, and to manage shoreline development.

That area subject to the Long Beach SMP is called the jurisdictional shoreline, and includes the following: 1) the ocean and beach from the ordinary high water mark three (3) nautical miles waterward (west of); 2) the continuous land area from the ordinary high water mark 200 feet landward (east of); and 3) any associated wetlands. These areas and the abundant and varied natural resources within them are considered special and valuable by the state of Washington. The SMP is one of the City's tools for protecting this area and its resources, protecting the ecological functions of these lands and resources and in some cases restoring them, increasing public access to the Washington shoreline, and identifying and regulating water-dependent and other land uses appropriate for location in the city's shoreline area.

Much of the City's jurisdictional shoreline is healthy and has remained undeveloped. Unlike lakefront communities, where homes are built up to the water's edge and many have docks or bulkheads located in the water, and while there are a few public facilities located that area, protective regulations and zoning prevent private structural development in the Long Beach jurisdictional shoreline west of or within 200 feet east of the ordinary high water mark. However, a fair amount of public and private development has occurred in areas of associated wetlands, including infrastructure and the homes it serves. Certainly some loss of wetlands has occurred in the city's dune area over the years; in addition, about 1.25 acres of fairly high-functioning wetlands have been created in recent years. Also, there are substantial stands of invasive Scotch broom and some small patches of highly invasive gorse in the dune area. This document identifies some available means to address these issues.

In addition, identifiable public access to the ocean beach is scarce. While there are two main beach approaches and numerous trails to the beach that follow undeveloped rights-of-way and are available for public use, only the two main beach approaches are well-signed. So, while there is substantial access, it take local knowledge to know where such access is located. This document identifies some available means to address the issue of identifiable beach access.

[1] The first use of an abbreviation, acronym, or term requiring definition in the document Glossary is marked with this symbol.

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1.0 Introduction

The city of Long Beach is updating its Shoreline Master Program (SMP) with project funding from the Washington State Department of Ecology (Ecology). SMPs must be updated in accordance with the state Shoreline Management Act (SMA[◆], Revised Code of Washington [RCW[◆]] 90.58) and SMP Guidelines[◆] adopted in 2003 (Washington Administrative Code [WAC[◆]] 173-26). The city is required to complete its update by June 30, 2016, consistent with SMP Grant Agreement No. 1400375 between the city and Ecology. With Ecology's guidance, the city will also prepare a Cumulative Impact Analysis and a Restoration Plan that will serve as input to the SMP update.

1.1 Background

The city of Long Beach adopted its current SMP in 1997 via Ordinance No. 708 and amended it also in 1997 by Ordinance No. 712. The city currently manages its shoreline via its existing SMP, its 2000 Dune Management Report, and city regulations, including Title 13, Critical Areas Regulations. Jurisdiction of the current SMP is from the western city limits (mean high water[◆] [MHW or MHT[◆]], roughly at the vegetation line located at the western base of the primary foredune)[◆] eastward to the 1889 Government Meander Line[◆]. This area varies in width from about 1,500 feet to about 2,000 feet. In addition, jurisdiction extends from the ordinary high water mark[◆] (OHWM)[◆] westward three nautical miles.

A Note on Shorelines of Statewide Significance

The Long Beach shoreline is considered a Shoreline of Statewide Significance[◆] (SSWS)[◆]. RCW 90.58 raises the status of SSWSs in two ways.

Preferred Uses. First, state law lays out specific preferences for uses of Shorelines of Statewide Significance. RCW 90.58.020 states:

> *The legislature declares that the interest of all of the people shall be paramount in the management of shorelines of statewide significance. The department, in adopting guidelines for shorelines of statewide significance, and local government, in developing master programs for shorelines of statewide significance, shall give preference to uses in the following order of preference which:*
>
> 1. *Recognize and protect the statewide interest over local interest;*
> 2. *Preserve the natural character of the shoreline;*
> 3. *Result in long term over short term benefit;*
> 4. *Protect the resources and ecology of the shoreline;*
> 5. *Increase public access to publicly owned areas of the shorelines;*
> 6. *Increase recreational opportunities for the public in the shoreline;*

7. *Provide for any other element as defined in RCW 90.58.100 deemed appropriate or necessary.*

Optimum Implementation. Second, the SMA calls for a higher level of effort in implementing its objectives on shorelines of statewide significance. RCW 90.58.090(5) states:

> *The department shall approve those segments of the master program relating to shorelines of statewide significance only after determining the program provides the optimum implementation of the policy of this chapter to satisfy the statewide interest.*

1.2 Purposes of this Document

The purpose of this Inventory and Characterization Report is to serve as input to development of the city's SMP update.

The purpose of the study underpinning this Inventory and Characterization Report is to establish existing natural and human-influenced conditions and as a baseline against which impacts of future development in the shoreline will be measured. It also estimates future land use needs and identifies opportunities for environmental protection and restoration, public access improvements, and support of water-dependent[◆] uses.

1.3 Methodology

This Inventory and Characterization Report evaluates existing data, information, studies, and analyses of city shorelines. Some limited field verification was conducted for this effort, however, new data development or primary research are outside of the scope of the city's SMP Update. This limitation of data is particularly important to the discussion of wetlands[◆].

Wetlands that are considered "associated"[◆] are part of the city's shoreline jurisdiction (see a discussion of "association" below). Therefore, it is important to understand where these wetlands are located to establish the city's shoreline jurisdiction. However, there is not sufficient funding to allow delineation of the exact location and quality of all dune wetlands. Even if there were, wetland delineations are considered valid for five (5) years, shorter than the lifespan of an SMP. Moreover, the dune environment where associated wetlands occur is dynamic in its topography due to the effect of wind on sand, and some wetlands—especially shallow, young wetlands—can be ephemeral. In order to address this data limitation, the city and Ecology used two (2) different methods to identify potential wetland locations (see discussion of wetlands in section 4.1.4 of this document), and references to wetland locations should be understood as potential wetland locations. The city and Ecology agree that in the dynamic area behind the primary foredune and west of the 1889 Government Meander Line that shoreline jurisdiction may be discontinuous, and SMP policies and permitting requirements will apply where actual associated wetlands occur, with that occurrence verified by a wetland delineation prepared at the time development is proposed.

This study analyzes specific segments or “reaches” of the shoreline, including the level of function, impairment, development, or other conditions affecting each reach.

Existing data were used to develop a map folio that catalogues features of the study area; this folio is Appendix A to this report.

1.4 How to Use this Document

This document is meant to inform the city’s development of its updated SMP. The public may best use this document to inform the city of resources or issues the city may not know about. Also, this document can be used by citizens to identify areas where resources should be protected, or where there are opportunities for restoration or improvements to public shoreline access. Finally, this document can be used to identify areas appropriate for development while maintaining or improving the shoreline. This is a public document, and to some extent a living document, and the citizenry of Long Beach should comment on and contribute to the information it contains.

Once this inventory and characterization has been vetted by the public, then it can be used as input to the SMP update.

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2.0 SMP Scope and Jurisdiction

2.1 Study Area

The city of Long Beach, population 1,410 as of 2012 (Washington State Office of Financial Management [OFM]*, 2014), is located in southwest Pacific County. The city has no urban growth area (UGA)* outside its corporate limits, and there are no incorporated cities adjacent to its jurisdiction. Seaview, an unincorporated area of urbanized development, is located immediately south of Long Beach.

The study area for this effort at a minimum includes the area within the city's corporate boundaries; for some topics it also includes the ocean beach, and for some topics it includes ocean waters out three (3) miles west. The study area encompasses approximately 2.5 lineal miles of shoreline.

2.2 Shoreline Jurisdiction

An SMP applies to shorelines of the state, which generally include lakes greater than twenty (20) acres and streams with a flow greater than twenty (20) cubic feet per second (cfs)*, together with shorelands* located within 200 feet of the OHWM, associated wetlands*, and floodways* (RCW 90.58.030). In addition, marine waters and their submerged lands to three (3) miles west of the OHWM are subject to the SMA, and so are included in the city's SMP analysis.

In the area of Long Beach there are no lakes greater than twenty (20) acres, no streams with a flow greater than twenty (20) cfs, and no floodways. Based on these local conditions and in consultation with Ecology, the city determined that shoreline jurisdiction for this SMP update includes a small portion of the Pacific Ocean and the ocean beach, shorelands, and associated dunal wetlands. This means the area of shoreline jurisdiction east to west for the city of Long Beach includes the Pacific Ocean and ocean beach/dune from three (3) nautical miles west of the OHWM to 200 feet east of the OHWM, plus those interdunal wetlands* located west of the1889 Government Meander Line. The area of shoreline jurisdiction north to south is the city's north and south city limits, extended 3 miles westward.

The map entitled *Preliminary Shoreline Jurisdiction* located in Appendix A (Map Atlas) to this document provides further information and a graphical presentation of the city's shoreline jurisdiction.

2.3 Exemptions

All lands and resources within the city's shoreline jurisdiction are subject to the SMA. However, pursuant to WAC 173-27-040, certain activities or project types are exempt from Shoreline Substantial Development permitting requirements. Exemptions are strictly interpreted, and the

interpretation must come from city staff, and not an applicant or applicant's representative. Exempt activities include the following:

- Normal maintenance or repair of existing structures
- Owner-occupied single family residences and appurtenant structures
- Certain farming, irrigation, drainage and ranching activities
- Emergency construction to protect property from the elements (after-the-fact permits may be required)
- Bulkheads to protect single family residences
- Improving habitat, cleaning toxic waste, controlling weeds, or restoring watersheds
- Single family or non-commercial community docks designed for pleasure craft and not exceeding fair market values specified at WAC 173-27-040(2)(h)(i) and (ii)
- Site exploration and investigation activities
- Navigation aids, marking property lines

3.0 Regulatory Framework

3.1 Shoreline Management Act (SMA) [RCW 90.58]

The Washington State Shoreline Management Act (SMA) is the primary law pertaining to shoreline management in the state of Washington, and is the law under which the city of Long Beach is updating its Shoreline Master Program. As such, it is the single most relevant law regarding this current effort.

The SMA, administered by Ecology, was passed by the state legislature in 1971 and adopted by public referendum, now codified as RCW 90.58. The SMA was created in response to a growing concern that uncoordinated and piecemeal development was causing serious and permanent damage to the state's shorelines. The legislature intended the SMA to set forth a clear, planned, rational, and concerted effort to avoid or minimize such development-related damage, while accommodating reasonable and appropriate shoreline uses. The Act comprises three broad policies 1) to protect shoreline environmental resources; 2) to promote public access to and enjoyment of the shoreline; and 3) to achieve responsible shoreline use and development.

The SMA establishes a cooperative shoreline management program between local government and the state. Local governments have the primary responsibility for initiating the planning and administration of local SMPs, with the SMP the primary local planning tool for determining shoreline use and protection in a given jurisdiction. Ecology is responsible for ensuring statewide policies are upheld and implemented when local SMPs are adopted, and for supporting and assisting local governments to ensure compliance with the SMA and its provisions. By approving a local SMP, Ecology becomes a full partner in defending any legal challenges to that updated Program.

3.2 Federal and State Agencies and Regulations

A number of federal and state agencies may have jurisdiction over land or natural resources in the city's shoreline jurisdiction. Local Long Beach development proposals most commonly trigger requirements for federal or state permits when they impact wetlands or result in over one acre of clearing and grading. As with local requirements, federal and state regulations apply throughout the city, but regulated resources are more common within the city's shoreline jurisdiction. Federal and state regulations that apply to shoreline-related resources include, but are not limited to the following:

3.2.1 Federal and State-Administered Federal

Rivers and Harbors Appropriation Act of 1899 (FRHA) [33 USC]: Section 10 of the FRHA provides the U.S. Army Corps of Engineers (Corps) authority to regulate activities that may affect navigable capacity of any of the waters of the U.S. [33 Unites States Code (USC) § 403]. The ocean within three (3) nautical miles seaward of ordinary low tide is designated a navigable water of the U.S. [33 Code of Federal Regulations (CFR) § 329.12(a)] Any proposal to

construct new or modify existing in-water structures (including piers, wind farms, wave energy facilities, etc.), to excavate or fill, or to alter or modify the course, location, condition, or capacity of marine waters must be reviewed and approved by the Corps.

Clean Water Act (CWA) [33 USC 1251 et seq.]: The CWA[✝], administered by the United States Environmental Protection Agency (EPA)[✝] establishes the basic structure for regulating discharges of pollutants into waters of the U.S. and regulating quality standards for surface waters. Under the CWA, EPA has implemented pollution control programs such as setting wastewater standards for industry, and has also set water quality standards for all contaminants in surface waters.

The CWA makes it unlawful to discharge any pollutant from a point source into navigable waters, unless a permit is obtained. EPA's National Pollutant Discharge Elimination System (NPDES)[✝] permit program controls discharges. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters.

The CWA regulates excavation and dredging in waters of the U.S., including wetlands. Certain activities affecting wetlands in the city's shoreline jurisdiction may require a permit from the Corps under § 404 or Ecology under § 401 of the Act. CWA § 404 provides the Corps, under oversight of the EPA, with authority to regulate discharge of dredged or fill material into waters of the United States, including wetlands. As applicable to the city of Long Beach's shoreline jurisdiction, the Corps must review and approve most activities affecting wetlands. These activities may include fill of wetlands, wetland restoration, and culvert installation or replacement, among others. The Corps is interested in a prioritized approach to wetland mitigation emphasizing first avoidance and minimization of impacts before proceeding to compensation for impacts.

CWA § 401, Water Quality Certification: This portion of the CWA, administered by Ecology, allows states to review, approve, approve with conditions, or deny certain actions that result in discharges to state waters, including wetlands. In Washington, Ecology conducts that review. Actions within marine waters or wetlands within the shoreline zone that require a FHRA § 10 or CWA § 404 permit (see above), must also be reviewed by Ecology.

National Pollutant Discharge Elimination System (NPDES) Program of the CWA: Ecology regulates activities that result in wastewater discharges to surface water from industrial facilities or municipal wastewater treatment plants.

Coastal Zone Management Act (CZMA) [USC §§ 1451-1464]. The CZMA[✝] does not directly affect shoreline permits, but indirectly it has important jurisdiction and coordination consequences. The CZMA allows states to undertake coastal development and protection planning. Being a voluntary effort, it is not enforced by a federal agency but all federal agencies are subject to the Act. Federal agency actions must be consistent with the state CZMA Plan and so the Act serves as a limit on federal authority. Planning and coordination elements at the state level are handled

by Ecology, which reviews federal actions and provides a "certification" that the action is consistent with the CZMA Plan.

The Washington CZMA Plan is administered by Ecology. It incorporates the local SMPs for coastal cities and counties, and for jurisdictions with rivers that flow to the coast. Consequently, federal agency actions must be consistent with local SMPs for projects undertaken by federal agencies in the coastal zone.

Ecology enforcement of the CZMA Plan for federal actions takes place between those agencies with little involvement from local jurisdictions. Enforcement for private action violations follows the normal SMP enforcement process.

The CZMA also provides states with special funding to assist in making improvements to their state CZM Programs. Washington State participates in this voluntary CZM Improvement Grants Program (also known as the Section 309 Program). Washington State uses these federal funds primarily to update and amend SMPs, including to help fund local SMP updates.

Endangered Species Act (ESA) [16 USC § 1531 et seq.]: The ESA, administered by the EPA, provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. The lead federal agencies for implementing the ESA are the U.S. Fish and Wildlife Service (USFWS) and the U.S. National Oceanic and Atmospheric Administration (NOAA) Fisheries Service (commonly, NOAA Fisheries). The USFWS maintains a worldwide list of endangered species, including birds, insects, fish, reptiles, mammals, crustaceans, flowers, grasses, and trees.

The law requires federal agencies, in consultation with the USFWS and and/or NOAA Fisheries, to ensure actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in destruction or adverse modification of designated critical habitat of such species. The law also prohibits any action that causes a "taking" of any listed species of endangered fish or wildlife. Likewise, import, export, interstate, and foreign commerce of listed species are all generally prohibited.

Activities with potential to affect federally listed or proposed species and that either require federal approval or assistance, or that occur on federal land must be reviewed by the NOAA Fisheries and/or the USFWS via a consultative process.

Other Federal Laws: Other relevant federal laws include the following: National Environmental Policy Act (NEPA) [42 USC § 4321 et seq.], Anadromous Fish Conservation Act [16 USC §§ 757a-757g], Clean Air Act (CAA) [42 USC § 7401 et seq.], and the Migratory Bird Treaty Act (MBTA) [16 USC §§ 703-712].

3.2.2. Washington State Laws and Agencies

Washington Hydraulic Code [RCW 77.55]: The Washington DFW regulates activities that use, divert, obstruct, or change the natural flow of the beds or banks of waters of the state and may affect fish habitat. DFW has the authority to review, conditionally approve, approve, or deny any construction activity that will use, divert, obstruct, or change the bed or flow of state waters. As

it applies to the city of Long Beach shoreline jurisdiction, this generally means that DFW must review and approve most activities in marine and fresh waters. These activities may include in-water repair or construction and culvert installation or replacement, among others. The DFW can condition projects to avoid, minimize, restore, and compensate for adverse impacts. Projects creating new impervious surface that could substantially increase stormwater runoff to waters of the state may also require approval.

Washington Marine Waters Planning and Management Act [RCW 43.372]: This law allows agencies with marine waters planning and management responsibilities to include marine spatial data and marine spatial planning elements in planning efforts. It also enables the state to augment the marine spatial component of existing plans and to improve coordination among state agencies in the development and implementation of marine management plans, such as SMPs. Finally, the Act also established policies to guide state agencies and local governments when exercising jurisdiction over proposed uses and activities in marine waters.

The Act directs Ecology to work with other agencies and entities with marine management responsibilities, and marine waters stakeholders to compile marine spatial information and to incorporate this information into plans. The Act establishes a marine interagency team that coordinates development of a comprehensive marine management plan for the state's marine waters and that includes marine spatial planning.

Washington Ocean Resources Management Act [(RCW 43.143]: This law establishes policies intended to protect functions and values of the state’s ocean resources. The Act also establishes the Washington Coastal Marine Advisory Council to communicate and collaborate with agencies and entities on coastal issues, including coastal resource policy, planning, and management issues; the Council also advises the governor, legislature, and Washington agencies on specific coastal waters resource management issues. The Council’s role also includes identifying and pursuing funding opportunities for relevant programs and activities of its members.

Washington Department of Natural Resources (DNR): Washington DNR protects and manages state-owned aquatic lands. The DNR manages more than 5.6 million acres of state-owned forest, range, commercial, agricultural, conservation, and aquatic lands for revenue, outdoor recreation, and wildlife habitat. Water-dependent uses waterward of the OHWM require review by DNR to establish whether the project is on state-owned aquatic lands.

Washington State Parks and Recreation Commission (the Commission): The Commission has jurisdiction over the Seashore Conservation Area (SCA). The SCA, established in 1967, includes those lands located between the line of ordinary high tide and the line of extreme low tide, including those lands immediately west of the city limits of Long Beach [RCW 79A.05.605]. The SCA also includes lands that have been formed by accretion and located landward of the present line of MHT, where private landowners have granted State Parks with a deed of dedication. The SCA is an area of ocean beaches dedicated to public recreation, where non-recreational use of the beach is strictly limited, and even recreational use of the beach is regulated in order that Washington’s seashore may be preserved into the future in much the same form as it is currently.

The SCA is an area where standards for ocean beach management are enforced by the Commission, including regulation of vehicular traffic and limits on mining for sand on the Long Beach Peninsula for purposes of cranberry growing and construction [RCW 79A.05.630].

Other Washington Laws: Other relevant Washington laws include the following: Growth Management Act (GMA)[✝] [RCW 36.70A], State Environmental Policy Act (SEPA)[✝] [RCW 43.21(C); SEPA rules at WAC 197-11], tribal agreements and case law, Watershed Planning Act [RCW 90.82], Salmon Recovery [RCW 77.85], and Water Pollution Control [RCW 90.48].

3.3 Pacific County

Long Beach is located in Pacific County. While Long Beach operates under its own land use and resource protection regulations, a brief summary of Pacific County regulations and plans is provided here for context.

Shoreline Management Program (SMP). Pacific County adopted its current SMP in 2000. It includes goals, policies, regulations, and SEDs for the management and protection of County shorelines. This program includes four main SEDs: Natural, Conservancy, Rural, and Urban, with some further divided into subcategories to better address specific circumstances.

Comprehensive Plan. The County adopted its current Comprehensive Plan in 2010. This plan establishes an overall desired land use pattern, and describes the general distribution, location, intensity, and nature of current and future development. It also lays out goals, preferences, and policies of the County regarding development and provides for supporting infrastructure.

Zoning Regulations. The Pacific County Zoning Regulations (Title 18 of the County code, fully revised and adopted in 2012 via Ordinance No. 162) work together with the SMP to control land use as well as development location, building bulk, and scale in the shoreline area.

Critical Areas Regulations. Pacific County Critical Areas Regulations were last updated in 1999 (via adoption of Ordinance 147 and 147A, and amended in 2000 with adoption of Ordinance No. 147B). These regulations establish the County's protections of waters, including shorelines and wetlands.

3.4 City of Long Beach

Shoreline Management Program (SMP). The city of Long Beach adopted its existing SMP in 1997 via Ordinance No. 712. The SMP includes policies and regulations to govern development and use of the city's shoreline.

The Long Beach SMP establishes shoreline environment designations (SEDs)[✝]. The purpose of SEDs is to establish a uniform basis for applying policies and use regulations within distinctly different shoreline areas. In a regulatory sense, SEDs function similarly to zoning districts. That is, they establish policy and regulation that applies, in conjunction with development standards, to lands and waters within shoreline jurisdiction. SEDs are based on biological and physical

characteristics of the shoreline, existing and planned development patterns, as well as community vision and objectives for future development.

The SEDs in the city's current SMP were developed based on land use patterns, biophysical characteristics of the shoreline, and input from local citizens as well as the city's Comprehensive Plan in combination with Ecology guidelines as they existed in 1997. The SEDs have not been updated since they were originally adopted, and include Natural, Conservancy, Rural Residential, Rural Resort, and Urban Resort.

Natural. The area west of the 1990 Seashore Conservation Line[4] (SCL)[4] to a point three (3) mile into the Pacific Ocean is designated Natural. This includes the primary foredune, ocean beach, and Pacific Ocean. This land is used for recreation, access (trails, beach approaches), and may be traversed by underground utilities. The distance between the OHWM and the 1990 SCL varies from 0 feet to about 500 feet.

Conservancy. About 200 acres of land in Long Beach, or fifty percent (50%) of the city's current shoreline jurisdiction is Conservancy. This includes all lands located between the 1980 and 1990 SCLs (the distance between these lines varies from 275 feet to 390 feet), as are all lands between the 1980 SCL and the 1889 Government Meander Line that are owned by the Washington State Parks & Recreation Commission at the time the SMP was adopted. As with the Natural designation, development has been restricted to access, although possible interpretive facilities are allowed but have not been constructed.

Rural Residential. This SED accommodates single- and multi-family residential.

Rural Resort. These lands are located west of residential or commercial areas not in the downtown core. They allow for support of a tourism-based economy, but without the intensity of an urban setting.

Urban Resort. These lands are located west of the downtown core and are intended for intense tourism-related development allowing high levels of pedestrian access to both the downtown core and the ocean beach/dune area.

Dune Management Plan. The city of Long Beach prepared its Dune Management Plan (March 2000) in cooperation with Ecology, the Corps, EPA, USFWS, and the Washington DFW. This plan is intended to combine land use planning, infrastructure planning, zoning, shoreline master planning, and design review guidelines to ensure environmental sensitivity and give predictability to development in the area of Long Beach west of Ocean Beach Boulevard. The Plan attempts to balance the requirement of the GMA to "push" growth toward cities with the requirement of the SMA to protect the shoreline, an issue of particular interest and complexity for coastal cities.

Comprehensive Plan. The city adopted its current Comprehensive Plan 2026 in August of 2008 (adopted via Ordinance No. 838). The Comprehensive Plan includes shoreline-specific zoning designations and development standards intended to implement the SMP. The Plan also recognizes the need for and includes many goals and strategies to encourage environmental sensitivity in development located in the dune area and otherwise near the shoreline jurisdiction area.

Unified Development Regulations. The city's Unified Development Regulations (Title 11 of the city code, fully revised and adopted in 2009 via Ordinance No. 848) regulate shoreline development by requiring shoreline substantial development permits, variances, conditional use permits, or statements of exemption according to the criteria established by the SMA (RCW 90.58.140).

Zoning Regulations. The Long Beach Zoning Regulations (Title 12 of the city code, fully revised and adopted in 2009 via Ordinance No. 849) codifies shoreline zoning regulations that implement policies of the SMP regarding basic land use and the built environment. The city's zoning regulations include development standards in shoreline zones consistent with the SMP.

The city's zoning code enforces the 1980 SCL as the setback for building in the Long Beach dune area. The setback line is based on and is approximately parallel to the vegetation line. While it varies in its distance from the vegetation line, its location averages about 600 to 700 feet east. Specific shoreline zoning exists in the city's current jurisdictional shoreline. The map entitled C*ity Zoning* located in Appendix A (Map Atlas) to this document provides further information and a graphical presentation of the city's shoreline zoning scheme.

Critical Areas Regulations. The city's Critical Areas Regulations are Title 13 of the city code, adopted in 2010 via Ordinance No. 857 pursuant to Washington's Growth Management Act (GMA). The city's Critical Areas Regulations preserve and protect critical areas functions and values as required by the GMA by regulating development—including development located in the city's jurisdictional shoreline—within and adjacent to critical areas (wetlands, habitat conservation areas, frequently flooded areas, critical aquifer recharge areas, and geologically hazardous areas, plus relevant buffers) while allowing for the reasonable use of private property. The protections provided by the city's Critical Areas Regulations go far beyond any others previously adopted by the city. For example, the Critical Areas Ordinance prohibits subdivision of land located wholly within a wetland or stream critical area or associated buffer except as a critical areas tract. Section 13-3-12 of the ordinance identifies mitigation and monitoring requirements, defines required treatment of buffers, establishes setbacks and subdivision requirements, and defines critical area marking/fencing requirements.

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4.0 Inventory of Ecosystem and Shoreline Processes and Functions

A map atlas depicting information amassed for this inventory informs the following description of area resources and conditions, and is included as Appendix A to this document.

4.1 Natural Conditions

4.1.1 Climate

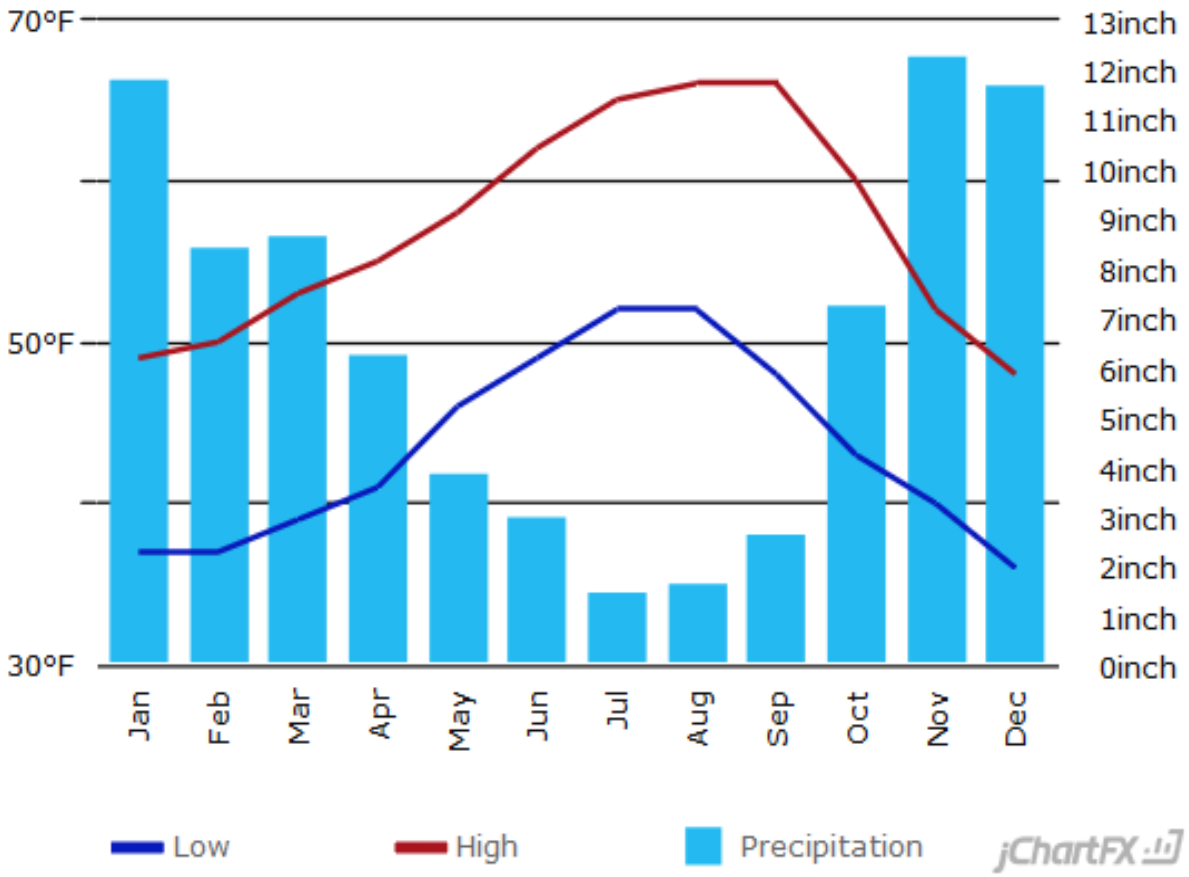
The long-term weather pattern of the city of Long Beach is classified as a marine west coast-cool summer Mediterranean climate. This includes warm—but not hot—summers, and cool, wet winters. Both extremely hot and cold temperatures are rare, with temperatures moderate throughout the year. The record high temperature is 99 degrees Fahrenheit on August 10, 1981 and the record low is 0 degrees Fahrenheit on December 8, 1972 (see Table 1). Long Beach records nearly80 inches of rainfall annually (see Figure 1); snow occurs on occasion. (Weather.com; Blakemore, 1995)

Table 1: Climate Data for Long Beach, Washington

Month:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Record high °F (°C)	65 (18)	74 (23)	72 (22)	82 (28)	94 (34)	93 (34)	95 (35)	99 (37)	92 (33)	90 (32)	72 (22)	64 (18)	99 (37)
Average high °F (°C)	49 (9)	51 (11)	53 (12)	55 (13)	59 (15)	62 (17)	65 (18)	66 (19)	66 (19)	60 (16)	52 (11)	48 (9)	57.2 (14.1)
Average low °F (°C)	37 (3)	37 (3)	39 (4)	41 (5)	46 (8)	50 (10)	52 (11)	52 (11)	48 (9)	43 (6)	40 (4)	36 (2)	43.4 (6.3)
Record low °F (°C)	8 (−13)	9 (−13)	25 (−4)	26 (−3)	30 (−1)	33 (1)	38 (3)	36 (2)	29 (−2)	21 (−6)	15 (−9)	0 (−18)	0 (−18)
Rainfall inches (mm)	11.79 (299.5)	8.69 (220.7)	8.64 (219.5)	6.26 (159)	3.81 (96.8)	2.94 (74.7)	1.44 (36.6)	1.66 (42.2)	2.58 (65.5)	7.20 (182.9)	12.26 (311.4)	11.67 (296.4)	78.94 (2,005.1)

Source: Weather.com

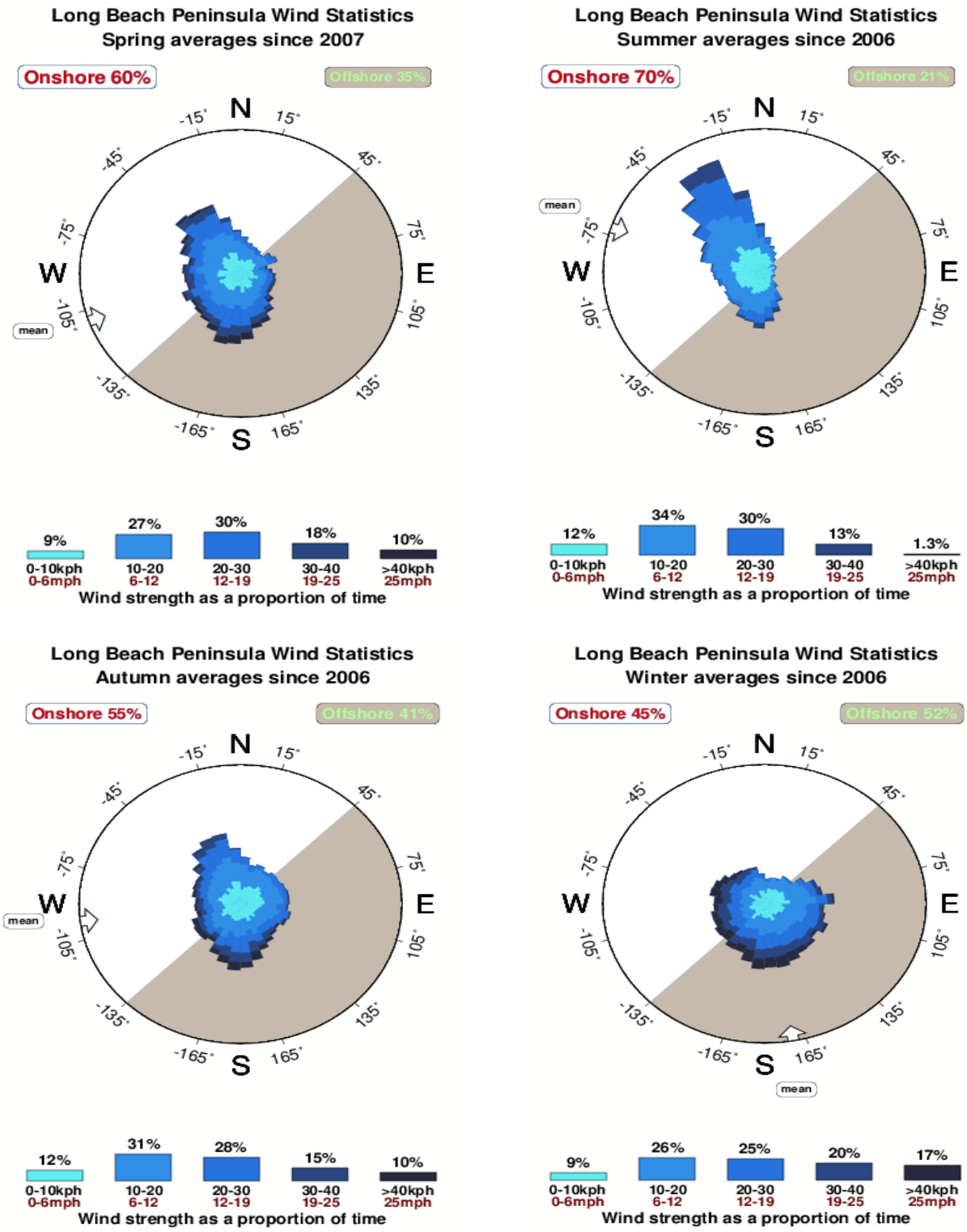
Figure 1: Long Beach Average Annual Temperature and Rainfall



source: U.S. Climate Data - Climate Long Beach

Winds are generally from a westerly direction, except in the winter, when they are from the south-southeast (see Figure 2). Wind speeds are highest in the winter and spring.

Figure 2: Long Beach Peninsula Wind Roses



Source: http://www.surf-forecast.com/breaks/Long-Beach-Peninsula/reliability_by_season

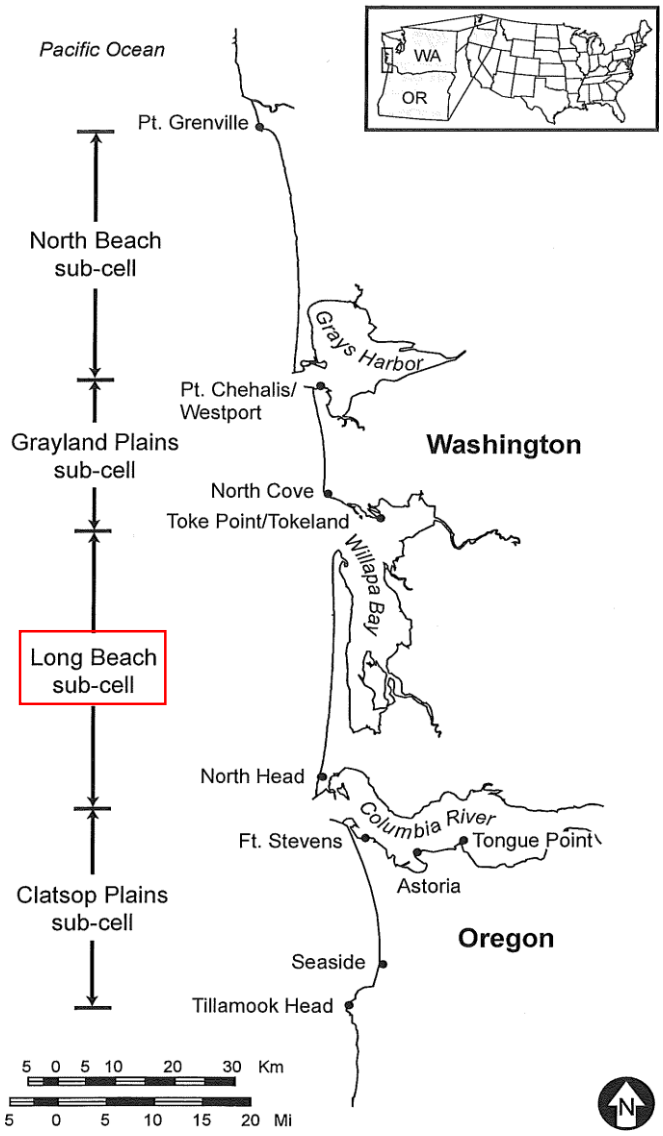
4.1.2 Geology, Soils, Groundwater, and Seismology

The maps entitled *Soils, Groundwater and Aquifer Recharge Areas and Well Locations, Geologic Hazards—Shallow Landslide Vulnerability, and Geologic Hazards—Liquefaction Potential* located in Appendix A (Map Atlas) to this document, provide graphical presentations of data and information discussed in this portion of the inventory.

Geology

The ocean beach of Long Beach is located in the Long Beach sub-cell of the Columbia River littoral cell[†]. The larger cell extends from Tillamook Head, Oregon to Point Grenville, Washington, and is the limit of influence of the Columbia River relative to sediment origin and transport. The Long Beach sub-cell extends from the mouth of the Columbia River northward to the mouth of Willapa Bay, encompassing the entire Long Beach Peninsula (see Figure 3).

Figure 3: Columbia River Littoral Cell



Source: Buijsman, et al, 2003

The majority of the Long Beach Peninsula—including the jurisdictional shorelands of the city of Long Beach—is an accreted sand bar created primarily from sediments transported by the Columbia River to the Pacific Ocean, then transported from the mouth of the Columbia northward by longshore[†] ocean currents.

A comparative review of historic aerial photos in the archives of the city of Long Beach reveal that the amount of accretion over time, using the 1889 Government Meander Line as the baseline, has been just under 2,000 feet in total, and accretion has averaged approximately 15.7 feet per year (see Table 2). Accretion accelerated to a peak around the 1960s-1970's, then dropped off. Since beach accretion has slowed, growth in the height of the primary dune has accelerated. (personal observation, G. Borchard; personal communication. M. Litawa)

Basal bedrock outcrops at the southern end of the peninsula, and the accreted sediments thicken south to north as the underlying bedrock dips away from its southern outcropping. Accretions toward the north end of the peninsula are as thick as 1,400 feet. While much of the sediments underlying the peninsula are heterogeneous and unconsolidated, reflecting changes in the depositional

environment, the upper 100 feet are dominated by sand underlain by discontinuous lenses of sand and silt/clay. (Blakemore, 1995; Ecology, 2000)

Table 2: Accretion at Long Beach Shoreline, from 1889 to 2013[1]

Period	No. of Years in Period	Linear Feet of Accretion	Feet of Accretion/Year	Cumulative Feet of Accretion
1889 to 1944	55	670	12.2	670
1944 to 1966	22	580	26.4	1,250
1966 to 1977	11	450	40.9	1,700
1977 to 1996	19	55	2.9	1,750
1996 to 2005	9	130	14.4	1,880
2005 to 2013	8	66	8.3	1,945

1 From an east-west transect whose origin is a point located at the intersection of the north side of the existing right-of-way of 13th Street SW and the 1889 Government Meander Line.

Source: city of Long Beach Historic Photographs Archives, 1944, 1966, 1977, 1996, 2005, and 2013

Soils

The Long Beach Peninsula is accreted land, with soils laid down by waves whose length parallel the coastline; as a result, the peninsula is a relatively long and narrow strip of land running north-south paralleling the mainland, with long and narrow Willapa Bay separating the peninsula from the mainland. Since deposition occurred in parallel north south waves from the east accreting to the west, the oldest soils occur on the eastern shore along Willapa Bay, and the youngest soils occur on western shore along the ocean beach. Also, because of this pattern of deposition, soils tend to trend in north-south bands.

Because the Long Beach Peninsula is relatively young in a geological sense, its soils are unweathered and relatively undeveloped (Blakemore, 1995). Therefore, the characteristics of peninsula soils, including the soils of Long Beach, are similar to the characteristics of the parent material(s). Area soils are generally derived from sand and from organic matter; those derived from sand have rapid infiltration rates and small water-holding capacities while those derived from organic matter have moderate infiltration rates and large water-holding capacities.

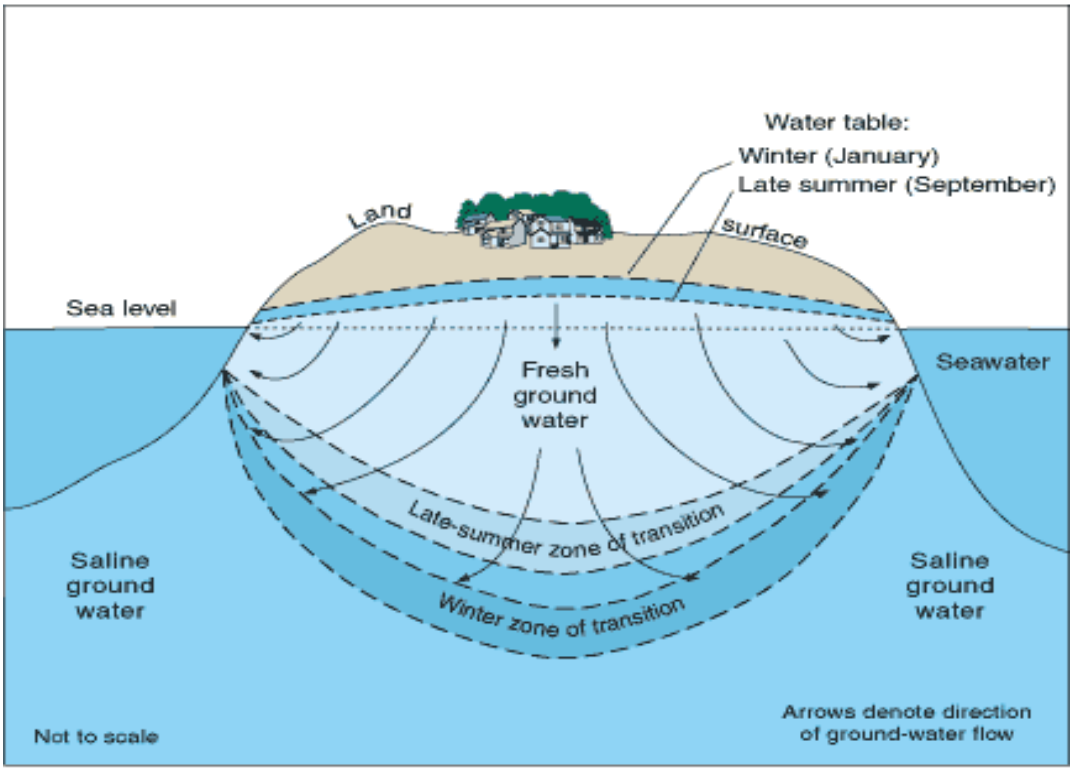
Nearly all of the soils of the Long Beach area are sand in nature, including—from west to east—moderately wide and continuous north-south bands of beach and dune lands; a wide continuous band of Westport fine sand; alternating discontinuous narrow bands of Netarts fine sand and Yaquina loamy fine sand; and a narrow discontinuous band of Seastrand mucky peat along the eastern limit of the city. (Slaughter, et al, 2013) The Netarts and Westport sands were formed on dune ridges. The Yaquina loamy sand and Seastrand mucky peat were formed in swales[◆] or deflation plains[◆] between the dunes. (Blakemore, 1995)

Groundwater

The following discussion is from Ground-water Flow and Water Quality in the Sand Aquifer of the Long Beach Peninsula, Washington (Blakemore, 1995).

The Long Beach Peninsula, including the Long Beach area, has a groundwater system similar to that of a homogeneous "island" groundwater flow system, where a lens of less dense freshwater "floats" on top of a body of more dense salt water (see Figure 4). This is a dynamic system, and the location and width of the fresh-saltwater interface—really a diffusion zone—is affected by the seasonal position of the water table, hydraulic characteristics of the aquifer, recharge-discharge relationships, and the tides. The saltwater bodies outside the fresh groundwater lens are the Pacific Ocean on the west and Willapa Bay on the east.

Figure 4: Generalized Flow Pattern of a Homogeneous Island Aquifer



Source: http://pubs.usgs.gov/fs/old.2000/fs-057-00/

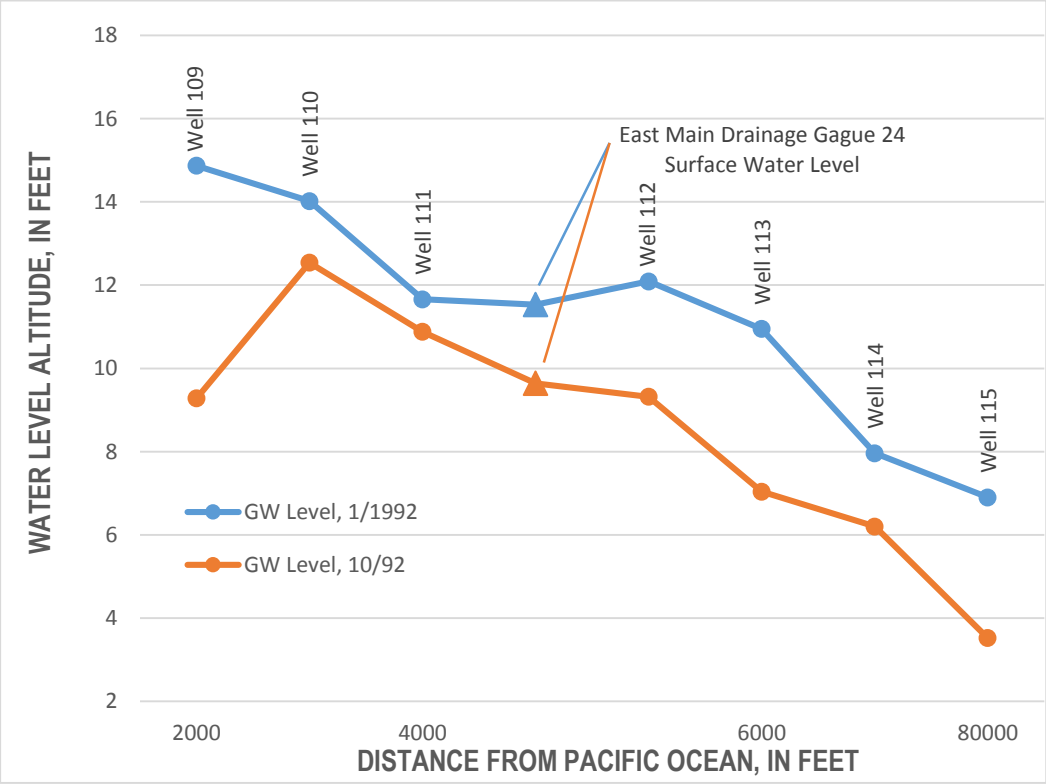
Recharge to the groundwater system is from infiltration/percolation of rainfall, and to a much lesser extent from seepage from lakes and marshes. The rate of recharge varies with the seasons, and depends on the amounts of rainfall and of evapotranspiration. In the spring, fall, and winter rainfall exceeds evapotranspiration, thus recharging; evapotranspiration generally exceeds rainfall in the summer, and recharge is small or non-existent.

The Long Beach area experiences shallow groundwater, with soils being a very consistent indicator of the depth to groundwater. The higher elevation Netarts and Westport sands soils tend to have a depth to groundwater of about 5 to 10 feet in the wintertime. The lower lying Yaquina

loamy sand and Seastrand mucky peat soils tend to have a depth to groundwater of about 2 to 6 feet during the wintertime. Water levels are higher on the western side of the Peninsula than they are on the eastern side and water levels are consistently higher in elevation (more shallow) in the wintertime than the summertime (see Figure 5).

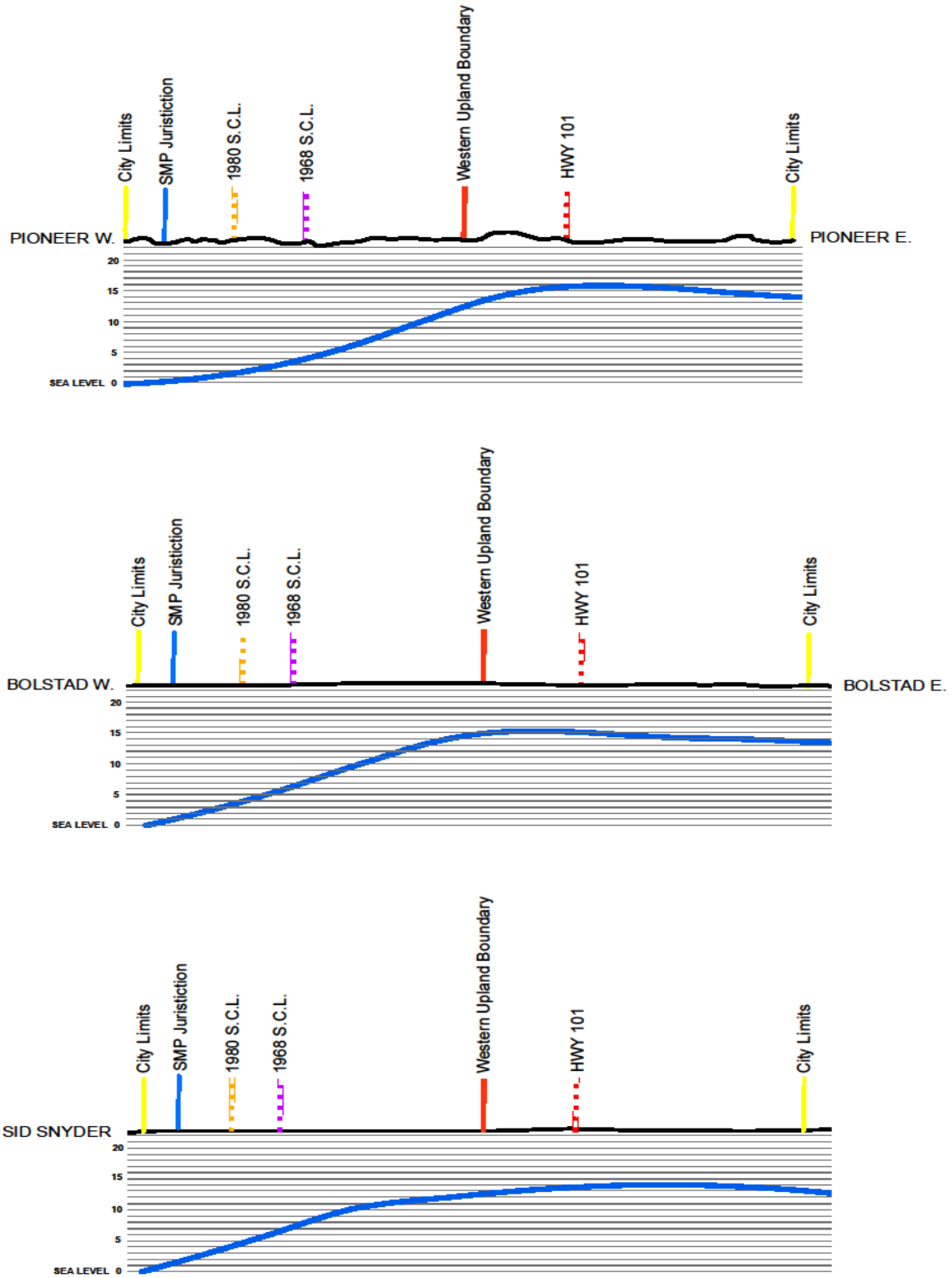
Groundwater generally moves perpendicular to the spine of the Peninsula. A groundwater divide exists where groundwater is its most shallow along a north-south axis, and groundwater moves away from this divide west or east toward either the Pacific Ocean or Willapa Bay, respectively. In some cases, groundwater discharges to area sloughs and drainages. The groundwater divide is located on the west side of the Peninsula, and most groundwater underlying the Peninsula flows toward Willapa Bay (see Figures 5 and 6).

Figure 5: Relationship between Groundwater and Surface Water Levels along Pioneer Road, Long Beach Peninsula, Washington



Source: Blakemore, 1995; Figure 24

Figure 6: Groundwater Levels and Flow Directions, January 1992



Source: Blakemore, 1995; Figure 17

The most prominent groundwater features in the dune area are interdunal wetlands located in the deflation plain behind the foredune. Natural interdunals are fairly shallow, and their formation is influenced by shallow groundwater at approximately the 14 foot elevation National Geodetic Vertical Datum of 1929[*] (NGVD29)[*] or its equivalent of 18.3 feet North American Vertical Datum of 1988[*] (NAVD88)[*]. There are two relatively large man-made interdunal wetlands in the dune complex that were created by excavation and are far deeper than naturally-occurring interdunal wetlands. Due to accretion, vegetation growth, and the action of wind on sand, the topography of the dune complex is dynamic, and smaller interdunal wetlands can be ephemeral. However, larger wetlands or those in pine forests where the sand is less subject to the effects of wind can be relatively stable. Currently, there are about 62 to 65 acres of interdunal wetlands located in the dune complex. (For additional information, see discussion of biology, below.)

Seismology

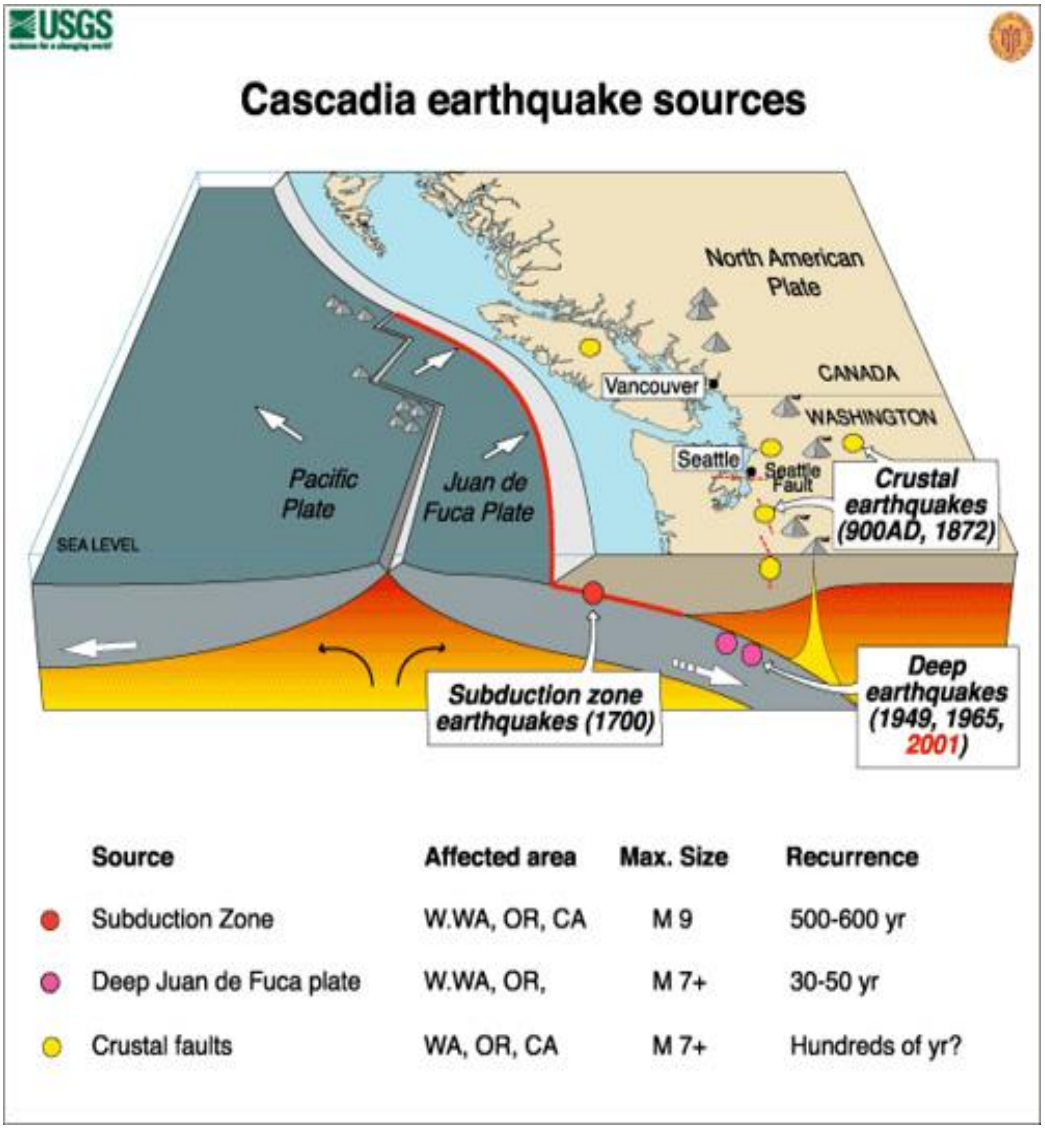
The Long Beach Peninsula is located approximately 80 miles east of the Cascadia Subduction[*] Zone (CSZ)[*], a "megathrust"[*] fault comprising a 1,000 kilometer dipping fault stretching between Northern Vancouver Island, Canada southward to Cape Mendocino, California, and separating the Juan de Fuca and North America plates. The Juan de Fuca plate is created offshore along the Juan de Fuca ridge and this plate moves toward—and eventually pushes/is shoved beneath, or is subducted beneath—the continental land mass of the North American plate (see Figure 7).

At depths shallower than about 30 kilometers (km)[*], the CSZ is locked by friction while strain slowly builds up as subduction forces act, until the fault's frictional strength is exceeded and the rocks slip past each other along the fault in a megathrust earthquake. The fault's frictional properties change with depth, and immediately below the locked part is a transitional strip or zone that slides in "slow slip events" that slip a few centimeters (cm) every dozen months or so. This relieves the plate boundary stresses along the transition zone, but adds to the stress on the locked part of the fault. Geodetic evidence suggests that below the transition zone the fault slides continuously and silently at a long term plate slip rate. From its surface trace offshore to a depth of possibly five (5) km, observations of CSZ mechanisms and activity are few and it remains unknown whether the fault is stuck or slipping silently.

The CSZ may be unique among the world's subduction zones in that it produces very few (if any) earthquakes unambiguously on the plate interface. Coupled with evident occurrence of great megathrust earthquakes, the CSZ must be much more strongly locked than other subduction faults. The geological evidence has led to differing interpretations about whether the entire CSZ always ruptures in great earthquakes, or whether smaller-sized events also can break parts of the zone in between the full rupture events.

A megathrust event is a very large earthquake along a subduction zone. Thirteen (13) megathrust events have been identified along the CSZ in the past 6,000 years. While the occurrence of these events averages one every 500 to 600 years, they have occurred as frequently as 200 years apart or as infrequently as 800 years, and there is no predictable interval. (Natural Resources Canada at www.earthquakescanada.nrcan.gc.ca)

Figure 7: Cascadia Subduction Zone (CSZ)



Source: Pacific Northwest Seismic Center at www.pnsn.org

The last CSZ megathrust event occurred just over 300 years ago on January 26, 1700. This event resulted in widespread tsunami damage to the Washington coast as well as to Japan. In addition, land mass of the Long Beach Peninsula subsided (dropped in elevation) approximately six feet. (Atwater et al, 2005) Evidence of this subsidence can be observed in the shallow waters of Willapa Bay offshore of Long Island, where submerged stumps of large evergreen trees can been seen that certainly once grew on land, and died once the land mass subsided and they were inundated by salt water. (G. Borchard, personal observation)

A CSZ seismic event may produce up to a magnitude (M)[†] 9+ earthquake with ground accelerations on the coast as much as 0.40*g*[†] (*g* is acceleration due to gravity), and severe ground shaking for several minutes. As such an event has done previously, it is likely to result in widespread and devastating damage, including substantial subsidence of up to six feet

accompanied by a large tsunami event. Should subsidence and tsunami damage occur to the level possible, the resulting state of the geography of near-beach areas such as Long Beach is difficult if not impossible to predict. That is, how much of the land mass of Long Beach would remain intact and above sea level after such an event is unknown.

A recent study of potential seismic landslide vulnerability of the Long Beach Peninsula, including the city of Long Beach, identified areas with potential for slope failure resulting from a megathrust CSZ event. The study found low to medium potential for slope failure on the outer face of the primary dune in the shoreline jurisdictional area. This potential is also predicted to exist in places along the dune ridge near Ocean Beach Boulevard where cuts were made through the dune to construct access to the west, creating fairly steep north and south facing dune side slopes. (Slaughter *et al*, 2013)

This same study also identifies areas susceptible to liquefaction as a result of a megathrust event on the CSZ. The study finds nearly all of Long Beach, including the entire shoreline jurisdiction area, as having a low to moderate liquefaction hazard rating, with some smaller areas in the central and eastern portions of the city rated as very low to low. On the eastern limit of the city is a lens of peat (see discussion of soils, above), which is not known to liquefy, but rather to deform as a result of a seismic event. Therefore, areas of peat may result in damage similar in appearance, extent, and severity to that of liquefaction.

4.1.3 Topography and Surface Water

The maps entitled *Stormwater Infrastructure, NGVD 29 Contour Lines, NAVD88 LiDAR Contour Lines, and FEMA 2013 Preliminary Flood Zones* located in Appendix A (Map Atlas) to this document, provide graphical presentations of data and information discussed in this portion of the inventory.

Topography, Terrestrial

The generally flat to modestly sloped topography of the Long Beach Peninsula is the result of millennia of ocean-deposited sediment shaped by wind into dunes stabilized by vegetation. This results in long and low parallel north-south dune ridges interspersed with shallow vales, many of them containing shallow water bodies (see Figure 8, an aerial photograph of this phenomenon). The following dune forms are found in this landscape: foredune, deflation plain, sand hummock, blowout, dune ridge, and swale. (Wiedemann, 1984)

Describing the topography, from west to east, first there is a broad, sandy, and gradually sloping ocean beach, which serves as the transition between land and ocean environments. The foredune is a ridge of sand parallel to the ocean beach and located just above the limit of ordinary wave action. It is created by the predominant wind from the west transporting ocean beach sand, which is trapped by vegetation, mostly European beach grass (*Ammophila arenaria*), which began developing in the dune area in the late 1940s to 1950s (see Figures 9 and 10 and note contrast in dune grass development). (City of Long Beach Historic Photographs Archives, 1944 and circa 1950s) As beach grass continues to grow, additional sand is trapped, and the dune increases in height and width. Behind the foredune is a low-lying deflation plain where interdunal wetlands

form at surface elevations of 14 feet (National Geodetic Vertical Datum of 1929 [NGVD29]) or lower. The formation of these wetlands depends on the presence of shallow groundwater. Also in the deflation plain are the hummocks—mounds of sand formed by vegetation-trapped sand—and blowouts—unvegetated areas where wind erosion forms either bowls or troughs. To the east of the deflation plain is the preceding historic foredune, or a dune ridge. The foredune, deflation plain, and dune ridge together comprise the city's dune area, or dune complex, an area averaging about 2,000 feet in width. Figure 11 is a typical cross section of the Long Beach dune area.[2]

To the east of the dune ridge is the developed part of the town of Long Beach, and the original landscape features are altered. To the east of town are manmade ditches and natural swales, including Tinker Lake, a Category II depressional wetland complex. This pattern of dune-deflation plain-dune is repeated in an attenuated manner across the Peninsula, with older eastern dunes ridges lower than the younger western dunes due to weathering and/or alteration by human activity (see Figure 11).

Figure 8: Aerial Photograph Depicting Dune Ridges and Interspersed Shallow Lakes, 1926

Source: City of Long Beach Historic Photographs Archives, 1926

[2] Section 5.1 of this document is an analysis of the Long Beach shoreline by sub-shoreline analysis units termed "reaches". Cross sections of dune topography by reach are included in the map atlas.

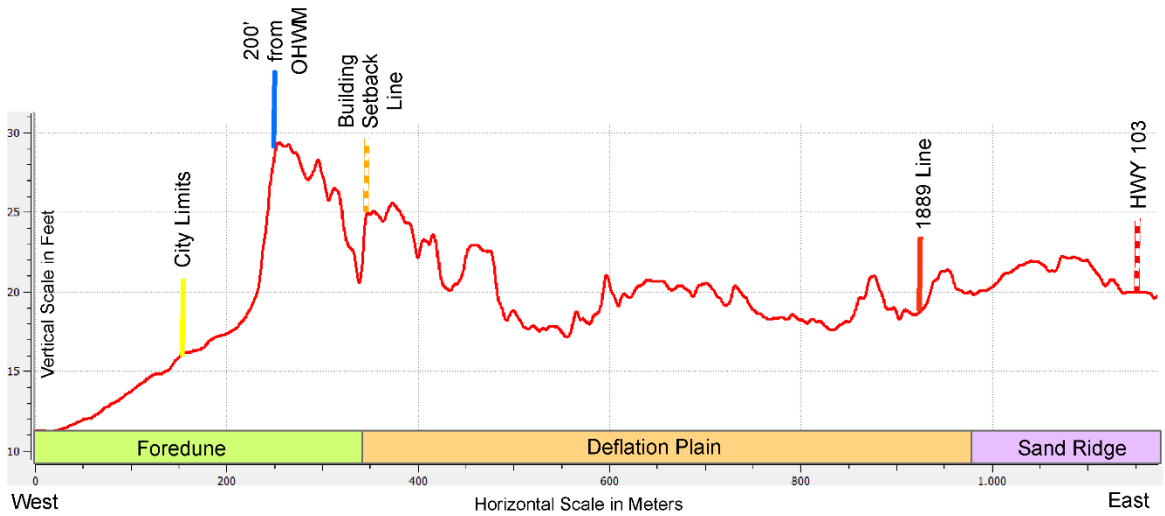
Figure 9: Aerial Photograph Depicting Long Beach Just South of Sid Snyder Drive, 1944

Source: City of Long Beach Historic Photographs Archives, 1944

Figure 10: Aerial Photograph Depicting Long Beach Dune Area, Circa 1950s

Source: City of Long Beach Historic Photographs Archives, circa 1950s

Figure 11: Typical Cross-Section of Long Beach Dune Area Topography



Source: City of Long Beach, 2014

Topography, Marine

The ocean floor from the shore outward to approximately seven (7) miles is considered the inner (nearshore-shallow) continental shelf[◆] with a relatively flat slope and depths up to 131 feet. West of the inner shelf is the midshelf, an irregular band varying in width from seven (7) to 17 miles, also of a relatively flat slope and with depths of 131 to 656 feet. Beyond the midshelf is a the relatively narrow mesobenthal[◆] upper continental slope with depths of 656 to 2,297 feet, and finally is the bathybenthal[◆] lower to toe of the continental slope with depths of 2,297 to 11,500 feet. (Washington Marine Spatial Planning, 2014)

A feature of the offshore topography of the region is the Astoria Canyon, a submarine canyon[◆] and fan valley[◆] system with its head 11 miles west of the mouth of the Columbia River. The canyon crosses the seaward half of the continental shelf in a westerly direction and trends sinuously down to the base of the continental slope and the apex of Astoria Fan at a depth of 6,840 feet at which point it passes into Astoria Seachannel, a fan valley. (Encyclopaedia Britannica, 2014)

The substrate of the inner shelf is sand; the substrate of the midshelf and the mesobenthal is sand and mud with some rock outcropping; and the substrate of the bathybental is mud. (Washington Marine Spatial Planning, 2014)

Surface Water, Terrestrial

Long Beach is located within the Willapa Watershed, also termed Water Resources Inventory Area (WRIA)[◆] No. 24. While numerous natural watercourses traverse WRIA No. 24, no natural rivers or streams are located in Long Beach. The Pacific County Main Drain, a man-made

drainage ditch, is located immediately east of the city limits, and discharges to the ocean at the Red Lake outfall at 30th Street in Seaview. This ditch has water in it all year, even during the dry season, and much of the water it transports is groundwater. (Blakemore, 1995) The city has several stormwater outfalls to the ocean beach, located—from south to north—at 11th Street Southwest, 3rd Street Northwest, between 6th and 7th Streets Northwest, and at 12th Street Northwest.

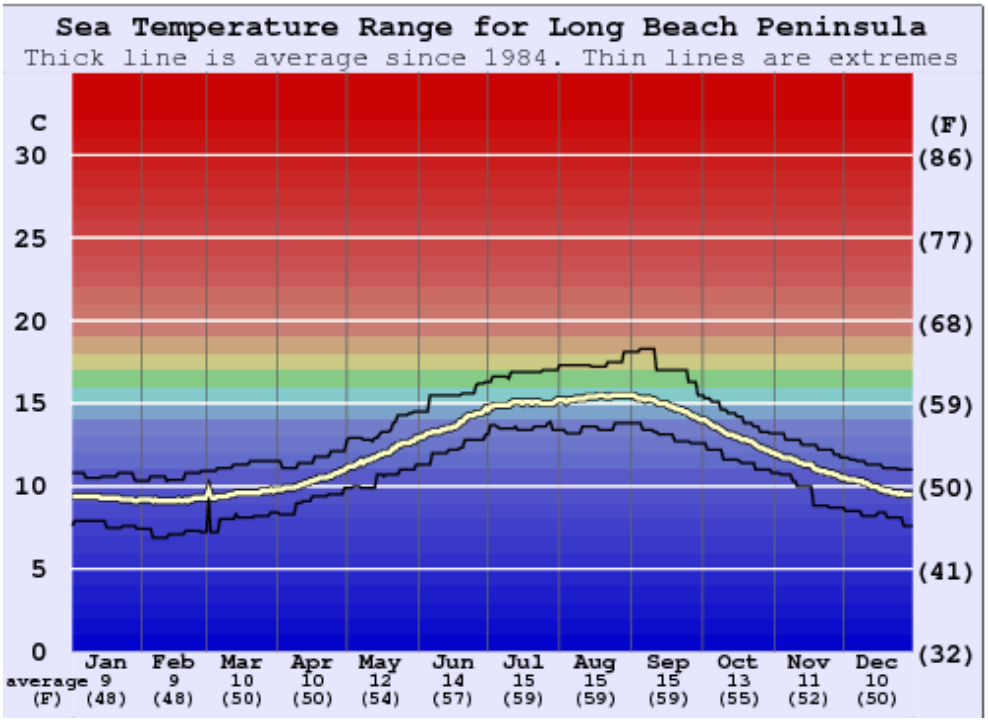
Under section 303(d) of the Clean Water Act, states, territories, and authorized tribes are required to develop lists of waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes. Currently, there are no identified 303(d) terrestrial surface water bodies in Long Beach or located near enough to the city to be affected by activities in the shoreline area. (Ecology, 2014)

Surface Water, Marine

Ocean waters off the shore of Long Beach are cool, with the average in summer at 60 degrees Fahrenheit, and the Winter and Spring average around 49 degrees (see Figure 12). Upwelling of deeper waters occurs close to shore, bringing cooler nutrient-enriched waters to the surface. Upwelling potential immediately offshore is considered low with a band of high upwelling potential slight further offshore. (Washington Marine Spatial Planning, 2014)

There are currently no identified 303(d) marine waters in the offshore area of Long Beach. (Ecology, 2014)

Figure 12: Historical Sea Surface Temperatures for Long Beach Peninsula



Source: http://www.surf-forecast.com/breaks/Long-Beach-Peninsula/seatemp

4.1.4 Biology: Key Habitats and Species

The maps entitled *Potential Wetlands, Priority Habitat and Species: Clam and Crab, Priority Habitat and Species: Shorebird and Waterfowl*, located in Appendix A (Map Atlas) to this document, provide graphical presentations of data and information discussed in this portion of the inventory.

Ocean

Vegetation. The presence of marine vegetation is not mapped in the near-shore (three [3] miles or less from shore) ocean off of Long Beach, including seagrass, kelp, or other macroalgae. (Washington State Department of Natural Resources, 2014) However, some sources state with certainty that eelgrass (*Zosteraceae*) beds are found throughout coastal areas of the North Pacific from the Gulf of Alaska to Coos Bay, Oregon. (NatureServe Explorer, 2014)

Fish. The ocean itself provides near-shore marine habitat supporting commercial and recreational Dungeness crab ocean fishing as well as recreational salmon and green sturgeon ocean fishing. Just beyond three (3) miles, the marine habit supports commercial ground and Pacific whiting fishing, as well as recreational sardine, bottom fish, and ling cod fishing. Further yet offshore, are recreational halibut and albacore fishing as well as commercial pink shrimp fishing. (Washington Marine Spatial Planning, 2014)

In addition to these commercially fished species, ocean waters provide habitat for many other species of fish. While Long Beach has no natural rivers or streams that provide fish habitat, the ocean water offshore provide habitat for anadromous fish that migrate up and spawn in nearby rivers and streams. Relevant species include fall and summer Chinook salmon, fall chum salmon, Coho salmon, pink salmon summer and winter steelhead, Dolly Varden/bull trout, and coastal cutthroat. (Ecology, 2008)

Birds. The western half of the state of Washington, including the Long Beach jurisdictional shoreline, is located along the Pacific Flyway[4]. Concentrations of sea/waterbirds, such as brown pelican (*Pelecanus occidentalis*) are frequently observed in the surf and near-shore area, as are terns (*spp. Sternidae*) cormorants (*spp. Phalacrocoracidae*), and gulls (*spp. Laridae*).

Actual surveys of the near-shore and offshore areas occurring in 2011 and 2012 observe higher concentrations of sea/water birds in winter than summer or fall. Table 3 identifies bird species observed on open water in relatively low numbers (less than fifty [50] individuals).

Table 3: Bird Species Observed in Relatively Low Numbers on Near-shore and Offshore Marine Waters Off the Coast of Long Beach, Washington, 2011-2012

Common Name	Scientific Name	Comment
Pacific/red throated loons	*Gavia pacifica/stellate*	
Black-footed albatross	*Phoebastria nigripes*	summer only
Northern fulmer	*Fulmarus glacialis*	

Common Name	Scientific Name	Comment
Pink-footed shearwater	*Puffiinus creatopus*	fall only
Forked-tail storm petrel	*Oceanodroma furcate*	
Leach's storm petral	*Oceanodroma leucorhoa*	
Cormorant spp.	*Phalacrocorax spp.*	summer only
Surf/white-winged scoter	*Melanitta perpicillata/fusca*	winter only
Black-legged kittiwake	*Risa tridactyl*	
Herring/Thayer's gull	*Larus argentatus/thayeri*	
Sabine's gull	*Xema sabini*	
Western gull	*Larus occidentalis*	
Caspian tern	*Hydroprogne caspia*	
Cassian's auklet	*Ptychoamphus aleuticus*	winter only
Rhinoceros auklet	*Cerorhinca moncersts*	

Source: Adams, *et al*, 2014

Table 4 identifies bird species observed on open water in relatively higher numbers (greater than fifty [50] individuals).

Table 4: Bird Species Observed in Relatively High Numbers on Near-shore and Offshore Marine Waters Off the Coast of Long Beach, Washington, 2011-2012

Common Name	Scientific Name	Comment
Sooty shearwater	*Puffinus griseus*	especially in summer
California gull	*Larus californicus*	especially in fall
Glaucous-winged gull	*Larus glaucesens*	especially in winter
Ancient murrelet	*Synthliboramphus antiquus*	
Common murre	*Uria aalge*	especially in winter

Source: Adams, *et al*, 2014

Mammals. Recent surveys of the near-shore and offshore areas observe higher concentrations of marine mammals in summer. Table 5 identifies marine mammal species observed on open water.

Table 5: Marine Mammal Species Observed in in Near-shore and Offshore Marine Waters Off the Coast of Long Beach, Washington, 2011-2012		
Common Name	**Scientific Name**	**Number & Season**
Humpback whale	*Megaptera novaeangliae*	1 individual, summer
Grey whale	*Megaptera novaeangliae*	1 pod of 2-10, summer
Minke whale	*Balaenoptera acutorostrata*	1 individual, fall
Risso's dolphin	*Grampus griseus*	1 pod of 2-10, summer
Killer whale	*Orcinus orca*	1 pod of 2-10, summer
Harbor porpoise	*Phocoena phocoena*	2 individuals, winter 2 pods of 2-10, winter 2 individuals, summer 1 pod of 2-10, summer 4 individuals, fall 1 pod of 2-10, fall
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	1 pod of 2-10, summer 2 pods of 11-100, summer
Northern right whale dolphin	*Lissodelphis borealis*	1 pod of 2-10, fall
Northern fur seal	*Callorhinus ursinus*	3 individuals, winter
Northern elephant sea	*Mirounga angustirostris*	1 individual, summer
California sea lion	*Zalophus californianus*	3 individuals, fall 2 groups of 2-10, fall
Harbor seal	*Phoca vitulina*	1 individual, summer 2 individuals, fall 1 group of 2-10, fall

Source: Adams, *et al*, 2014

Ocean Beach

Shellfish. The marine intertidal area of the ocean beach is the location of large and prolific beds of Pacific razor clams *(Siliqua patula)*. These shellfish beds perform several ecological functions, including nutrient cycling, water quality enhancement, and serving as a food source for invertebrates, fish, mammals, and birds. In addition, these shellfish beds are the foundation of an important recreational fishery. In recent years, the Long Beach Peninsula has been one of the

most prolific recreational Pacific razor clamming location in Washington and Oregon. Recreational clamming is a substantial contributor to the local economy.

Birds. The ocean beach performs the ecological functions of roosting and foraging for concentrations, sometimes very large concentrations, of shorebirds and seabird. It is also common to see both juvenile and adult bald eagles (*Haliaeetus leucocephalus*), a federal species of special concern, roost along the ocean beach and forage in its near-shore waters. (G. Borchard, personal observation) Observations of other priority species on the ocean beach include brown pelican (*Pelecanus occidentalis*) and snowy plover (*Charadrius nivosus*).

Mammals. Marine mammals do not normally roost or forage on the ocean beach. However, occasionally a harbor seal (*Phoca vitulina*) or Stellar sea lion (*Eumetopias jubatus*) may be observed on the beach. On occasion, a stranded mammal pup is rescued from the beach.

Reptiles. Marine reptiles do not normally roost or forage on the ocean beach. Two observations of a green sea turtle (*Chelonia mydas*), a species listed as Threatened by both federal and state governments, were made on the same day in 1999 near the city's main beach approach. (Washington Department of Fish & Wildlife, 2014) In December of 2009, a green sea turtle was rescued from the ocean beach near Long Beach. (www.bechconnection.net, 2009) This species is normally found in tropical or sub-tropical waters, so those found in Long Beach are well outside their normal range, and these incidents are isolated.

Dune Complex

Wetlands. Wetlands are those areas that are inundated or saturated by ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands perform many functions, including the following:

1. Purify water and improve water quality;
2. Control stormwater and provide flood protection;
3. Stabilize shoreline and dune areas;
4. Recharge groundwater;
5. Provide valuable habitat for fish and wildlife; and
6. Provide low-impact recreational and aesthetic (wildlife and nature viewing) opportunities.

Wetlands are difficult to re-create or replace, and so avoiding or minimizing effects to wetlands is important.

Wetlands in the jurisdictional shoreline occur in the low-lying deflation plain east of the main foredune and west of the secondary sand ridge. Wetlands located in the deflation plain are "interdunal" wetlands created primarily by the influence of shallow groundwater rather than surface water. (see Appendix B to the document for a more detailed description of these wetlands) In this area, there are potentially more than 60 acres of Category II, III, and IV interdunal wetlands. The word "potentially" is used because funding limitations and the

ephemeral nature of some young, shallow interdunals make it uncertain where wetlands may be located at the time development is proposed and possible impacts to wetlands may occur. For purposes of this inventory, Ecology and the city agreed to map potential wetlands using two methods. First, the most recent version of the National Wetland Inventory (NWI)[4] was used. This database covers the entire study area, but because it is a gross-level aerial inventory, its accuracy is known to be relatively low, especially where there is shore pine forest coverage. Second, because interdunal wetlands are driven by groundwater, history and experience substantiate that they occur below 14 feet elevation (NGVD 29 or 18.3 NAVD88). The 14 foot elevation is a relatively good indicator of wetland location, however, the elevation data become dated relatively quickly in the dynamic deflation plain. Wetlands were mapped using both methods, and while the total amount of wetland acreage was consistent between methods, the location of wetlands mapped using the two methods varied considerably.

Vegetation. The dune complex is predominately vegetated with European and American beachgrasses (*Ammophila arenaria and breviligulata*, respectively) exotic species that have crowded out or limited the range of other plants. That is not to say no other plants exist in the dune area, and other species occurring there include coastal strawberry (*Fragaria chileonsis*), seashore lupine (*Lupinus littoralis*), searocket (*Cakile edentula*), beach pea (*Lathryrus japonicas*), and beach morning glory (*Convolvus soldanella*). In addition, other invasive species once in the dune are tend to spread rapidly, including Scotch broom (*Cytisus scoparius*), gorse (*Ulex europaeus*), and stands of beach (or shore) pines (*Pinus contorta*).

The dune complex is peppered with relatively young interdunal wetlands, and these wetlands have a different vegetation regime than the dryer areas of the dune. Dominant wetland-associated plant species of the dune area include Hooker willow (*Salix hookeriana*), slough sedge (*Carex obnupta*) hardhack (*Spiraea douglasii*), and black twinberry (*Lonicera involucrate).* (Ecological Land Services, 2007, 2008, 2011, 2012, 2013.)

Birds. The dune complex provides roosting habitat for shorebirds and songbirds; seabirds will also seek cover and roost in the dune during Pacific storm events. Observations of raptors are frequent.

Mammals. Small, shy or nocturnal mammals such as rodents and rabbits are infrequently observed in the dune. (ELS, *ibid*). Larger mammals such as deer are frequently observed, and in the springtime, black bear (*Ursus americanus*) are always present, but in varying degree depending on the year. Both deer and bear are accustomed to human presence.

Eastern Wetlands

Most wetlands located within the city of Long Beach are situated in the deflation plain between the foredune near the ocean beach and the older dune ridge near Ocean Beach Boulevard. However, there exists an extensive north-south trending area of wetlands immediately east of and in some cases located within Long Beach (the “eastern wetlands”). The question arises whether the eastern wetlands located within the city are “associated wetlands” and therefore part of the Long Beach jurisdictional shoreline and subject to the SMA because they either 1) are hydrologically connected to a lake with a surface area of more than 20.0 acres (making that lake

subject to the SMA); or 2) are part of a continuum of wetlands related to (associated with) such a lake. In order to be associated, the wetland must be proximate to and either influence or be influenced by the SMA lake.

Based on the most current version of the NWI, there are no wetlands mapped within the eastern limits of the city north of Pioneer Road. There are currently wetlands mapped by NWI immediately east of the city limits in that area, which places them outside the city's jurisdiction and the scope of the current SMP update and this report.

South of Pioneer Road and immediately east of the city limits are wetlands surrounding Tinker Lake, which is less than 20 acres in surface area, and therefore not subject to the SMA. A recent 26-month study and associated report evaluate the direction of flow from Tinker Lake. The study finds and the report states that the majority of water from Tinker Lake discharges to the East/South Main Drain and flows south to the Pacific Ocean via the Red Lake outfall, about three (3) miles southwest of Tinker Lake. These flows averaged 5.1 cfs. During the rainy season of November through March, and only during rain events, there are sporadic and relatively low volume flows (averaging 1.0 cfs) northward from Tinker Lake that extend north of Pioneer Road. (Curran-McLeod, Inc., 2014) The eastern wetlands south of Pioneer Road do not have a continuous hydrologic connection to a lake subject to the SMA, nor have they been shown to be part of a continuum of associated wetlands. They do not meet the definition of associated wetlands.

For these reasons, wetlands located within the eastern city limits of Long Beach are not considered associated wetlands, are not located within the city's shoreline jurisdiction, and are not further considered in this inventory.

4.2 Human-influenced Conditions

Land use in shoreline areas is an important factor in the preparation of SMPs for two reasons. First, the SMA establishes preference for uses unique to or dependent upon a shoreline location, and WAC 173-26-201(2)(d) requires SMPs give higher priority to the following types of uses, in order of preference:

1. Areas for protecting and restoring ecological functions.
2. Water-dependent and associated water-related[*] uses.
3. Other water-related and water-enjoyment[*] uses.
4. Single-family residential uses where they are appropriate and can be developed without significant impact to ecological functions and displacement of water-dependent uses.
5. Non-water-oriented[*] uses where the uses described in 1-4 are inappropriate or where non-water-oriented uses demonstrably contribute to the objectives of the SMA.

A second important reason for inventorying shoreline and adjacent land uses is that this inventory information is critical for assigning environment designations as called for in WAC

173-26-211. The city's SMP and Comprehensive Plan must be consistent with one another, and shoreline and adjacent land use is relevant to the establishment of SEDs that will be implemented via the city's Comprehensive Plan and land use regulations to protect the shoreline and allow reasonable and appropriate land uses there.

4.2.1 Land Use Patterns

The maps entitled *City Zoning, Existing Land Use Classifications, General Land Ownership, Existing Structures and Impervious Surfaces, and Water Distribution System*, located in Appendix A (Map Atlas) to this document, provide graphical presentations of data and information discussed in this portion of the inventory.

In Long Beach, the western limit of private development is the 1980 SCL. The location of the 1980 SCL relative to the OHWM varies between 400 to 700 feet, and no private structural development has occurred—or under current law can occur—in that portion of the city's shoreline jurisdiction from the OHWM two hundred feet (200') landward. However, land-based structural development in the dune area can be and is located in the area of associated wetlands, which comprise a portion of the city's shoreline jurisdiction. In addition, public recreational amenities such as the Discovery Trail, as well as the city's boardwalk, public beach pavilion, beach approaches, and three (3) stormwater outfalls are located in the city's jurisdictional shoreline, some in the jurisdictional wetland area and some in the western area within 200' landward of the OHWM.

Land uses reflect the recreation-based purpose of Long Beach. It is a place where people come to play, and there are many recreational amenities of a wide variety located in Long Beach. These amenities are both passive and active and provide a rich and varied recreational experience.

Central Long Beach. Long Beach is oriented along and bisected by north-south trending State Route (SR)[4]103 , also called Pacific Avenue or Pacific Highway). A centrally-located business district lies between Sid Snyder Drive to the south and Bolstad Avenue to the north. The central business district focuses on visitor-serving uses such as retail stores, hotels, restaurants, and many amusements, as well as some government uses, including city hall and the police station. Immediately east of the downtown corridor is a recently-developed park, Veteran's Field, including a large grassy area, performance stage, and commemorative flag plaza. Beyond Veterans Field are residential neighborhoods, parks, tennis courts, playgrounds, ball fields, basketball courts, the elementary school, the post office, and a smattering of neighborhood commercial uses such as banks and the local newspaper. West of downtown are resorts, and some high-density residential; residential uses in this area are now prohibited and the area is intended for visitor-serving uses. In addition there are amusements, trails and the boardwalk, and many acres of undeveloped passive recreational dune area as well as the ocean beach beyond.

Outside of Central Long Beach. South of Sid Snyder Avenue and north of Bolstad Avenue are mostly neighborhood-serving businesses along SR 103 as well as several visitor serving recreation vehicle facilities. East and west of the mostly neighborhood-serving businesses located on SR 103 are residential neighborhoods, as well as a several resorts, hotels, and bed & breakfasts. Beyond these are the dunes, Discovery Trail, and the ocean beach.

Shoreline Conservancy Lands. All lands located west of the 1980 SCL and any lands deeded to the state located west of the 1889 Government Meander Line as well as certain lands controlled by the city and located west of that line are considered Shoreline Conservancy lands. There are about a dozen (12) narrow parcels west of the 1889 Line controlled by the state in this category; there are two large blocks of land located west of the 1889 Line in this category that are controlled by the city: between 5th Street Southwest and 4th Street Northwest (about 66 acres), and between 8th Street Northwest and 14th Street Northwest (about 73 acres). Shoreline Conservancy lands are not subject to private development, and their use by the state or city is for dune/open space preservation, public beach access, view corridors, comfort stations, and for recreational uses. To date, development in Shoreline Conservancy has been limited to the Discovery Trail, beach access, the boardwalk, two public restrooms, a public beach pavilion, and parking, and stormwater outfalls. In addition, festivals are held on these lands.

4.2.2 Public Access

The map entitled *Transportation—Green Streets and Trails*, located in Appendix A (Map Atlas) to this document, provides graphical presentation of data and information discussed in this portion of the inventory.

The main beach access points in Long Beach are Sid Snyder Drive West and Bolstad Avenue West. These public beach access points are connected by the Discovery Trail and the city's boardwalk, as well as the ocean beach. These two beach access points are identified along SR103 only, by fairly nondescript brown signs. The city engaged with the Chinook Nation on 2011 to instigate a more distinctive signage program using the unique and visually striking Chinook Nation red/black/white symbol of a salmon to identify not only beach access, but other recreation and interpretive facilities. This is an ongoing project.

Other than in the downtown corridor, pedestrian beach access is not signed, and there are many opportunities to increase the visibility of public pedestrian beach access. Streets that extend to MHT that could be used for this purpose are listed in Table 6, below.

Table 6: Streets that could be used for Pedestrian Beach Access, North to South

26th Street Northwest	25th Street Northwest	24th Street Northwest
23rd Street Northwest	22nd Street Northwest	Pioneer Road West
20th Street Northwest	19th Street Northwest	17th Street Northwest
16th Street Northwest	14th Street Northwest	13th Street Northwest
12th Street Northwest	11th Street Northwest	10th Street Northwest
9th Street Northwest	8th Street Northwest	7th Street Northwest
6th Street Northwest	5th Street Northwest	4th Street Northwest
3rd Street Northwest	2nd Street Northwest	Bolstad Avenue West[1]

2nd Street Southwest	3rd Street Southwest	4th Street Southwest
5th Street Southwest	6th Street Southwest	7th Street Southwest
8th Street Southwest	Sid Snyder Ave West[1]	11th Street Southwest
12th Street Southwest	13th Street Southwest	14th Street Southwest
15th Street Southwest	16th Street Southwest	17th Street Southwest
18th Street Southwest	19th Street Southwest	

1 One of two existing main beach approaches.

4.2.3 Cultural Resources

There remain a substantial number of structures in Long Beach dating from the late 1800s. However, due to the nearly 2,000 linear feet of beach accretion since that time, no paleontological, archaeological, or historic resources are known to occur in the relatively young jurisdictional shoreline area.

4.3 Environmental Impairments

Foredune. European beachgrass has crowded out other species in the outer primary foredune. This may in part be the reason the dune is increasing in height, as European beachgrass more effectively traps sand than other beach grasses, increasing dune height. (http://www.ecy.wa.gov/programs/sea/coast/plants/dunegrass.html) This may be considered an impairment of certain functions. However, however, a taller dune also provides more protection from storms and flooding, an increase in some functions.

Deflation Plain/Associated Wetlands. Dunes/sand ridges and deflation plains run north-south; therefore, associated wetlands located in the deflation plain between the foredune and sand ridge run north-south as well. Development that occurs in the city's jurisdictional shoreline is located in the associated wetlands, as east-west access is sought across the wetlands to gain access to a dry western building site. In several cases, once a house was constructed, damage occurred to a wetland or its buffer. Any unmitigated wetland or buffer impairment offers an opportunity for restoration or mitigation.

The city along with Pacific County, Ecology, the Corps, and the EPA participated in creation of a mitigation bank to mitigate the effects of development on associated wetlands located in the shoreline jurisdiction. Nevertheless, in 2012 the EPA and Corps made rules eliminating the use of Nationwide Permit No. 18 for small fills (less than 1/10th of an acre) of interdunal wetlands in the Long Beach area, among other areas. Therefore, any fill of an interdunal wetland requires the work occur under an Individual Permit from the Corps.

5.0 Reach Analysis

Because of its homogeneous beachfront, drift cells, topography, or geology offer little basis for dividing the Long Beach jurisdictional shoreline into units for analysis. Therefore, based on land use the city's jurisdictional shoreline has been divided units for analysis, termed "reaches", plus the ocean as a separate unit for analysis.[3] Each unit is described as follows:

1. Overview
2. Physical Attributes
3. Natural Resources
4. Land Use
   - 4.1 Current Land Use
   - 4.2 Future Land Use
   - 4.3 Transportation and Utilities
   - 4.4 Modifications to Associated Wetlands
5. Public Access
6. Restoration Opportunities

Table 7 and Figure 13 identify the reaches evaluated in this analysis:

Table 7: Long Beach Shoreline Jurisdiction Reaches

Reach	Description
1	Southern corporate limits to 11th Street Southwest
2	11th Street Southwest to 5th Street Southwest
3	5th Street Southwest to 4th Street Northwest
4	4th Street Northwest to 8th Street Northwest
5	8th Street Northwest to 14th Street Northwest
6	14th Street Northwest to 16th Street Northwest
7	16th Street Northwest to the Discovery Trailhead (the extension of 26th Street Northwest)
8	Discovery Trailhead (the extension of 26th Street Northwest) to 28th Street Northwest
9	28th Street Northwest to 31st Street Northwest
10	Ocean beach and Pacific Ocean

[3] The City has no Urban Growth Area outside its corporate limits, and this study confines itself to lands within the City plus the ocean beach and ocean beyond.

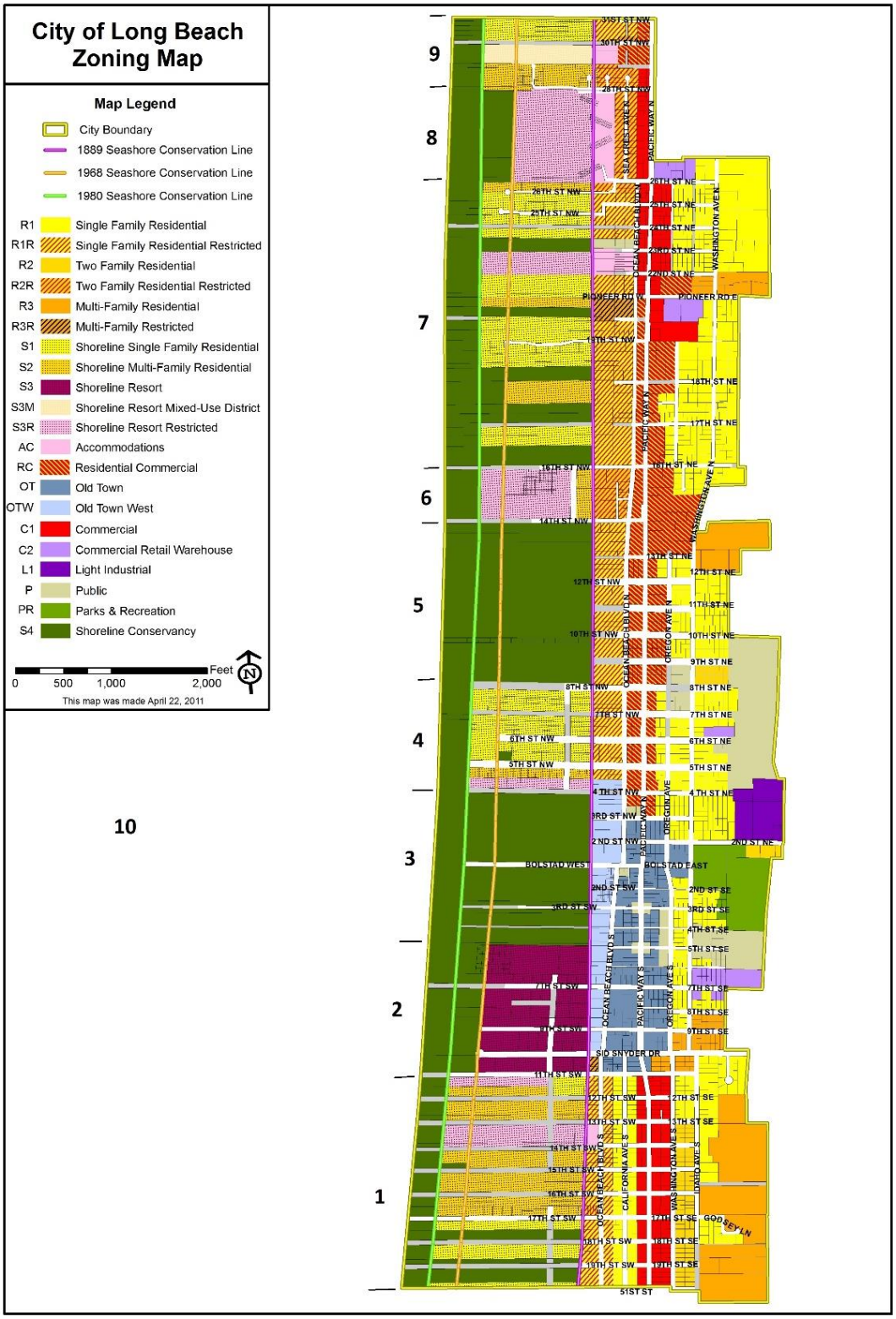
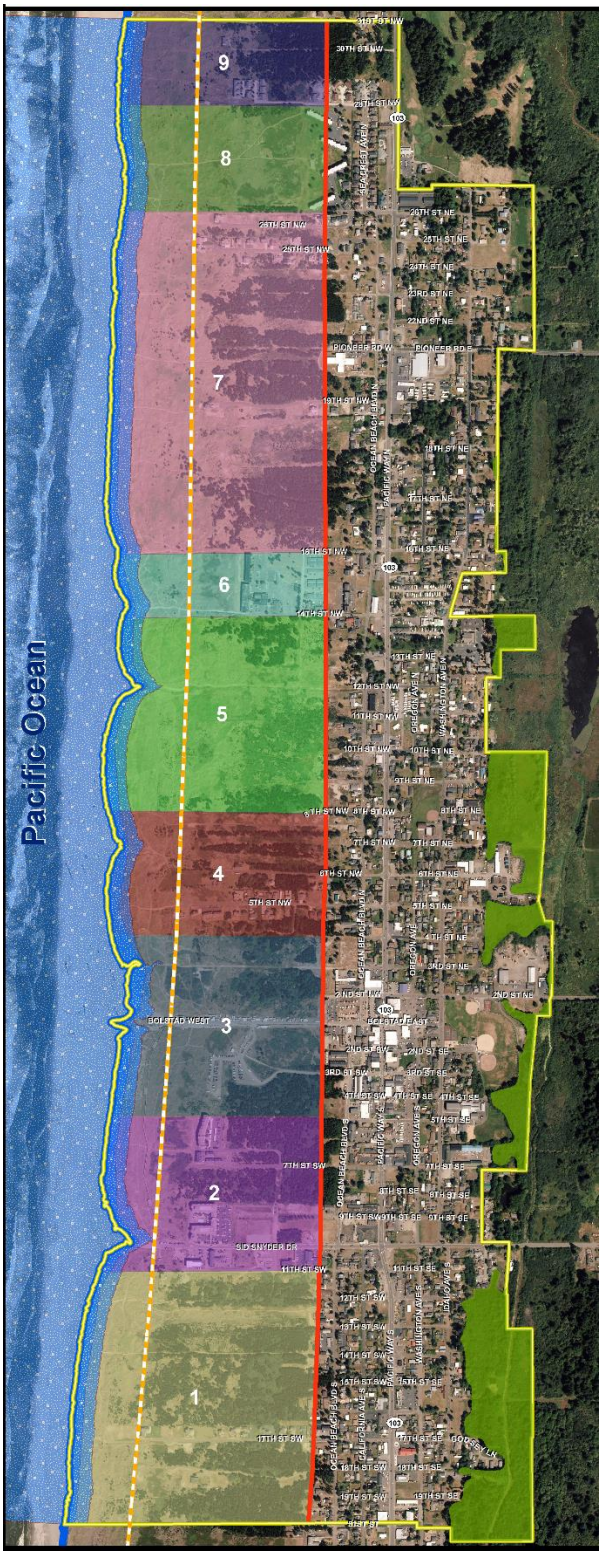


Figure 13a: Long Beach Shoreline Jurisdiction Reaches with Zoning Overlay

Source: City of Long Beach, 2014

Figure 13b: Long Beach Shoreline Jurisdiction Reaches with Shoreline Jurisdiction Overlay



Source: City of Long Beach, 2014

5.1 Current Conditions, Future Conditions, and Opportunities, by Reach

5.1.1 Reach No. 1: Southern City Limits to 11th Street Southwest

Overview

Reach No. 1 is approximately 2,300 linear feet, north to south. About 10.1 acres encompasses the area between the OHWM and 200 feet landward. The remainder of Reach No. 1 to the limits of associated potential wetlands encompasses approximately 97 acres. The nature of this reach is predominately residential with some low-density resort and some open space.

Physical Attributes

The jurisdictional shoreline landward 200 feet of the OHWM comprises the outer face of the foredune. This portion of the jurisdictional shoreline is located between approximately 355 and 390 feet west of the 1980 SCL building setback line, and no private structural development occurs in this area. Shoreline modifications in the jurisdictional area with 200 feet east of the OHWM include several unpaved and meandering pedestrian and one equestrian beach access trails; in addition, the paved Discovery Trail traverses this reach west of the 1980 SCL trending north-south, with about 120 feet located within 200 feet of the OHWM. There are portions of 119 parcels in this reach; of these, 49 are developed and 70 are undeveloped. Impervious cover is 3.0%.

Natural Resources

The jurisdictional shoreline landward 200 feet of the OHWM is primarily vegetated with European dunegrass. The undeveloped portion of the area of associated wetlands is about 48 acres beach pine forest and wetland vegetation, and the remainder is dunegrass. Other plant species known to occur in this area include red alder (*Alnus rubra*), Sitka spruce (*Picea sitchensis*), Hooker willow (*Salix hookeriana*), sweet vernalgrass (*Anthoxanthum odoratum*), velvetgrass (*Holcus lanatus*), slough sedge (*Carex obnupta*), birdsfoot trefoil (*Lotus corniculatus*), sword fern (*Polystichum munitum*), and hairy cat's ear (*Hypochaeris radicata*). (ELS, 2011) In addition, invasive Scotch broom (*Cytisus scoparius*) occurs sporadically in this reach. Based on estimates of wetland acres derived from elevations (assuming, based on historic evidence, that lands lying below the 14' NGVD29 elevation may be wetlands), it is conservatively estimated that up to 13.8 acres of Reach No. 1 are interdunal wetland. There are no natural streams or floodways in this reach.

The following types of wildlife are known to occur in Reach No. 1: raptors, shorebirds, waterfowl, and songbirds. (ELS, 2011) In addition, it is reported that deer are observed on occasion, as are black bear, especially in the springtime. There are rare reported observations of mountain lion.

Land Use

Current Land Use. The developed portion of Reach No. 1 is primarily low density residential, with a small amount of medium density residential (duplexes and triplexes) along the north side

of 17th Street Southwest. In addition, there is one small hotel located on the most northern lot in this reach.

There are 34.8 acres of Shoreline Conservancy land in this reach which are undeveloped and serve as passive recreation, open space, and public access. These Conservancy lands support fairly dense shore pine forests.

Lot sizes are a minimum of 10,000 square feet to allow on-site detention of stormwater (see below). The city imposes a performance standard on drainage that requires development not alter either the amount or direction of run-off. That is, unless flooding now exists, water must enter and exit a site in the same places and amounts after development as before. If flooding is an issue, if a project is large or complicated, or if the city determines it is necessary, an Engineered Drainage Plan is required.

Future Land Use. In the future, the Shoreline Conservancy lands are likely to remain undeveloped, and provide the functions of passive recreation, open space, and pedestrian beach access. Remaining undeveloped acres are zoned as follows:

- 12.4 acres, S1-Shoreline Single Family Residential
- 29.4 acres, S2-Shoreline Multi-Family Residential
- 10.3 acres, S3R-Shoreline Resort Restricted

Therefore, the current predominately low-density residential with some resort can be expected to densify as relatively more medium-density multi-family and resort are developed in Reach No. 1.

Transportation and Utilities. There is 0.3 mile of developed road in Reach No. 1. The area is served by city water and sewer, PUD No. 2 electricity, public transit provided by Pacific Transit is available at nearby SR 103, refuse service is provided by Peninsula Sanitation. There is no storm water system in this area, and development must detain runoff on site; the minimum lot size of 10,000 SF allows for onsite stormwater management.

Modifications to Associated Wetlands. Several substantial areas of wetland fill have occurred in reach one:

- Along a portion of the south side of 18th Street Southwest;
- Along the entire north side of 17th Street Southwest; and
- Along a portion of the south side of 11th Street Southwest.

In addition, several owners have removed beach pine forests to improve ocean views.

Public Access. There is a spur of the Discovery Trail along the south side of 17th Street Southwest, connecting Ocean Beach Boulevard and a future trail on that road to the main spine in the dune. In addition, there exists informal public pedestrian beach access, established by historic use, in or near the following undeveloped rights-of-way:

- 19th Street Southwest;
- 17th Street Southwest (as the spur described above continues past the Discovery Trail to the ocean beach);
- 14th Street Southwest; and
- on private property just south of 11th Street Southwest.

In addition, a well-developed and meandering horse trail accesses the beach via the undeveloped western right-of-way of 12th Street Southwest.

Restoration Opportunities

1. Increase city efforts to have property owners eradicate invasive nuisance species.

5.1.2 Reach No. 2: 11th Street Southwest to 5th Street Southwest

Overview

Reach No. 2 is approximately 1,600 linear feet, north to south. About 6.3 acres encompasses the area between the OHWM and 200 feet landward. The remainder of Reach No. 2 to the limits of associated potential wetlands encompasses approximately 52 acres. The nature of this reach is predominately high-density resort, with two high-density residential developments.

Physical Attributes

The jurisdictional shoreline landward 200 feet of the OHWM comprises the outer face of the foredune. This portion of the jurisdictional shoreline is located between approximately 0 and 310 feet west of the 1980 SCL building setback line, and no private structural development occurs in this area. Shoreline modifications in the jurisdictional area within 200 feet east of the OHWM include the Sid Snyder beach approach and city stormwater outfall located on that beach approach as well as two unpaved meandering pedestrian beach access trails; in addition the Discovery Trail traverses this reach west of the 1980 SCL, as does the Long Beach Boardwalk, which terminates at Sid Snyder Drive. For the southern 2/3 of this reach, the Discovery Trail is located immediately west and parallel to the Boardwalk; the trail crosses under the Boardwalk, and for the northern 1/3 of this reach is located east of the Boardwalk, and parallels it at a distance of approximately 100 feet. About 260 feet of the Trail and 115 feet of the Boardwalk are located within 200 feet of the OHWM. There are 105 parcels in this reach; of these, 55 are developed and 50 are undeveloped. Impervious cover is 1.9%.

Natural Resources

The jurisdictional shoreline landward 200 feet of the OHWM is primarily vegetated with European dunegrass. The undeveloped portion of the area of associated wetlands is about 18.3 acres of beach pine forest and wetland vegetation, and the remainder is dunegrass. Information regarding species known to occur in this area is not current; a 2002 SEPA document for development of a proposed convention center is the most current site-specific information on file. Recognizing the limitations of that information, species known to occur in this area at that time include Sitka spruce (*Picea sitchensis*), shore pine (*Pinus contorta*), Hooker willow (*Salix*

hookeriana), European beachgrass (*Ammophila arenaria*), velvetgrass (*Holcus lanatus*), slough sedge (*Carex obnupta*), tapered rush (*Juncus acuminatus*), sickleleaf rush (*Juncus falcatus*), Lynby's sedge (*Carex lyngbyei*), coastal strawberry (*Fragaria chiloensis*), pearly everlasting (*Anaphalis margaritacea*), and hairy cat's ear (*Hypochaeris radicata*). (ELS, 2002) In addition, invasive Scotch broom (*Cytisus scoparius*) occurs sporadically in this reach. Based on estimates of wetland acres derived from elevations (assuming, based on historic evidence, that lands lying below the 14' NGVD29 elevation may be wetlands), it is conservatively estimated that up to 7.7 acres of Reach No. 2 are interdunal wetland. Of this, two wetlands of about 1.25 acre each are man-made; these wetlands appear to be functioning well. There are no natural streams or floodways in this reach.

Recognizing the same limitations of data as above regarding vegetation, the following types of wildlife are known to occur in Reach No. 2: shorebirds, crows, jays, passerine birds, mice, rabbit, and squirrel. (ELS, 2002) In addition, it is reported that deer are observed regularly (they are frequently observed from the boardwalk), as are black bear, especially in the springtime.

Land Use

Current Land Use. The developed portion of Reach No. 2 is high-density resort and high-density residential (townhomes and condominiums). This is the area of intense hotel development along the city's southern beach approach. The Adrift, with about 65 rooms, is located on the south side of the beach approach and the Wyndam, with 95 rooms, is located on the north. Both facilities are built to the 1968 SCL.

There are 20.8 acres of Shoreline Conservancy land in this reach which are undeveloped and serve as passive recreation, open space, and public access. In this area, all lands west of the 1968 SCL are Conservancy, and these are the only Conservancy lands in this reach. These Conservancy lands support dunegrass, with a smattering of shore pines near the 1968 SCL on the east.

Lot sizes are a minimum of 10,000 square feet to allow on-site detention of stormwater.

Future Land Use. In the future, the Shoreline Conservancy lands are likely to remain undeveloped, and provide the functions of passive recreation, open space, and pedestrian beach access. Remaining undeveloped acres are zoned as follows:

- 29.8 acres, S3-Shoreline Resort

The current predominately high–density resort is expected to be built out just north of the Wyndam site. There is sufficient acreage for one more "behind the boardwalk" hotel. The high-density residential land use in this reach is now a legal non-conforming use, and that use is no longer allowed in this area.

Transportation and Utilities. There is 0.9 mile of developed road in Reach No. 2. The area is served by city water and sewer, PUD No. 2 electricity, public transit provided by Pacific Transit is available at nearby SR 103, refuse service is provided by Peninsula Sanitation. There is no storm water system in this area, and development must detain runoff on site; the minimum lot size of 10,000 SF allows for onsite stormwater management.

Modifications to Associated Wetlands. Several substantial areas of wetland fill have occurred in this reach:

- Along the south side of Sid Snyder in the early 1990s;
- Along the north side of Sid Snyder in 2006 to construct the Wyndam; and
- Along the north side of 7th Street Southwest in the early 2000s to construct high density housing (Windward Passage and Behind-the-Boardwalk Townhomes).

Several property owners have removed areas of beach pine forest, but several large areas remain intact.

Public Access. The Sid Snyder beach approach is located in this reach, as is a spur to the Discovery Trail from a townhome/condo development. Two pedestrian beach access trails, one a continuation of a Discovery Trail spur exist. In Reach No. 2 no public pedestrian beach access exists via undeveloped rights-of-way.

Restoration Opportunities

1. Culvert installation in 7th Street Southwest in the vicinity of the Shoreview Drive right-of-way could restore north-south hydraulic connectivity in this area.
2. Hydraulic connectivity could be established between the two relatively large wetlands located west of Windward Passage and west of the On-the-Boardwalk townhomes, which are located immediately south of Windward Passage.
3. Increase city efforts to have property owners eradicate invasive nuisance species.

5.1.3 Reach No. 3: 5th Street Southwest to 4th Street Northwest

Overview

Reach No. 3 is approximately 1,720 linear feet, north to south. About 7.3 acres encompasses the area between the OHWM and 200 feet landward. The remainder of Reach No. 3 to the limits of associated potential wetlands encompasses approximately 58 acres. The nature of this reach is relatively undeveloped, and includes substantial open space, low-intensity recreation amenities, and support facilities. This area is controlled and managed by the city of Long Beach.

Physical Attributes

The jurisdictional shoreline landward 200 feet of the OHWM comprises the outer face of the foredune. This portion of the jurisdictional shoreline is located between approximately 105 feet east of and 370 feet west of the 1980 SCL building setback line, and no private structural development occurs in this area. Shoreline modifications in the jurisdictional area with 200 feet east of the OHWM include numerous unpaved and meandering pedestrian and one equestrian beach access trails; the Boldstad beach approach; a city stormwater outfall located at 3rd Street Northwest, a public beach pavilion, the Long Beach Boardwalk; and the Discovery Trail. In Reach No. 3, approximately 800 linear feet of the Boardwalk and 330 linear feet of the Discovery Trail are within 200 feet of the OHWM. Further east in the associated wetlands area

are a large parking lot and comfort station in support of public recreational activities. There are 11 parcels in this reach; of these, 5 are "developed" with parking and public amenities and 6 are undeveloped. Impervious cover is 1.0%.

Natural Resources

The jurisdictional shoreline landward 200 feet of the OHWM is primarily vegetated with European dunegrass. The undeveloped portion of the area of associated wetlands is about 19.7 acres of beach pine forest and wetland vegetation, and the remainder is dunegrass. Species known to occur in this area include, shore pine (*Pinus contorta*), Hooker willow (*Salix hookeriana*), European beachgrass (*Ammophila arenaria*), American beachgrass (*Ammophila* breviligulata), Scotch broom (*Cytisus scoparius*), twinberry (*Lonicera involucrate*), and slough sedge (*Carex obnupta*). (City of Long Beach, 2010) In addition, invasive Scotch broom (*Cytisus scoparius*) occurs in this reach, fairly thickly in some areas. Based on estimates of wetland acres derived from elevations (assuming, based on historic evidence, that lands lying below the 14' NGVD29 elevation may be wetlands), it is conservatively estimated that up to13.6 acres of Reach No. 3 are interdunal wetland. There are no natural streams or floodways in this reach.

The following types of wildlife are known to occur in Reach No. 3: shorebirds, gulls, terns, and eagles (City of Long Beach, 2010) In addition, deer are observed frequently, and black bear are occasionally observed, especially in the springtime. This is the reach in which two green sea turtles were observed in 1999.

Land Use

Current Land Use. Reach No. 3 is predominantly undeveloped open space. This is the area where many people approach the ocean beach, and beyond the Long Beach arch the visual environment is uncluttered to allow visual access to the dunes and ocean. A large parking area and older comfort station in need of upgrading/replacement are located south of the Bolstad approach and east of the boardwalk.

This area is entirely Shoreline Conservancy which serve as passive recreation, open space, and public access. These Conservancy lands support dunegrass, with shore pine forests south of 3rd Street Southwest and north of Bolstad West.

Future Land Use. In the future, the Shoreline Conservancy lands are likely to remain largely undeveloped, with some addition of recreational/interpretive amenities. The city currently plans to construct a cross-town trail that will traverse the dune area east-west from the Discovery Trail to the eastern corporate limit. This trail spur will include public art installations; the city is hopeful the Chinook Nation will provide at least one Native American art installation along this trail and will work with local youth to develop other nature-themed art installations. They city also plans to construct a splash park east of the boardwalk to provide children a wind- sheltered water-play alternative to the ocean. The functions of this feature are both recreation and water safety. Reach No. 3 will continue to provide the functions of recreation, open space, and pedestrian beach access.

Transportation and Utilities. There is 0.54 mile of developed road in Reach No. 3. The area is served by city water and sewer, PUD No. 2 electricity, public transit provided by Pacific Transit is available at nearby SR 103, refuse service is provided by the city of Long Beach. There is no storm water system looped into the city's overall system in this area.

Modifications to Associated Wetlands. Several small areas of wetland fill have occurred in this reach:

- Some wetland alteration likely occurred when the parking lot and restrooms were constructed.

Public Access. The main Bolstad beach approach is located in this reach, as are a numerous spurs to the Discovery Trail from the public parking lot and beyond to the ocean beach. In Reach No. 3 no public pedestrian beach access exists via undeveloped rights-of-way. A well-developed beach access equestrian trail is located in the right-of-way of 3rd Street Northwest.

Restoration Opportunities

1. Culvert installation in 3rd Street Southwest west of the 1889 line and east of the public parking lot could restore north-south hydraulic connectivity in this area.
2. Two trail segments in this reach south of Bolstad West bisect wetlands. Board-walking these areas could restore habitat value and improve hydraulic continuity.
3. Eradicate invasive nuisance species on city-managed lands.

5.1.4 Reach No. 4: 4th Street Northwest to 8th Street Northwest

Overview

Reach No. 4 is approximately 1,180 linear feet, north to south. About 5.0 acres encompasses the area between the OHWM and 200 feet landward. The remainder of Reach No. 4 to the limits of associated potential wetlands encompasses approximately 42 acres. The nature of this reach is entirely residential (single family and medium-density multi-family).

Physical Attributes

The jurisdictional shoreline landward 200 feet of the OHWM comprises the outer face of the foredune. This portion of the jurisdictional shoreline is located between approximately 315 and 425 west of the 1980 SCL building setback line, and no private structural development occurs in this area. Shoreline modifications in the jurisdictional area with 200 feet east of the OHWM include the western limits of an open-channel stormwater outfall maintained by the city located between 6th and 7th Streets Northwest; in addition there are several well developed and meandering public beach access trails in or near city rights-of-way. The paved Discovery Trail traverses this reach west of the 1980 SCL trending north-south, with about 200 feet located within 200 feet of the OHWM. A pedestrian bridge overcrossing the open-channel outfall is located approximately 250 feet west and 290 feet east of, respectively, the 1980 SCL and the OHWM. There are 96 parcels in this reach; of these, 32 are developed and 64 are undeveloped. Impervious cover is 6.5%.

Natural Resources

The jurisdictional shoreline landward 200 feet of the OHWM is primarily vegetated with European dunegrass. The undeveloped portion of the area of associated wetlands is about 11.5 acres of beach pine forest and wetland vegetation, and the remainder is dunegrass.

Information regarding species known to occur in this area is not current; a 2005 SEPA document for development of a proposed residential subdivision convention is the most current site-specific information on file. Recognizing the limitations of that information, species known to occur in this area at that time include Sitka spruce (*Picea sitchensis*), shore pine (*Pinus contorta*), Hooker willow (*Salix hookeriana*), European beachgrass (*Ammophila arenaria*), American beachgrass (*Ammophila breviligulata*) velvetgrass (*Holcus lanatus*), sweet vernal grass (*Anthoxanthum odoratum*), slough sedge (*Carex obnupta*), hardhack (*Spiraea douglasii*), hairy cat's ear (*Hypochaeris radicata*), (Atlas Construction, 2005; ELS, 2005). In addition, invasive Scotch broom (*Cytisus scoparius*) occurs sporadically in this reach. Based on estimates of wetland acres derived from elevations (assuming, based on historic evidence, that lands lying below the 14' NGVD29 elevation may be wetlands), it is conservatively estimated that up to 6.4 acres of Reach No. 4 are interdunal wetland. There are no natural streams or floodways in this reach.

Recognizing the same limitations of data as above regarding vegetation, the following types of wildlife are known to occur in Reach No. 4: gulls, terns, sandpipers, crows, jays, deer, mice, rats, voles, rabbits, raccoons, opossum, and squirrels. (Atlas Construction, 2005)

Land Use

Current Land Use. The developed portion of Reach No. 4 is low- and medium-density residential. Medium-density residential is located along the south side of 5th Street Northwest. The south side of this street is also the location of several vacation rentals, which are well used in the summer months. The remainder of housing in Reach No. 4 is single family residential, with the exception of the Tinker House, currently serving as a vacation rental.

There are 4.7 acres of Shoreline Conservancy land in this reach which are undeveloped and serve as passive recreation, open space, and public access. In this area, all lands west of the 1968 SCL are Conservancy, and these are the only Conservancy lands in this reach. These Conservancy lands support dunegrass, with a smattering of shore pines near the 1968 SCL on the east.

Lot sizes are a minimum of 10,000 square feet to allow on-site detention of stormwater.

Future Land Use. In the future, this area is likely to develop as predominantly low-density single family dwellings. A few remaining medium-density lots remain, and on the south side of this reach, a large parcel is set aside for shoreline resort uses. There are currently no plans to develop that parcel. The Shoreline Conservancy lands west of the 1980 SCL are likely to remain undeveloped, and provide the functions of passive recreation, open space, and pedestrian beach access. Remaining undeveloped acres are zoned as follows:

- 3.0 acres, S3R-Shoreline Resort Restricted
- 17.2 acres, S1-Shoreline Single Family Residential
- 3.0 acres, S2-Shoreline Multi-Family Residential

Transportation and Utilities. There is 0.6 mile of developed road in Reach No. 4. The area is served by city water and sewer, PUD No. 2 electricity, public transit provided by Pacific Transit is available at nearby SR 103, refuse service is provided by Peninsula Sanitation. There is no storm water system in this area, and development must detain runoff on site; the minimum lot size of 10,000 SF allows for onsite stormwater management.

Modifications to Associated Wetlands. Several areas of wetland fill or dune modification have occurred in this reach:

- Along the both sides of 5th Street Northwest;
- At the western developed limit of 6th Street Northwest; also, a wetland buffer was substantially disturbed by gravelling of a drive way/parking area along the north side of 6th Street Northwest;
- Past the western paved limit of 6th Street Northwest, the dune was excavated and the natural flow of surface water altered;
- Along 8th Street Northwest and a driveway extension west of that road, wetlands fill occurred for road improvements and land development. There are culverts in the driveway on two locations, and it appears that hydraulic connectivity between wetlands has been maintained in those culverted areas. During heavy rains, the extended driveway is flooded. Also, an on-site mitigation site was disturbed and restoration was required.

Several property owners have removed areas of beach pine forest, but several large areas remain intact.

Public Access. The undeveloped western street rights-of-way of 5th, 6th, and 8th Streets Northwest serve as pedestrian beach access and spurs to the Discovery Trail. These access points are unsigned.

Restoration Opportunities

1. A home along 6th Street Northwest graveled a wetland buffer for parking. This gravel could be removed and the area allowed to recover. This would protect and could possibly enhance habitat.
2. Increase city efforts to have property owners eradicate invasive nuisance species.

5.1.5 Reach No. 5: 8th Street Northwest to 14th Street Northwest

Overview

Reach No. 5 is approximately 2,070 linear feet, north to south. About 7.8 acres encompasses the area between the OHWM and 200 feet landward. The remainder of Reach No. 5 to the limits of

associated potential wetlands encompasses approximately 66 acres. The nature of this reach is predominantly undeveloped, and includes substantial open space. This area is controlled and managed by the city of Long Beach.

Physical Attributes

The jurisdictional shoreline landward 200 feet of the OHWM comprises the outer face of the foredune. This portion of the jurisdictional shoreline is located between approximately 230 and 525 feet west of the 1980 SCL building setback line, and no private structural development occurs in this area. Shoreline modifications in the jurisdictional area with 200 feet east of the OHWM include a city stormwater outfall located at 12th Street Northwest; two meandering public access trails/fire access roads; in addition, the paved Discovery Trail traverses this reach west of the 1980 SCL trending north-south, with about 810 linear feet located within 200 feet of the OHWM. There is one large undeveloped parcel in this reach. Impervious cover is 0%.

Natural Resources

The jurisdictional shoreline landward 200 feet of the OHWM is primarily vegetated with European dunegrass. The undeveloped portion of the area of associated wetlands is about 17.8 acres of beach pine forest and wetland vegetation, and the remainder is dunegrass. There are no records of species known to occur in this area, however it is expected to include those types of plants common to the dune area—dune grasses, pines, spruce, strawberries, Scotch broom, and in wetland areas willows and sedges. Based on estimates of wetland acres derived from elevations (assuming, based on historic evidence, that lands lying below the 14' NGVD29 elevation may be wetlands), it is conservatively estimated that up to 6.3 acres of Reach No. 5 are interdunal wetland. There are no natural streams or floodways in this reach.

As with vegetation, there are no records of wildlife species known to occur in Reach No. 5. However, it is expected to include those types of wildlife common to the dune area: shorebirds, gulls and terns, raptors, small and medium rodents and marsupials, and larger mammals such as deer and bear.

Land Use

Current Land Use. Reach No. 5 is entirely undeveloped open space. This is an isolated block of Shoreline Conservancy land that is not subject to the kind of public use that similar land in Reach 3 is. The visual environment is uncluttered and allows visual access to the dunes and ocean. This area is entirely Shoreline Conservancy which serves as passive recreation, open space, and public access. These Conservancy lands support dunegrass, with shore pine forests at the north and south limits just north of 8th Street Northwest and just south of 14th Street Northwest.

Future Land Use. In the future, the Shoreline Conservancy lands are likely to remain largely undeveloped, with the potential for some addition of recreational/interpretive amenities. The city currently has no plans to construct any amenities in this area.

Transportation and Utilities. There are no developed roads in Reach No. 5. The area is not served by utilities. There is no storm water system looped into the city's overall system in this area

Modifications to Associated Wetlands. No wetland fill has occurred in this reach.

Public Access. Extensions of the western undeveloped rights-of-way of 9th and 12th Streets Northwest serve as spurs to the Discovery Trail and access to the ocean beach; they also serve as fire roads. These access points are not signed.

Restoration Opportunities

1. Eradicate invasive nuisance species on city managed lands.

5.1.6 Reach No. 6: 14th Street Northwest to 16th Street Northwest

Overview

Reach No. 6 is approximately 615 linear feet, north to south. About 2.6 acres encompasses the area between the OHWM and 200 feet landward. The remainder of Reach No. 6 to the limits of associated potential wetlands encompasses approximately 21 acres. The nature of this reach is predominately high-density resort, with medium -density moderate-income residential developments to the east.

Physical Attributes

The jurisdictional shoreline landward 200 feet of the OHWM comprises the outer face of the foredune. This portion of the jurisdictional shoreline is located between approximately 345 feet and 455 west of the 1980 SCL building setback line, and no private structural development occurs in this area. Shoreline modifications in the jurisdictional area with 200 feet east of the OHWM include several unpaved and meandering pedestrian beach access trails; in addition, the paved Discovery Trail traverses this reach west of the 1980 SCL trending north-south, with none of that trail located within 200 feet of the OHWM. There are 82 parcels in this reach; of these, 75 are developed and 7 are undeveloped. Impervious cover is 2.8%.

Natural Resources

The jurisdictional shoreline landward 200 feet of the OHWM is primarily vegetated with European dunegrass. The undeveloped portion of the area of associated wetlands is about 0.03 acre of wetland vegetation, and the remainder is dunegrass. No beach pine forest occurs in Reach No. 6. There are no records of species known to occur in this area, however it is expected to include those types of plants common to the dune area—dune grasses, strawberries, and possibly Scotch broom, and in wetland areas willows and sedges. Based on estimates of wetland acres derived from elevations (assuming, based on historic evidence, that lands lying below the 14' NGVD29 elevation may be wetlands), it is conservatively estimated that up to 0.1 acres of Reach No. 6 is interdunal wetland. There are no natural streams or floodways in this reach.

As with vegetation, there are no records of wildlife species known to occur in Reach No. 6. However, it is expected to include those types of wildlife common to the dune area: shorebirds, gulls and terns, raptors, small and medium rodents and marsupials, and larger mammals such as deer and bear.

Land Use

Current Land Use. The developed portion of Reach No. 6 is high-density resort to the west and medium-density residential (duplexes) to the east. The Chautauqua Lodge, with about 120 rooms, is located 200 feet east of the 1968 SCL, and extends between 14th and 16th Streets Northwest. The Chautauqua Lodge was built in two phases, in the 1970s and then in the early 1980s. The property has declined in recent years.

There are 7.6 acres of Shoreline Conservancy land in this reach which are undeveloped and serve as passive recreation, open space, and public access. In this area, all lands west of the 1980 SCL are Conservancy, and these are the only Conservancy lands in this reach. These Conservancy lands support dunegrass, with a smattering of shore pines.

Lot sizes are a minimum of 10,000 square feet to allow on-site detention of stormwater.

Future Land Use. In the future, the Shoreline Conservancy lands are likely to remain undeveloped, and provide the functions of passive recreation, open space, and pedestrian beach access. Remaining undeveloped acres are zoned as follows:

- 11.4 acres, S3R-Shoreline Resort Restricted, located west of the existing Chautauqua Lodge.

There is sufficient acreage west of the Chautauqua to build another hotel. The city is hopeful the Chautauqua can be brought up to modern hotel standards.

Transportation and Utilities. There is 0.2 mile of developed road in Reach No. 6. The area is served by city water and sewer, PUD No. 2 electricity, public transit provided by Pacific Transit is available at nearby SR 103, refuse service is provided by Peninsula Sanitation. Development must detain runoff on site; the minimum lot size of 10,000 SF allows for onsite stormwater management.

Modifications to Associated Wetlands. Several substantial areas of wetland fill have occurred in this reach:

- Along the south side of Sid Snyder in the early 1990s;
- Along the north side of Sid Snyder in 2006 to construct the Wyndam; and
- Along the north side of 7th Street Southwest in the early 2000s to construct high density housing (Windward Passage and Behind-the-Boardwalk Townhomes).

Several property owners have removed areas of beach pine forest, but several large areas remain intact.

Public Access. In this reach there exists informal public pedestrian beach access, established by historic use, in or near the following undeveloped rights-of-way:

- 14th Street Northwest; and
- 15th Street Northwest.

Restoration Opportunities

1. One trail segment in this reach west of the Chautauqua Lodge bisects wetlands. Board-walking this area could restore habitat value and improve hydraulic continuity.
2. Increase city efforts to have property owners eradicate invasive nuisance species, if present.

5.1.7 Reach No. 7: 16th Street Northwest to the Discovery Trailhead (Extension of 26th Street Northwest)

Overview

Reach No. 7 is approximately 4,440 linear feet, north to south. About 13.9 acres encompasses the area between the OHWM and 200 feet landward. The remainder of Reach No. 7 to the limits of associated potential wetlands encompasses approximately 116 acres. The nature of this reach is predominately residential with some low-density resort and open space.

Physical Attributes

The jurisdictional shoreline landward 200 feet of the OHWM comprises the outer face of the foredune. This portion of the jurisdictional shoreline is located between approximately 415 and 550 feet west of the 1980 SCL building setback line, and no private structural development occurs in this area. Shoreline modifications in the jurisdictional area with 200 feet east of the OHWM include several unpaved and meandering pedestrian beach access trails; in addition, the paved Discovery Trail traverses this reach west of the 1980 SCL trending north-south, with about 110 feet located within 200 feet of the OHWM. There are no shoreline modifications in this area. There are 108 parcels in this reach; of these, 21 are developed and 87 are undeveloped. Impervious cover is 2.6%.

Natural Resources

The jurisdictional shoreline landward 200 feet of the OHWM is primarily vegetated with European dunegrass. The undeveloped portion of the area of associated wetlands is about 38.5 acres beach pine forest and wetland vegetation, and the remainder is dunegrass. Other plant species known to occur in this area include European beachgrass (*Ammophila arenaria*), red alder (*Alnus rubra*), Sitka spruce (*Picea sitchensis*), shore pine (*Pinus contorta*) Hooker willow (*Salix hookeriana*), slough sedge (*Carex obnupta*), birdsfoot trefoil (*Lotus corniculatus*), and sword fern (*Polystichum munitum*). (ELS, 2012; ELS 2013) In addition, invasive Scotch broom (*Cytisus scoparius*) occurs sporadically in this reach, as does gorse (*Ulex*). Based on estimates of wetland acres derived from elevations (assuming, based on historic evidence, that lands lying below the 14' NGVD29 elevation may be wetlands), it is conservatively estimated that up to 8.1 acres of Reach No. 7 is interdunal wetland. There are no natural streams or floodways in this reach.

The following types of wildlife are known to occur in Reach No. 7: raptors, shorebirds, waterfowl, and songbirds, deer, rabbit, raccoon, rodents, bats. (ELS, 2012; ELS 2013) In addition, this reach generates occasional reports of black bear, especially in the springtime.

Land Use

Current Land Use. The developed portion of Reach No. 7 is low density residential, with one medium density residential building (a duplex). Pioneer Road West and 19th, 25th, 26th Streets Northwest have been subdivided, and the remaining properties of this reach remain in larger parcels. There are 76.3 acres of Shoreline Conservancy land in this reach which are undeveloped and serve as passive recreation, open space, and public access.

Lot sizes are a minimum of 10,000 square feet to allow on-site detention of stormwater (see below). The city imposes a performance standard on drainage that requires development not alter either the amount or direction of run-off. That is, unless flooding now exists, water must enter and exit a site in the same places and amounts after development as before. If flooding is an issue, if a project is large or complicated, or if the city determines it is necessary, an Engineered Drainage Plan is required.

Future Land Use. In the future, the Shoreline Conservancy lands are likely to remain undeveloped, and provide the functions of passive recreation, open space, and pedestrian beach access. Remaining undeveloped acres are zoned as follows:

- 35.6 acres, S1-Shoreline Single Family Residential
- 5.1 acres, S2-Shoreline Multi-Family Residential
- 6.9 acres, S3R-Shoreline Resort Restricted

Therefore, the current land use mix of low-density residential can be expected to densify as relatively more medium-density multi-family and resort are developed in Reach No. 7.

Transportation and Utilities. There is 0.6 mile of developed road in Reach No. 7. The area is served by city water and sewer, PUD No. 2 electricity, public transit provided by Pacific Transit is available at nearby SR 103, refuse service is provided by Peninsula Sanitation. There is no storm water system in this area, and development must detain runoff on site; the minimum lot size of 10,000 SF allows for onsite stormwater management.

Modifications to Associated Wetlands. Several areas of wetland fill have occurred in this reach:

- Along those streets that have been subdivided: Pioneer Road, and 19th, 25th, and 26th Streets Northwest. These impacts to wetlands were mitigated when the subdivisions were approved.

In addition, several owners have removed beach pine forests to improve ocean views.

Public Access. The head of the Discovery Trail is located at the very north end of this reach, at the Breakers Resort, and the trail trends east-west in or near the 26th Street Northwest right-of-way for about 1,600 feet, when it trends generally north-south for the remainder of its 8.2-mile alignment. A spur of the Discovery Trail exists along the south side of 19th Street Northwest between Ocean Beach Boulevard North and the Discovery Trail; it also continues beyond the Trail to the ocean beach. West of the cul-de-sac at the end of 19th Street Northwest, this spur passes between two homes, drops sharply downward in elevation, then continues to meander through the dune. In addition, there exists informal public pedestrian beach access, established by historic use, in the following undeveloped rights-of-way:

- Pioneer Road West; and
- 23rd Street Northwest.

None of this informal pedestrian beach access is signed.

Restoration Opportunities

1. Increase city efforts to have property owners eradicate invasive nuisance species.

5.1.8 Reach No. 8: Discovery Trailhead (Extension of 26th Street Northwest) to 28th Street Northwest

Overview

Reach No. 8 is approximately 935 linear feet, north to south. About 4.3 acres encompasses the area between the OHWM and 200 feet landward. The remainder of Reach No. 8 to the limits of associated potential wetlands encompasses approximately 34 acres. The nature of this reach is undeveloped, with high-density resort, the Breakers, located immediately east of this reach.

Physical Attributes

This entire reach is undeveloped dune and wetlands and is the land located west of the Breakers Resort. From the 1968 line west is Shoreline Conservancy. Shoreline modifications in the jurisdictional area with 200 feet east of the OHWM include several unpaved and meandering pedestrian trails originate at the Breakers; in addition, the paved Discovery Trail traverses this reach west of the 1980 SCL trending east west, with none of the trail within 200 feet of the OHWM. There are 3 parcels in this reach; of these, all are undeveloped. Impervious cover is 0%.

Natural Resources

The jurisdictional shoreline landward 200 feet of the OHWM is primarily vegetated with European dunegrass. The undeveloped portion of the area of associated wetlands is about 7.8 acres of wetland vegetation, and the remainder is dunegrass. Two narrow areas of pine forest occur in Reach No. 8 at the north and south fringes. There are no records of species known to occur in this area, however it is expected to include those types of plants common to the dune area—dune grasses, strawberries, and possibly Scotch broom, and in wetland areas willows and sedges. Based on estimates of wetland acres derived from elevations (assuming, based on historic evidence, that lands lying below the 14' NGVD29 elevation may be wetlands), it is conservatively estimated that up to 2.5 acres of Reach No. 8 is interdunal wetland. There are no natural streams or floodways in this reach.

As with vegetation, there are no records of wildlife species known to occur in Reach No. 8. However, it is expected to include those types of wildlife common to the dune area: shorebirds, gulls and terns, raptors, small and medium rodents and marsupials, and larger mammals such as deer. Due to its open nature, it is not likely for bear to occur in this reach other than in passing.

Land Use

Current Land Use. The entire reach is undeveloped dune providing functions of habitat, passive recreation, open space, and providing open views of the ocean. The Breakers condo-tel is located

immediately east of this reach. The eastern portion of this reach is low-lying (14 to 16 feet elevation NGVD29) and is subject to inundation from land-originating (not ocean–originating) storm water, with shallow ponding in this area for much of the winter.

Future Land Use. In the future, the Shoreline Conservancy lands are likely to remain undeveloped, and provide the functions of habitat, passive recreation, open space, and pedestrian beach access. Remaining undeveloped acres are zoned as follows:

- 3.9 acres, S3R-Shoreline Resort Restricted, located west of the existing Beakers Resort buildings and east of the 1968 SCL.

There is sufficient acreage west of the Breakers—about 15 acres—to build another facility. The Breakers has expressed interest in such development, but application has not been made.

Transportation and Utilities. There are no developed roads in Reach No. 8. The area is served by city water and sewer, PUD No. 2 electricity, public transit provided by Pacific Transit is available at nearby SR 103, refuse service is provided by Peninsula Sanitation. Development must detain runoff on site; the minimum lot size of 10,000 SF allows for onsite stormwater management.

Modifications to Associated Wetlands. Minor wetland fill has occurred in this reach to create 2 elevated trails. These trials include culverts to retain hydraulic connectivity.

The Breakers has removed and keeps clear all evergreen vegetation, except as noted.

Public Access. The Discovery Trail begins at the southern parking lot of the Breakers, trends west, then south from there. A western extension of the trail as well as two (2) other well-defined elevated and culverted informal pedestrian dune trails provide beach access. In Reach No. 8 no public pedestrian beach access exists via undeveloped rights-of-way. None of the pedestrian beach access is signed.

Restoration Opportunities

1. Installation of culverts in 28th Street Northwest could restore hydraulic continuity.
2. Increase city efforts to have property owners eradicate invasive nuisance species.

5.1.9 Reach No. 9: 28th Street Northwest to 31st Street Northwest

Overview

Reach No. 9 is approximately 780 linear feet, north to south. About 3.5 acres encompasses the area between the OHWM and 200 feet landward. The remainder of Reach No. 9 to the limits of associated potential wetlands encompasses approximately 28 acres. The nature of this reach is predominately medium-density residential with a small amount of single family residential and a fairly large proportion if undeveloped land.

Physical Attributes

The jurisdictional shoreline landward 200 feet of the OHWM comprises the outer face of the foredune. This portion of the jurisdictional shoreline is located between 450 and 500 feet west of

the 1980 SCL building setback line, and no private structural development occurs in this area. Shoreline modifications in the jurisdictional area with 200 feet east of the OHWM include two unpaved and meandering pedestrian beach access trails. There are 51 parcels in this reach; of these, 30 are developed and 21 are undeveloped. Impervious cover is 6%.

Natural Resources

The jurisdictional shoreline landward 200 feet of the OHWM is primarily vegetated with European dunegrass. The undeveloped portion of the area of associated wetlands is about 9.1 acres beach pine forest and wetland vegetation, and the remainder is dunegrass. Other than shore pine (*Pinus contorta*) and European and American beachgrass (*Ammophila arenaria and breviligulata*, respectively**)** specific species from this area have not been identified. However, in general, grasses, sedges, and blackberries have been identified, as have invasive Scotch broom (*Cytisus scoparius*) and gorse (*Ulex*). Based on estimates of wetland acres derived from elevations (assuming, based on historic evidence, that lands lying below the 14' NGVD29 elevation may be wetlands), it is conservatively estimated that up to 1.5 acres of Reach No. 9 is interdunal wetland. There are no natural streams or floodways in this reach.

The following types of wildlife are known to occur in Reach No. 9: raptors, shorebirds, songbirds, deer, rabbit, marsupials, raccoon, and rodents. (ELS, 2012; ELS 2013) In addition, this reach generates reports of black bear, especially in the springtime.

Land Use

Current Land Use. The developed portion of Reach No. 9 is primarily medium-density residential (duplexes) along the north side of 28th Street Northwest, with a few single family residences. There are 11.5 acres of Shoreline Conservancy land in this reach which are undeveloped and serve as habitat, passive recreation, open space, and public access.

Lot sizes are a minimum of 10,000 square feet to allow on-site detention of stormwater (see below). The city imposes a performance standard on drainage that requires development not alter either the amount or direction of run-off. That is, unless flooding now exists, water must enter and exit a site in the same places and amounts after development as before. If flooding is an issue, if a project is large or complicated, or if the city determines it is necessary, an Engineered Drainage Plan is required.

Future Land Use. In the future, the Shoreline Conservancy lands are likely to remain undeveloped, and provide the functions of habitat, passive recreation, open space, and pedestrian beach access. Remaining undeveloped acres are zoned as follows:

- 6.2 acres, S1-Shoreline Single Family Residential
- 7.3 acres, S2-Shoreline Multi-Family Residential
- 5.2 acres, S3M-Shoreline Resort Mixed Use

The current land use mix of medium-density residential can be expected to densify as high density resort or residential develops to the north of the existing duplex developments on 28th

Street Northwest. There is a current pending application for eight (8) units on the last undeveloped parcel in that street. The city anticipates construction to occur in by 2016.

Transportation and Utilities. There is 0.2 mile of developed road in Reach No. 9. The area is served by city water and sewer, PUD No. 2 electricity, public transit provided by Pacific Transit is available at nearby SR 103, refuse service is provided by Peninsula Sanitation. There is no storm water system in this area, and development must detain runoff on site; the minimum lot size of 10,000 SF allows for onsite stormwater management.

Modifications to Associated Wetlands. Substantial wetland fill has occurred in this reach as subdivisions were built out. This fill was mitigated at the time permits were issued.

In Reach No. 9, remaining shore pine stands have been left essentially intact.

Public Access. There is no informal public pedestrian beach access in any undeveloped right-of-way. One dune path traverses private property.

Restoration Opportunities

1. Installation of culverts at 30th Street Northwest could restore or improve hydraulic continuity.
2. Increase city efforts to have property owners eradicate invasive nuisance species.

5.1.10 Reach No. 10: Ocean Beach and Pacific Ocean

Overview

Reach No. 10 is approximately 2.5 miles north to south between the north and south city limits; it is three (3) nautical miles east to west, from the OHWM waterward. The nature of this reach is ocean beach and the Pacific Ocean beyond.

Physical Attributes

Ocean Beach. The ocean beach is relatively flat, and so tide run-up can be substantial, and the width of the beach from the OHWM to the water's edge can vary from zero to 1,000 feet or more, depending on the tide. The beach is of medium to fine grained sand, which is relatively homogeneous in nature. There are no native rock outcroppings. In the surf zone, the bottom can be hummocky, and comprises a series of low sand bars, with substantial swales on their ocean side. These sandbars have a three-stage lifecycle: they generate near the shoreline, migrate seaward, and they degenerate in the outer nearshore. (Ruggiero, *et al*, 2013) These uneven bottom features can result in unsafe conditions for humans in the shallow surf zone.

More information on the ocean beach portion of this reach is located in this report in Sections 4.14 (Topography and Surface Water) and 4.14 (Biology: Key Habitats and Species).

Pacific Ocean. The physical characteristics of the Pacific Ocean portion of this reach are described in this report in Sections 4.14 (Topography and Surface Water) and 4.14 (Biology: Key Habitats and Species).

Natural Resources

Ocean Beach. The substantial biological resources associated with the beach portion of this reach are described in this report in Section 4.14 (Biology: Key Habitats and Species). In addition to biological resources, the beach is the source of sand, a resource mined by local contractors and farmers pursuant to RCW 79A.05.630 if such sand removal is reasonable and not generally harmful or destructive to the character of the land. The ocean beach provides a variety of visual resources, with expansive views of the beach itself, the ocean to the west, the foredune to the east, and of North Head to the south.

Pacific Ocean. Biological resources associated with the ocean portion of this reach are described in this report in Section 4.14 (Biology: Key Habitats and Species). While the ocean provides mineral resources, none are mined or harvested in this area at this time. The ocean tides and winds that pass over this area are a potential source of energy, but there is no harnessing of these resources at this time.

Land/Ocean Use

Current Land Use, Ocean Beach. The ocean beach (including the nearshore surf zone) portion of Reach No. 10 supports numerous recreational activities, including pedestrian and equestrian activities, wildlife viewing, surf fishing, festivals (*e.g.*, the Washington State International Kite Festival), surfing, limited wading/swimming, and clamming. Beach-related tourism is the basis of the Long Beach economy, and coastal recreation/tourism is a substantial source of income to the state of Washington. (Industrial Economics, 2014b)

This reach supports a thriving recreational razor clam *(Siliqua patula)* fishery, as does the entire Peninsula. A "clam tide" refers to a day when recreational clam harvesting is allowed. Clam tides result in thousands of people flocking to the Long Beach Peninsula in hopes of digging a daily limit of 15 clams per clammer. In the most recent season, there were 72 clam tides, and diggers netted 2.4 million clams Peninsula-wide. (Washington State Department of Fish and Wildlife, 2014)

In addition, as described above, limited sand mining occurs on and near the ocean beach.

Current Use, Pacific Ocean. As described in Section 4.14 (Biology: Key Habitats and Species) of this report, several commercial fisheries operate within the ocean portion of this reach. In addition, recreational fishing occurs in these waters.

Future Land Use, Ocean Beach. The ocean beach is expected to continue to provide the recreation and sand mining land uses it currently supports. Given the community's general assumption the beach is open to all and unspoiled, structural development such as a pier or breakwater is not foreseen during the life of the planning period.

Future Use, Pacific Ocean. The Pacific Ocean is expected to continue to support commercial and recreational fisheries; the species fished may change reflecting changes in fish/shellfish populations. The ocean tides and winds have potential to serve as sources of energy, with either in-water tidal or floating wind farms or facilities being required to harness this energy. Recent

studies indicate this source of energy is not expected to be cost-effective during the planning period for this SMP update. (Industrial Economics, 2014c)

Transportation and Utilities, Ocean Beach. In order to access clam beds, other recreation amenities and festivals, or just to travel, the beach is used as a roadway, and is defined as a "public highway" in Shoreline Conservation Areas (including this reach) pursuant to RCW 79A.05.693. Vehicles must be "street legal", and both vehicles and drivers must be licensed. Drivers are required to drive in the most landward wet sand, and to observe the rules of the road and a 25 mile per hour speed limit. From the Bolstad beach approach southward to the southern limit of Reach No. 10 and beyond to the Seaview beach approach, the beach is closed to driving (except during a clam tide) from April 15 through the day following Labor Day. While driving on the beach occurs daily and is generally accepted, there is a segment of the population that opposes this practice.

Transportation and Utilities, Pacific Ocean. Tug and cargo, tanker, and passenger ship traffic traverses the Pacific Ocean off of the Long Beach Peninsula. However, there is no destination for this vessel traffic in shallow Willapa Bay (much of which is a mud flat during low tides), and so this traffic does not enter the bay or the waters within three miles of the Long Beach shoreline. Therefore, this vessel traffic does not enter Reach No. 10. (BST Associates, 2014)

The Southwest Washington coastline is known as The Graveyard of the Pacific; more than 2,000 vessels and 700 lives have been lost in this area. So while a ship, tug or barge may not traverse Reach No. 10, there is a remote possibility that while approaching the Columbia River a shipwreck could occur and in some manner affect the waters, ocean bottom, or the beach of Reach No. 10.

Restoration Opportunities

There do not appear to be substantial or meaningful restoration opportunities in Reach No. 10.

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6.0 Opportunities

6.1 Protect Ecological Functions

This report has inventoried several distinct land and water forms within the city's shoreline jurisdiction: the Pacific Ocean, ocean beach, foredune, and deflation plain (associated) wetlands. Each of these forms performs important ecological functions. Ecological functions are some of the positive "jobs" that these land and water forms perform; they are described below, as are opportunities for this SMP update to protect these ecological functions.

6.1.1 Ocean

Ecological functions of the Pacific Ocean include the following:

1. **Climate Regulation:** The oceans play a key role in climate regulation especially in buffering (neutralizing) the effects of increasing levels of greenhouse gases in the atmosphere and rising global temperatures. The oceans are the main store of carbon dioxide (CO_2)[4]; they are estimated to have taken up approximately 40% of human-generated CO_2 from the atmosphere since the beginning of the industrial revolution.
2. **Energy Storage and Transfer:** The ocean stores thermal solar energy, and creates mechanical energy via tides and waves. The ocean stores much more energy than the land, and this storage in part plays a role in climate regulation.
3. **Fish and Wildlife Habitat:** The ocean is home to millions of species of fish and mammals, providing breeding, nursery, foraging, and sheltering habitats. In addition, ocean birds forage in ocean waters and shelter on its surface.

Opportunities. Because of the vastness and interconnectedness of ocean waters, and the tiny portion the Long Beach jurisdictional shoreline represents, there is little Long Beach can do to directly and meaningfully influence the ocean's ecological functions. However, the city can participate in larger programs meant to protect ocean ecological functions, such as greenhouse gas reduction programs, ocean de-acidification efforts, climate change initiatives, etc.

6.1.2 Ocean Beach

Ecological functions of the ocean beach include the following:

1. **Wildlife Habitat:** The ocean beach is breeding, nursery, and foraging habitat for clams, snails, crabs, and worms. It is also foraging and sheltering habitat for shorebirds, and can occasionally serve as nursery habitat for mammals.
2. **Flood Protection:** Wave run-up on the beach reduces wave energy and helps keep water from reaching the primary foredune.
3. **Tsunami Attenuation:** The beach would serve to reduce wave energy as a tsunami makes landfall.

4. **Water Filtration:** The ocean is the source of the essentials of life: food, nutrients, and oxygen. As a wave runs up the slope the beach, seawater sinks into the sand, which filters out particles of algae and other organic material, providing a food source for the beach community.

Opportunities. The city can continue its current efforts to maintain the health of the ocean beach: participate in beach clean-ups, especially at the 4th of July, close a good portion of the beach to vehicle traffic during the busy season, and enforce wildlife protection and vehicle codes on the beach.

6.1.3 Foredune

Functions of the foredune include the following:

1. **Wildlife Habitat:** The foredune provides sheltering habitat for shorebirds during coastal storm events.
2. **Flood Protection:** The foredune prevents ocean waters from entering the deflation plain and areas east.
3. **Tsunami Attenuation:** The foredune would take the brunt of a tsunami's energy as it makes landfall.

Opportunities. The foredune has been radically altered at the two main beach approaches—it has been removed in these areas. Some have suggested the dune be allowed to return to its natural profile in these areas, and that vehicular beach access pass over the dune at the beach approaches. This would improve both flood protection and tsunami attenuation functions. This is a controversial proposal. The city recently banned the use of off-road vehicles and all-terrain vehicles in the dune and on the beach, and reiterated its ban on any off-road vehicle use in the dune area west of Ocean Beach Boulevard (other than that associated with short-term property maintenance). The fine is $1,000 for an infraction of this code. This new law protects foredune (as well as deflation plain) ecological functions.

6.1.14 Associated Wetlands

Functions of wetlands include the following:

1. **Water Purification:** Wetlands protect water quality by trapping sediments and retaining excess nutrients and other pollutants such as heavy metals.
2. **Flood Protection:** Wetlands provide flood protection by holding excess runoff after a storm and then releasing it slowly.
3. **Groundwater Recharge:** Those wetlands connected to groundwater systems or aquifers are important areas for groundwater exchange; they retain water and provide time for infiltration to occur.
4. **Wildlife Habitat:** Many species of birds, mammals, reptiles, and amphibians rely on wetland habitat for breeding, foraging, and cover. Wetland plants and small animals—especially

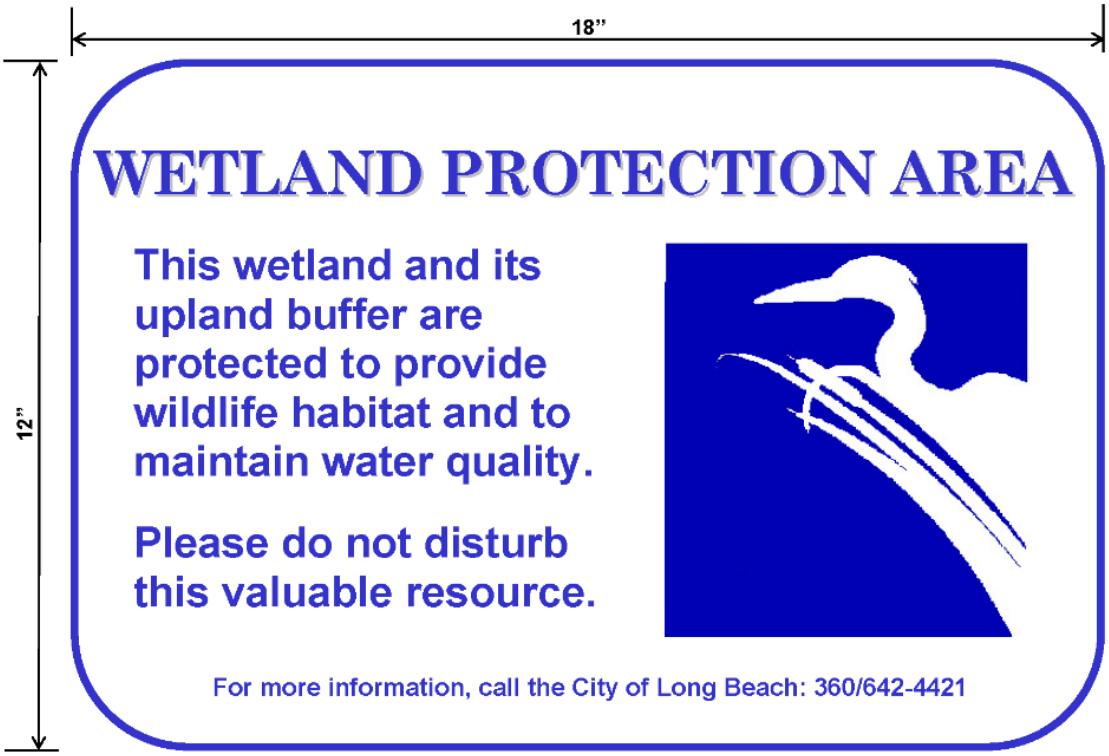
insects—are essential links at the lowest levels of the food chain. In addition to this wetland function, the deflation plain itself provides sheltering habitat for shorebirds during coastal storm events.

5. **Economic Benefits:** The economic benefits associated with the environmental values of wetlands also can be substantial. If, for example, a community had to build flood control or water treatment systems to replace those functions provided by wetlands, the costs could far outweigh the land purchase price of preserving the natural wetland systems.

Opportunities. Section 5.1 of this document identifies by reach restoration opportunities that would protect or enhance the water purification, flood protection, groundwater recharge, habitat, and economic benefit functions of associated wetlands. In addition, the prior section describes a new city law that protects interdunal wetlands from vehicular damage, protecting their functions.

The city has designed a sign identifying wetlands and asking they be left undisturbed (see Figure 14). The city has required and will continue to require as a condition of certain approvals these signs be used to mark wetlands. The city could also set aside a certain amount of money each year to offer these signs to willing property owners in order to increase protection of all ecological functions of wetlands.

Figure 14: Wetland Protection Area Sign



Source: city of Long Beach, 2012

6.2 Restore Degraded Habitat

Both non-native American and European beach grasses have taken hold in the dune area of the Long Beach shoreline. This has led to foredune growth, especially vertical growth. It is debatable that this may be degrading habitat. However, it definitely increases the storm protection and tsunami attenuation functions provided by the outer foredune. Therefore, eradication of these non-native species seems unwise, unless they can be replaced with a native species that also provides equal or better storm protection and tsunami attenuation functions.

By restoring hydraulic continuity between wetland areas as identified in this report in Section 5.1 by reach, any degraded associated wetland habitat should improve.

Eradication of invasive Scotch broom and gorse, whose existence by reach is identified in in this report in Section 5.1, would improve or restore degraded habitat.

6.3 Improve Public Access

As demonstrated in the reach analysis of this document, there are numerous formal and casual vehicular, pedestrian, and equestrian access points to the beach. However, there could be more access points in public rights-of-way west of the developed portion of roads. Dune trails could be established by mowing a path for several years until a footpath is worn. Candidates for establishing pedestrian beach access include the following:

- 15th Street Southwest
- 3rd Street Southwest
- 11th Street Northwest
- 17th Street Northwest

In addition, the steep drop in elevation on the path at 19th Street Northwest could be mitigated with installation of steps in the steep area, improving access.

While there is much pedestrian access, except at the main beach approaches, none of it is signed. Therefore, it takes “local knowledge” to understand that a street-end trail is providing public rather than private access. Alternatively, it is also possible that private trails could be mistaken for public. The city should consider instigating a public pedestrian beach access signage program, where attractive and eye-catching signs would identify where public trails are located. The city began a partnership with the Chinook Nation for signage a few years ago, using the Nation’s distinctive symbol on visitor-oriented signs. The city could investigate whether the Chinook Nation would be interested in expanding that program to include trailhead signage.

6.4 Support Water-Dependent Uses

Pursuant to WAC173-26-020(39) “Water-dependent use” means a use or portion of a use which cannot exist in a location that is not adjacent to the water and which is dependent on the water by

reason of the intrinsic nature of its operations. Current water-dependent uses in the study area include commercial and recreational fin and shell fishing, certain recreation activities, and certain beach-oriented festivals. The city does not have a port or wharf whereby it can directly support commercial fishing. The city currently supports recreational fishing, recreation activities, and certain beach-oriented festivals through funding and manpower. For example, the city supports the water-dependent Clam Festival, Kite Festival, and Sandsations Sandcastle Festival financially and with manpower, and supports use of the beach for the Surf Perch Derby. In addition, the city provides some limited signage for beach access for water-dependent recreational activities (*e.g.*, equestrian trails are marked, as are the two main beach approaches), and participates in all marketing regarding clam tides.

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7.0 Conclusions

The Long Beach jurisdictional shoreline extends approximately 2.5 miles north-south, extends eastward 200 landward of the OHWM plus the area of associated wetlands (but not their buffers), and extends west three (3) miles waterward of the OHWM. The jurisdictional shoreline is physically characterized by the Pacific Ocean, a broad, gently sloping ocean beach, substantial primary foredune, deflation plain, and secondary sand ridge. The entire Peninsula continues east of Long Beach in this pattern of dune/swale/dune.

Both water-dependent and water-oriented uses occur in the city's jurisdictional shoreline. There are no permanent structural water-dependent uses in the city's jurisdictional shoreline. Water-oriented uses, such as trails/boardwalks, housing, and hotels are of a more permanent structural nature.

Beyond a few outfalls, minor portions of trails, a portion of the city's boardwalk, and one public shelter, no structural shoreline modifications occur in the ocean, on the ocean beach, or within 200 feet landward of the OHWM. There are no bulkheads, wharves, or habitable buildings in this area.

There exist several opportunities to protect ecological functions, restore degraded habitat, and support water-dependent uses. There exist many opportunities to improve pedestrian access to the ocean beach or to improve the public's awareness of such access.

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8.0 Acknowledgements

The city of Long Beach is one of numerous government entities in the state of Washington required to update its SMP. We all do undertakes these updates with assistance from Ecology staff, and in accordance with Ecology's SMP Guidelines, the requirements of individual but similar SMA Grant Agreements, and following Ecology's Master Program Planning Process. Therefore, there exists a consistent SMP update approach across the state; this consistency of approach leads to a general product consistency while taking into account local circumstances. For that reason Long Beach looked toward its municipal and county colleagues and their SMP update work products in preparing this document. The city reviewed several existing Inventory and Characterization documents. We used ideas, approaches, and even text from several plans. In addition, we have engaged in numerous conversations with our planning and community development contemporaries at the city of Ilwaco and Pacific County. Thanks to our colleagues who went before us in the SMP update process for creating a most worthwhile legacy.

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9.0 References

Adams, Josh, *et al*, 2014. *Pacific Continental Shelf Environmental Assessment PaCSEA): Aerial Bird and Marine Mammal Surveys off Northern California, Oregon, and Washington, 2011-2012.* U.SA. Department of the Interior, Bureau of Ocean Energy Management, Pacific OCS Region, Camarillo, CA. OCS Study BOEM 2014-003. 266 pp.

Atlas Construction, 2005. *SEPA Documentation for 8th Street Northwest Project.* May. city of Long Beach Case No. 05-Atlas-SSDP.

Atwater, Brian F., et al, 2005. *The Orphan Tsunami of 1700—Japanese Clues to a Parent Earthquake in North America*. U.S. Geological Survey Professional Paper 1707.

BeachConnection.net. Site visited August 21, 2014.

Blakemore, Thomas E., 1995. *Ground-Water Flow and Water Quality in the Sand Aquifer of Long Beach Peninsula, Washington.* U.S. Geological Survey Water-Resources Investigations Report 95-4026.

BST Associates, 2014. *Washington Coast Marine Spatial Planning Assessment of Shipping Sector: Final Sector Assessment. Prepared for Washington State Department of Natural Resources.* August 30.

Buijsman, Maarten C., et al., 2003. *Regional Sediment Budget of the Columbia River Littoral Cell, USA: Analysis of Bathymetric and Topographic-Volume Change.* Open-File Report 02-281. U.S. Department of the Interior and the U.S. Geological Survey. March.

City of Long Beach, 1997. *City of Long Beach Shoreline Master Program*. July.

City of Long Beach, 2000. C*ity of Long Beach Dune Management Report*. March.

City of Long Beach, 2008. *Long Beach Comprehensive Plan Update, 2026*. August.

City of Long Beach, 2010. *SEPA Documentation for the Bolstad West Kite Festival Improvements Project.* June. City of Long Beach Case No. SSDP 2010-01.

Curran-McLeod, Inc., 2014. *Engineering Report: City of Long Beach Tinker Lake Receiving Water & Effluent Study, Final Report, Pacific County, Washington*. August.

Ecological Land Services (ELS), 2011. *SEPA Documentation for the 28th Street Northwest Townhouses Project.* February. City of Long Beach Case No. SSDP 2010-02 (includes Case No. SP 2010-02).

Ecological Land Services (ELS), 2011. *SEPA Documentation for the 17th Street Southwest Hobson Homes Project.* May. City of Long Beach Case No. SSDP 2011-01.

Ecological Land Services (ELS), 2012. *SEPA Documentation for the Pioneer Road West Discovery Point Project.* August. City of Long Beach Case No. SSDP 2012-01.

Ecological Land Services (ELS), 2013. *SEPA Documentation for the 26th Street Northwest Bichsel Project.* August. City of Long Beach Case No. SSDP 2013-01.

Encyclopaedia Britannica at http://www.britannica.com/EBchecked/topic/39897/Astoria-Canyon. Site visited 7/22/14.

Industrial Economics, Inc., 2014a. *Marine Sector Analysis Report: Non-Tribal Fishing.* Prepared for Washington Coastal Marine Advisory Committee. August 14.

_____, 2014b. *Marine Sector Analysis Report: Recreation and Tourism.* Prepared for Washington Coastal Marine Advisory Committee. August 14.

_____, 2014c. *Marine Sector Analysis Report: Marine Renewable Energy.* Prepared for Washington Coastal Marine Advisory Committee. August 15.

McCully, Glen, Pacific County Flood Control District, 2014. Personal communication.

Natural Resources Canada at www.earthquakescanada.nrcan.gc.ca/zones/cascadia/qa-eng.php. Site visited 6/24/14

NatureServe Explorer at http://explorer.natureserve.org. Site visited 10/7/14.

Pacific County Flood Control District, undated. *Flood Control Zone District No. 1: Subzones & Drainage Basin.* Prepared by the Pacific County Department of Public Works. Map.

Pacific Northwest Seismic Center: www.pnsn.org/outreach/earthquakesources/csz. Site visited 6/25/14

Pool Engineering, 1985. *Long Beach Peninsula Surface Water Management Plan*.

Ruggiero, Peter, George M Kaminsky, and Sally Hacker, 2013. *Morphodynamics of Prograding Beaches.* Proceeding (pages 1,375-1,384) of the conference entitled Coastal Dynamics 2013, 7th International Conference on Coastal Dynamics. June.

Ruggiero, Peter; Jeff Wood, 2013. *2012 CRLC Open Coast Beach Data Collection, Analysis, and Archiving to Support Coastal and Marine Spatial Planning.* July 10.

Slaughter, Stephen L., Timothy J. Walsh, Anton Ypma, Kelsay M.D. Stanton, Recep Cakir, and Trevor A. Contreras, 2013. *Earthquake-Induced Landslide and Liquefaction Susceptibility and*

Initiation Potential Maps for Tsunami Inundation Zones for the Long Beach Peninsula, Pacific County, Washington, for a 9+ Cascadia Subduction Zone Event. Washington State Department of Natural Resources, Division of Geology and Earth Resources. October.

Surf-Forecast.com. http://www.surf-forecast.com/breaks/Long-Beach-Peninsula/reliability_by_season. Site visited 7/21/14

U.S. Climate Data. http://www.usclimatedata.com/climate/long-beach/washington/united-states/uSouthwesta0234 Site visited 6/24/14

United States Geologic Survey. http://pubs.usgs.gov/fs/old.2000/fs-057-00. *Is Seawater Intrusion Affecting Ground Water on Lopez Island, Washington?* U.S. Geological Survey Fact Sheet 057-00. Site visited 6/25/14.

Washington Marine Spatial Planning at https://fortress.wa.gov/dnr/mspmaps/index.html#. Site visited 7/22/14.

Washington State Department of Ecology, 2000. *Report of Examination to Appropriate Public Waters of the State of Washington: North Beach Water, North Wellfield.*

_____, 2008. *Willapa Water Resource Inventory Area (WRIA) #24: WDFW- Salmonid Stock Inventory* (nine maps).

_____. *Water Quality Assessment for Washington Marine Waters* at https://fortress.wa.gov/ecy/wqamapviewer/default.aspx?res=1536x960. Site visited 7/22/14.

_____. *Beachgrass*. www.ecy.wa.gov/programs/sea/coast/plants/dunegrass.html. Site visited 8/20/2014.

Washington State Department of Fish and Wildlife, 2014. *Washington Razor Clam Management: Setting the 2014-2015 Season.*

_____. http://apps.wdfw.wa.gov/phsontheweb/. Site visited 7/22/14

Washington State Department of Natural Resources, 2011. *Ecological Integrity Assessments: North Pacific Coast Interdunal Wetland.* Version 2.22.2011.

_____. https://fortress.wa.gov/dnr/mspmaps/index.html. Site visited 7/22/14.

_____. *Washington Marine Vegetation Atlas* at http://mva.apphb.com/index.html#. Site visited July 23, 2014.

Washington State Office of Financial Management, 2014. *Population of Cities, Towns, and Counties Used for Allocation of Selected State Revenues, State of Washington*. June.

Weather.com. "Monthly Averages for Long Beach, WA". Weather Channel. 2012. Retrieved 2012-07-16.

Wiedemann, Alfred M., 1984. *The Ecology of Pacific Northwest Coastal Sand Dunes: A Community Profile.* FWS/OBS-84/04. U.S. Department of the Interior, Fish and Wildlife Service; U.S. Department of the Army, Corps of Engineers. March.

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Long Beach Shoreline Jurisdiction Reaches with Zoning Overlay

Long Beach Shoreline Jurisdiction Reaches with Shoreline Jurisdiction Overlay

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B Interdunal Wetlands

Ecological Integrity Assessment: North Pacific Coastal Interdunal Wetland

This document is part of a collection of Ecological Integrity Assessments addressing 67 of Washington's 99 Ecological Systems. These documents were prepared by the Washington Natural Heritage Program with funding provided by the Washington Department of Fish and Wildlife.

Ecological Integrity Assessment: North Pacific Coastal Interdunal Wetland

Ecological Summary

North Pacific Coastal Interdunal wetlands are located in small interdunal depressions to extensive deflation plains behind stabilized foredunes. They may be referred to as "dune slacks" and are common components of larger active and stabilized coastal barrier islands, spits, and coastal dunes occurring along the Pacific Coast. This small patch system ranges from southern Oregon to the Aleutian Islands in Alaska. Dune slacks are highly ranked in international conservation agenda due to frequent association with many rare and endangered plant species and their associated fauna (Grootjans et al. 2004). This small patch system is only found embedded within the North Pacific Maritime Coastal Sand Dune and Strand system.

North Pacific Coastal Interdunal wetlands typically occur behind stabilized foredunes. Foredunes are tall ridges created by sand-trapping vegetation with a swale between it and the next dune. As wind blows inland it erodes the sand behind foredunes down to the level of the water table. The swale or dune slack elevation varies with depth to water table as the sand is actively eroded by wind. When sand is wet, it is more resistant to further erosion and interdunal wetlands are able to develop. Winter precipitation increases the water table and inundates some communities to a depth of 1 m (3 feet) with fresh or brackish water. A variety of moisture and salinity gradients occur due to variations in the depth of sand and distance from estuaries or ocean water. Seasonal rise in the water table also causes vernal pools to form in forested sites on old deflation plains. In areas with many interdunal wetlands slight differences in water level may initiate groundwater flow from one wetland to another (Grootjans et al. 2004). Some wetlands are perched on an iron-cemented duripan, and groundwater may be charged with iron and pH ranges from 5.0-6.3 (6.9), with low conductivity. Soils are mineral sometimes with a thin organic layer (less than 40 cm (16 in)). This primarily freshwater wetland system is 1) not tidally-influenced although maritime water effects salinity and pH, 2) has a mineral soil sometimes with a thin organic layer and 3) is groundwater dependent with seasonal fluctuations. Under natural conditions, individual wetlands (slacks) are temporary being filled by sand or vegetation through succession to other wetland systems or isolated from the water table.

Distinct landform and vegetation patterns are common to these dune systems. Depending on moisture and salinity gradients, North Pacific Coastal Interdunal wetlands are colonized by herbaceous species such as *Carex obnupta*, *Argentina egedii*, *Juncus lesueurii*, *Juncus falcatus* ssp. *sitchensis*, *Juncus nevadensis*, *Equisetum variegatum* and various other emergent species resembling wet meadows or marshes (Weideman 1984). Shrubs such as, *Salix hookeriana* and *S. sitchensis* can be present particularly in older wetlands that gain characteristics of shrub swamps

(Christy et al. 1998, Weideman 1984). Older slacks with persistent freshwater (near lakes and ponds) support conifer swamps with *Pinus contorta* var. *contorta, Picea sitchensis* or *Thuja plicata* and, in some cases, develop peat over 40 cm and then represent the North Pacific Bog and Fen ecological system. Interdunal wetlands may occur in mosaics with forested swamps or rarely with Bogs and Fens.

As applied here, the North Pacific Interdunal wetland system includes all herbaceous, woody species-dominated wetlands with less than 40 cm organic soil layer within a coastal dune landscape.

Stressors

The stressors described below are those primarily associated with the loss of extent and degradation of the ecological integrity of existing occurrences. The stressors are the cause of the system shifting away from its natural range of variability. In other words, type, intensity, and duration of these stressors is what moves a system's ecological integrity rank away from the expected, natural condition (e.g. A rank) toward degraded integrity ranks (i.e. B, C, or D).

The physical forms of dunes have been altered by European beachgrass (*Ammophila arenaria*), which has been extensively planted for stabilization purposes and has also spread widely on its own. *Ammophila arenaria* foredune stabilization decreases sand supply to backdune areas that leads to soil formation and an increase in invasive and native grassland, coastal scrub, and wetlands (Wiedemann and Pickart 2004). **Unstabilized** sand is now a relatively rare condition primarily because of the introduction of this species and many deflation plains are much larger than their historical extent. It is not clear how this may affect vegetation patterns relative to historical conditions, however without dynamic dune systems, the diversity of structure within interdunal wetlands may homogenize, with shrubby and/or forested wetlands predominating.

Conceptual Ecological Model

The general relationships among the key ecological attributes associated with this system are presented in Figure 1.

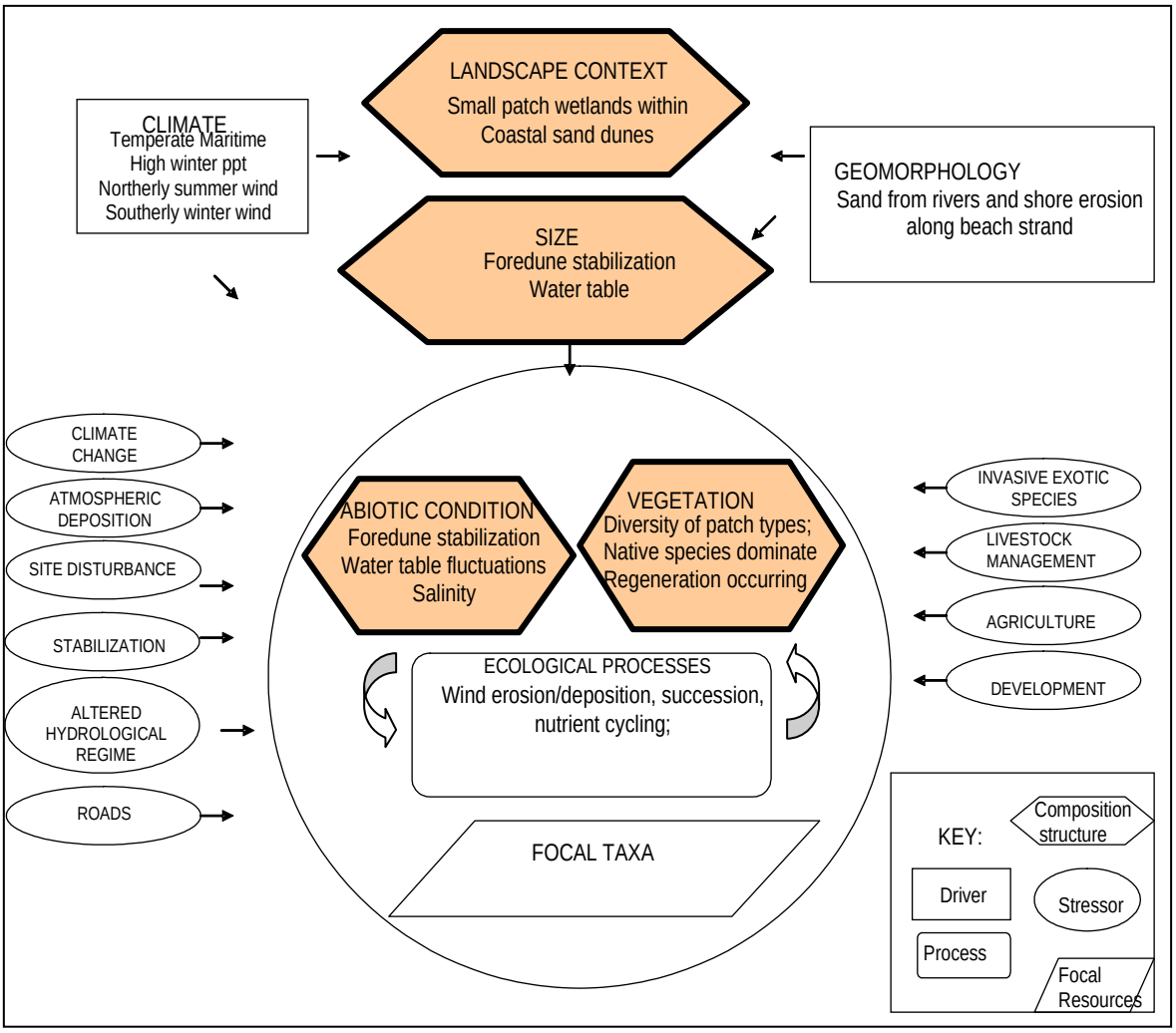

Figure 1. Conceptual Ecological Model for North Pacific Coastal Interdunal Wetland

Ecological Integrity Assessments

The assessment of ecological integrity can be done at three levels of intensity depending on the purpose and design of the data collection effort. The three-level approach is intended to provide increasing accuracy of ecological integrity assessment, recognizing that not all conservation and management decisions need equal levels of accuracy. The three-level approach also allows users to choose their assessment based in part on the level of classification that is available or targeted. If classification is limited to the level of forests vs. wetlands vs. grasslands, the use of remote sensing metrics may be sufficient. If very specific, fine-scale forest, wetland, and grassland types are the classification target then one has the flexibility to decide to use any of the three levels, depending on the need of the assessment. In other words, there is no presumption that a fine-level of classification requires a fine-level of ecological integrity assessment.

Because the purpose is the same for all three levels of assessment (to measure the status of ecological integrity of a site) it is important that the Level 1 assessment use the same kinds of metrics and major attributes as used at Levels 2 and 3. Level 1 assessments rely almost entirely

on Geographic Information Systems (GIS) and remote sensing data to obtain information about landscape integrity and the distribution and abundance of ecological types in the landscape or watershed. Level 2 assessments use relatively rapid field-based metrics that are a combination of qualitative and narrative-based rating with quantitative or semi-quantitative ratings. Field observations are required for many metrics, and observations will typically require professional expertise and judgment. Level 3 assessments require more rigorous, intensive field-based methods and metrics that provide higher-resolution information on the integrity of occurrences. They often use quantitative, plot-based protocols coupled with a sampling design to provide data for detailed metrics.

Although the three levels can be integrated into a monitoring framework, each level is developed as a stand-alone method for assessing ecological integrity. **When conducting an ecological integrity assessment, one need only complete a single level that is appropriate to the study at hand.** Typically only one level may be needed, desirable, or cost effective. But for this reason it is very important that each level provide a comparable approach to assessing integrity, else the ratings and ranks will not achieve comparable information if multiple levels are used.

Level 1 EIA

A generalized Level 1 EIA is provided in Rocchio and Crawford (2009). Please refer to that document for the list of metrics applicable to this ecological system.

Level 2 EIA

The following tables display the metrics chosen to measure most of the key ecological attributes in the conceptual ecological model above. The EIA is used to assess the ecological condition of an assessment area, which may be the same as the element occurrence or a subset of that occurrence based on abrupt changes in condition or on artificial boundaries such as management areas. **Unless otherwise noted, metric ratings apply to both Level 2 and Level 3 EIAs. The difference between the two is that a Level 3 EIA will use more intensive and precise methods to determine metric ratings.** To calculate ranks, each metric is ranked in the field according the ranking categories listed below. Then, the rank and point total for each metric is entered into the EIA Scorecard and multiplied by the weight factor associated with each metric resulting in a metric 'score'. Metric scores within a key ecological attribute are then summed to arrive at a score (or rank). These are then tallied in the same way to arrive at an overall ecological integrity score.

Table 1. North Pacific Coastal Interdunal Wetland Level 2 EIA.

Metric	Justification	Rank			
		A (5 pts.)	B (4 pts.)	C (3 pts.)	D (1 pts.)
Rank Factor: LANDSCAPE CONTEXT					
Key Ecological Attribute: *Buffer*					
Buffer Length	The buffer can be important to biotic and abiotic aspects of the wetland. Buffer Width Slope Multiplier 5-14% -->1.3; 15-40%-->1.4; >40%-->1.5	Buffer is > 75 – 100% of occurrence perimeter.	Buffer is > 50 – 74% of occurrence perimeter.	Buffer is 25 – 49% of occurrence perimeter	Buffer is < 25% of occurrence perimeter.
Buffer Width		Average buffer width of occurrence is > 200 m, adjusted for slope.	Average buffer width is 100 – 199 m, after adjusting for slope.	Average buffer width is 50 – 99 m, after adjusting for slope.	Average buffer width is < 49 m, after adjusting for slope.
Buffer Condition		Abundant (>95%) cover native vegetation, little or no (<5%) cover of non-native plants, intact soils, AND little or no trash or refuse.	Substantial (75–95%) cover of native vegetation, low (5–25%) cover of non-native plants, intact or moderately disrupted soils; minor intensity of human visitation or recreation.	Moderate (25–50%) cover of non-native plants, moderate or extensive soil disruption; moderate intensity of human visitation or recreation.	Dominant (>50%) cover of non-native plants, barren ground, highly compacted or otherwise disrupted soils, moderate or greater intensity of human visitation or recreation, no buffer at all.
Key Ecological Attribute: *Landscape Structure*					

Connectivity	Intact areas have a continuous corridor of natural or semi-natural vegetation between areas	Intact: Embedded in 90-100% natural habitat; connectivity is expected to be high.	Variegated: Embedded in 60-90% natural or semi-habitat; habitat connectivity is generally high, but lower for species sensitive to habitat modification;	Fragmented: Embedded in 20-60% natural or semi-natural habitat; connectivity is generally low, but varies with mobility of species and arrangement on landscape.	Relictual: Embedded in < 20% natural or semi-natural habitat; connectivity is essentially absent
Landscape Condition Model Index	The intensity and types of land uses in the surrounding landscape can affect ecological integrity.	Landscape Condition Model Index > 0.8		Landscape Condition Model Index 0.65 – 0.79	Landscape Condition Model Index < 0.65
Sand Dynamics	Sand dune systems are dependent on the ability of a mosaic of non- vegetated shifting sands and sparsely vegetated sand dunes or swales to freely shift.	Open/migrating stage, native anchored stage and native stabilized stage are present and transitions among stages functional	Open/migrating and native anchored stages present and exotic stabilizing species replacing native stabilizing species on <50% of total area.	Either open/migrating or native anchored stage present and exotic stabilizing species-replacing native stabilizing species on <50% of total area open/migrating and native anchored stages present and native stabilized on >50% of total area	One or both open/migrating or native anchored stages absent and exotic stabilizing species-replacing native stabilizing species on >50% of total area.
Rank Factor: CONDITION					
Key Ecological Attribute: *Vegetation Composition*					
Relative Cover Native Plant Species	Native species dominate this system; non-natives increase with human impacts.	Cover of native plants 95-100%.	Cover of native plants 80-95%.	Cover of native plants 50 to 79%.	Cover of native plants <50%.
Absolute Cover of Invasive Species	Invasive species can inflict a wide range of ecological impacts. Early detection is critical. *Phalaris arundinacea* and *Polygonum sahalinense*, are examples.	None present.	Invasive species present, but sporadic (<3% cover).	Invasive species prevalent (3–10% absolute cover).	Invasive species abundant (>10% absolute cover).
Relative Cover of Native Increasers	Some stressors such as grazing can shift or homogenize native composition toward species tolerant of stressors.	Absent or incidental	<10% cover	10-20% cover	>20% cover

Species Composition Note: Once developed, the Floristic Quality Assessment index could be used here instead.	The overall composition of native species can shift when exposed to stressors.	Species diversity/abundance at or near reference standard conditions. Native species sensitive to anthropogenic degradation are present, functional groups indicative of anthropogenic disturbance (ruderal or "weedy" species) are absent to minor, and full range of diagnostic / indicator species are present.	Species diversity/abundance close to reference standard condition. Some native species reflective of past anthropogenic degradation present. Some indicator/ diagnostic species may be absent.	Species diversity/abundance is different from reference standard condition in, but still largely composed of native species characteristic of the type. This may include ruderal ("weedy") species. Many indicator/diagnostic species may be absent.	Vegetation severely altered from reference standard. Expected strata are absent or dominated by ruderal ("weedy") species, or comprised of planted stands of non-characteristic species, or unnaturally dominated by a single species. Most or all indicator/diagnostic species are absent.
Key Ecological Attribute: *Vegetation Structure*					
Physical Patch Diversity	Intact sites have a diversity of environments	Full range of physical patch types expected at any given interdunal wetland such as wet bare swales, herbaceous swales, shrub swales, open water are present. Human-induced impacts have not eliminated the presence of any patch types.		Most physical patch types are present but some may have been lost or eliminated due to human-induced impacts.	Many physical patch types are missing from the site due to human-induced impacts. Patch diversity has been homogenized.
Coarse Woody Debris	Accumulation of coarse woody debris is minimal in these shrublands. Too much CWD can increase risk from fire.	CWD is common or frequently observed; all size classes	CWD occasionally observed to present; moderate to small size classes		CWD is rare absent; mostly small size class
Key Ecological Attribute: *Hydrology*					
Water Source	Anthropogenic sources of water can have detrimental effects on the hydrological regime	Source is natural or naturally lacks water in the growing season. No indication of direct artificial water sources	Source is mostly natural, but site directly receives occasional or small amounts of inflow from anthropogenic sources	Source is primarily urban runoff, direct irrigation, pumped water, artificially impounded water, or other artificial hydrology	Water flow has been substantially diminished by human activity
Hydrological Connectivity (Non-riverine)	Surface water movement should not be impeded by anthropogenic structures or activities.	Rising water in the site has unrestricted access to adjacent upland, without levees, excessively high banks, artificial barriers, or other obstructions to the lateral movement of flood flows.	Lateral excursion of rising waters is partially restricted by unnatural features, such as levees or excessively high banks, but < than 50% of the site is restricted by barriers to drainage. Restrictions may be intermittent along the site, or the restrictions may occur only along one bank or shore. Flood flows may exceed the obstructions, but drainage back to the wetland is incomplete due to impoundment.	Lateral excursion of rising waters is partially restricted by unnatural features, such as levees or excessively high banks, and 50-90% of the site is restricted by barriers to drainage. Flood flows may exceed the obstructions, but drainage back to the wetland is incomplete due to impoundment.	All water stages in the site are contained within artificial banks, levees, sea walls, or comparable features, or greater than 90% of wetland is restricted by barriers to drainage. There is essentially no hydrologic connection to adjacent uplands.
Key Ecological Attribute: *Physicochemical*					

Soil Surface Condition	Soil disturbance can result in erosion thereby negatively affecting many ecological processes	Bare soil areas are limited to naturally caused disturbances such as low tide exposure, flood deposition or game trails	Some bare soil due to human causes but the extent and impact is minimal. The depth of disturbance is limited to only a few inches and does not show evidence of ponding or channeling water.	Bare soil areas due to human causes are common. There may be pugging due to livestock resulting in several inches of soil disturbance. ORVs or other machinery may have left some shallow ruts.	Bare soil areas substantially & contribute to altered hydrology or other long-lasting impacts. Deep ruts from ORVs or machinery may be present, or livestock pugging and/or trails are widespread. Water will be channeled or ponded.
Water Quality	Excess nutrients, sediments, or other pollutant have an adverse affect on natural water quality	No evidence of degraded water quality. Water is clear; no strong green tint or sheen.	Some negative water quality indicators are present, but limited to small and localized areas. Water may have a minimal greenish tint or cloudiness, or sheen.	Negative indicators or wetland species that respond to high nutrient levels are common. Water may have a moderate greenish tint, sheen or other turbidity with common algae.	Widespread evidence of negative indicators. Algae mats may be extensive. Water may have a strong greenish tint, sheen or turbidity. Bottom difficult to see during due to surface algal mats and other vegetation blocking light to the bottom.
Rank Factor: SIZE					
Key Ecological Attribute: *Size*					
Relative Size	Indicates the proportion lost due to stressors.	Site is at or minimally reduced from natural extent (>95% remains)	Occurrence is only modestly reduced from its original natural extent (80-95% remains)	Occurrence is substantially reduced from its original natural extent (50-80% remains)	Occurrence is severely reduced from its original natural extent (<50% remains)
Absolute Size	Occurrences of this size may have relatively high species diversity and are well buffered from edge effects.	> 100 ac/ 40 ha	10-100 ac/4-40 ha	1-10 ac/0.5-4 ha	< 1 ac/0.5 ha

Level 3 EIA
Level 3 metrics would include more quantitative measures of the metrics listed above. In addition, the following metrics should be considered in a Level 3 EIA:

- Nitrate/Nitrite
- Ammonia
- Phosphorus

Triggers or Management Assessment Points
Ecological triggers or conditions under which management activities need to be reassessed are shown in the table below. Since the Ecological Integrity rankings are based on hypothesized thresholds, they are used to indicate where triggers might occur. Specific details about how these triggers translate for each metric can be found by referencing the values or descriptions for the appropriate rank provided in the Table above.

Table 2. Triggers for Level 2 & 3 EIA

Key Ecological Attribute or Metric	Trigger	Action
Any metric (except Connectivity)	▪ C rank ▪ Shift from A to B rank ▪ negative trend within the B rating (Level 3)	Level 2 triggers: conduct Level 3 assessment; make appropriate short-term management changes to ensure no further degradation Level 3 triggers: make appropriate management adjustments to ensure no additional degradation occurs. Continue monitoring using Level 3.
Any Key Ecological Attribute	▪ any metric has a C rank ▪ > ½ of all metrics are ranked B ▪ negative trend within the B rating (Level 3)	Level 2 triggers: conduct Level 3 assessment; make appropriate short-term management changes to ensure no further degradation Level 3 triggers: make appropriate management adjustments to ensure no additional degradation occurs. Continue monitoring using Level 3.

Protocol for Integrating Metric Ranks
If desired, the user may wish to integrate the ratings of the individual metrics and produce an overall score for the three rank factor categories: (1) Landscape Context; (2) Condition; and (3) Size. These rank factor rankings can then be combined into an Overall Ecological Integrity Rank. This enables one to report scores or ranks from the various hierarchical scales of the assessment depending on which best meets the user's objectives. Please see Table 5 in Rocchio and Crawford (2009) for specifics about the protocol for integrating or 'rolling-up' metric ratings.

Supporting documents for the EIAs can be found at:
http://www1.dnr.wa.gov/nhp/refdesk/communities/eia.html

Documentation about Ecological Systems can be found at:
http://www1.dnr.wa.gov/nhp/refdesk/communities/ecol_systems.html

References

Christy, J.A., J.S. Kagan, and A.M. Wiedemann. 1998. Plant associations of the Oregon Dunes National Recreation Area. Siuslaw National Forest, Oregon. US Department of Agriculture, Forest Service. PNW Region. Technical Paper R6-NR-ECOL-TP-09-98.

Grootjans, A.P., E.B. Adema, R.M. Bekker and E.J. Lammerts. 2004. Why Young Coastal Dune Slacks Sustain a High Biodiversity. 2004. *in* Coastal Dunes, Ecology and Conservation Ecological Studies 171. M.L.Martínez, N.P. Psuty (Eds.) Springer-Verlag.

NatureServe Explorer. 2007. Descriptions of Ecological Systems for the State of Washington. Data current as of October 06, 2007. NatureServe, Arlington, VA. [http://www.natureserve.org/explorer/index.htm]

Rocchio, F.J. and R.C. Crawford. 2009. Monitoring Desired Ecological Conditions on Washington State Wildlife Areas Using an Ecological Integrity Assessment Framework. Washington Natural Heritage Program, Washington Department of Natural Resources, Olympia, WA.

Wiedemann A. M. 1984. The Ecology of Pacific Northwest Coastal sand dunes: a community profile. U.S.Fish Wildl. Serv. FWS/OBS-84/04.

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