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SHORELINE INVENTORY AND CHARACTERIZATION REPORT

FOR

LEWIS COUNTY, AND THE CITIES OF CENTRALIA, CHEHALIS, WINLOCK, AND MORTON

Prepared for:
Lewis County Community Development

Ecology Grant # G1200468

HERRERA

AHBL

core GIS
COMMUNITY, REGIONAL & ENVIRONMENTAL

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SHORELINE INVENTORY AND CHARACTERIZATION REPORT

FOR
LEWIS COUNTY AND THE CITIES OF CENTRALIA, CHEHALIS, MORTON, AND WINLOCK

Prepared for
Lewis County Community Development
2025 NE Kresky Avenue
Chehalis, Washington 98532

Prepared by
Herrera Environmental Consultants, Inc.
2200 Sixth Avenue, Suite 1100
Seattle, Washington 98121
Telephone: 206/441-9080

AHBL
1200 Sixth Avenue, Suite 1620
Seattle, Washington 98101

and

CORE GIS
355 NW 47th Street
Seattle Washington 98107

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CONTENTS

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LIMITATIONS

As with any report, there are limitations (inherent or otherwise) that must be acknowledged. This report is limited to the subjects covered, materials reviewed, and data available at the time the report was prepared. The authors and reviewers have made a sincere attempt to provide accurate and thorough information using the most current and complete information available and their own best professional judgment. If you have questions regarding the content of this report, please contact the Lewis County Community Development department.

GLOSSARY

Active channel: The portion of the channel or floodplain network that receives periodic scour and/or fill during sediment transport events.

Alluvial fan: A low, outspread mass of loose materials (sand, cobbles, boulders), with variable slope, shaped like an open fan or a segment of a cone, deposited by a stream at the place where it issues from a narrow mountain or upland valley; or where a tributary stream is near or at its junction with the main stream.

Alluvium: Material (sand, gravel, cobbles, or small boulders) that is deposited by flowing water.

Anabranching: A channel pattern that is characterized by low width-depth ratio, gentle gradient, variable peak discharge, frequent flooding, and high sediment load. Anabranching rivers consist of multiple channels separated by vegetated semi-permanent alluvial floodplain islands excised from existing floodplain or formed by within-channel or deltaic accretion. The development of anabranches is related to rapid and frequent avulsions of the river channels and lateral migration.

Anthropogenic: Caused either directly or indirectly by human activity.

Avulsion: The process in which a stream rapidly abandons a developed channel and creates a new one.

Bedrock: Bedrock is a general term that includes any of the generally indurated or crystalline materials that make up the earth‘s crust.

Braided stream: A channel or stream that has interconnecting multiple channels formed by flow that repeatedly divides and converges around mid-channel bars. In the plan view, the channel resembles strands of a complex braid. Braiding is generally confined to broad, shallow streams of low sinuosity, variable discharge, high bedload, non-cohesive bank material, and a steep gradient.

Channel confinement: The width between the channel’s valley walls relative to the width of the active channel. Used to describe how much a channel can potentially shift within its valley.

Channel migration: The lateral or downstream shifting of a river channel within a river valley.

Debris flow: A fast moving, liquefied landslide of mixed and unconsolidated water and debris.

Delta: A body of alluvium consisting mostly of stratified clay, silt, sand, and gravel, nearly flat and fan-shaped, deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, usually a sea or lake.

Ditch: An artificial channel that is designed to convey water and drain perennially or seasonally wet areas.

Floodplain: An area of low-lying ground adjacent to a river, formed mainly of river sediments and subject to flooding.

Fluvial: Of or pertaining to rivers or streams; produced by stream action.

Incision: The process of downcutting into a stream channel leading to a decrease in the channel bed elevation.

Levee: An embankment built to prevent the overflow of a river.

Management Area: A management area is an area of shoreline typically distinguished by similar characteristics relating to the relative intensity of land use, the physical landscape and/or critical hydrogeomorphic or biological processes. Management areas are comprised of smaller units called reaches.

Mass wasting: The down slope movement of material due to gravity (rather than water, wind, or ice, for example).

Meander: One of a series of freely developing sinuous curves or loops produced as the stream moves from side to side of its floodplain. **Meander bend** is the convex side of a meander. **Meander bend migration** is the lateral or downstream movement of a sinuous curve in a stream within a river valley

Ordinary high water mark: On all lakes, streams, and tidal water is 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.

Oxbow lake: A crescent-shaped, body of standing water along a stream created by a **meander-bend cutoff** or **avulsion**. Once isolated, oxbow lakes will slowly fill up with sediment, as point bar sands and gravels are buried by silts, clays, and organic material carried in by floods and by sediment slumping in from sides as rain fills up lake.

Oxbow: A closely looping stream meander having an extreme curvature such that only a neck of land is left between the two parts of the stream.

Planform: The shape and size of channel and overbank features as viewed from above.

Point bars: Bars that are formed on the inside of meander bends.

Puget Lobe: The southernmost finger of the Cordilleran Ice Sheet that advanced into and filled the Puget Lowland.

Puget Lowland: The low area between the Olympic and Cascade mountain ranges.

Reach: A segment of shoreline that has a similar geomorphic context used for assessment of ecological conditions. Reaches are smaller units that comprise the management areas.

Relic channel: An abandoned channel that is not presently active.

Revetment: A sloping structure placed on banks in such a way as to absorb the energy of waves or flowing water.

River [streams]: A general term for a natural, freshwater surface stream of considerable volume and generally with a permanent base flow, moving in a defined channel toward a larger river, lake, or sea. Rivers are a subset of **streams**.

Shoreline Armoring: Placing a fixed, immobile structure along the shoreline to protect uplands from current- and wave-induced erosion. Armoring can include, but is not limited to, bulkheads and placed rock (riprap).

Stream: A naturally occurring body of periodic or continuously flowing water where: (1) The mean annual flow is greater than 20 cubic feet per second; and (2) the water is contained within a channel. A channel is an open conduit either naturally or artificially created. This definition does not include artificially created irrigation, return flow, or stock watering channels. Rivers, creeks, brooks and runs are all streams.

Tributary: A stream flowing into a larger stream or lake.

Valley: An elongate, relatively large, externally drained depression that is primarily developed by stream erosion or glacial activity.

List of Acronyms and Abbreviations

CAO	Critical Areas Ordinance
cfs	cubic feet per second
CenMC	Centralia Municipal Code
CheMC	Chehalis Municipal Code
CMZ	Channel Migration Zone
Corps	U.S. Army Corps of Engineers
DPS	Distinct Population Segment
Ecology	Washington Department of Ecology
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
GIS	Geographic Information Systems
GMA	Growth Management Act
LWD	Large Woody Debris
NLCD	National Land Cover Data
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
PCB	Polychlorinated Biphenyl
PHS	Priority Habitats and Species
PUD	Public Utility District
RCW	Revised Code of Washington
RGP	Regional General Permit
SEPA	State Environmental Policy Act
SMA	Shoreline Management Act
SMP	Shoreline Master Program
SSURGO	Soil Survey Geographic Database

UGA	Urban Growth Area
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WRIA	Watershed Resource Inventory Area

EXECUTIVE SUMMARY

This Shoreline Inventory and Characterization Report was prepared in support of the Comprehensive Shoreline Master Program (SMP) update for the Lewis County Coalition (referred to as the Coalition). The Coalition SMP update covers Lewis County, and the cities of Centralia, Chehalis, Winlock, and Morton. This work was funded by a Washington State Department of Ecology (Ecology) grant to help update the Coalition's SMP.

Washington's Shoreline Management Act of 1971 (SMA) and its implementing State SMP Guidelines adopted in 2003 require an update to the Coalition members SMPs. Lewis County's SMP was last amended in 1998; the city of Centralia's SMP was originally adopted in 1977 and subsequent amendments were not formally adopted; the city of Chehalis' SMP was last amended in 1982; and the city of Morton and Winlock's SMPs were adopted in 1977 and were not amended.

Under these SMP Guidelines, the Coalition must base the master program provisions on an analysis of the most relevant and accurate scientific and technical information (Washington Administrative Code (WAC) 173-26-201(3)(c) and (d)). This includes meeting the mandate of "no net loss" of shoreline ecological functions as well as providing mechanisms for restoration of impaired shoreline functions. The Shoreline Inventory and Characterization Report is not a binding regulatory document but rather provides guidance for potential future updates to the SMP.

The Coalition's SMP update is a multi-year process, which begins with an inventory and characterization of existing environmental and land use conditions. The report contains an inventory of a variety of elements, including land use, landscape processes, and ecological functions. These elements are spatially catalogued using a Geographic Information System (GIS), where possible, and are presented as a Map Folio that covers the Coalition SMP jurisdiction. Together, these elements define what is understood to be the existing present day condition, help inform the review of current shoreline regulations, and highlight areas where changes may be necessary to meet shoreline management goals for water dependent uses, public access and the protection of natural resources.

Key information provided in this report includes: characterization of existing ecological functions through an analysis of both physical and biological processes; analysis of existing land uses, shoreline modifications, land capacity, public access, and areas under public ownership or preservation holdings; preliminary identification of restoration opportunities; evaluation of current shoreline environment designations, their purpose and criteria; and recommendations for the SMP to help meet the SMP Guidelines.

1. INTRODUCTION

1.1. Background and Purpose

The Shoreline Master Program (SMP) update covers the jurisdictions that make up the Lewis County Coalition (Coalition): Lewis County, and the cities of Centralia, Chehalis, Winlock, and Morton. The Coalition's SMP update requires preparation of the Shoreline Inventory and Characterization Report to be used as a foundation for the SMP update process (WAC 173-26-201(3)(c) and (d)). This document was prepared to fulfill that requirement and serves to:

- Inform the review of current shoreline regulations required by the update process
- Highlight areas where shoreline resources protection measures and shoreline use designations could be improved to meet shoreline management goals

Information provided includes existing physical conditions as well as data and descriptions of watershed and shoreline attributes that pertain to the Coalition SMP jurisdiction. In addition, existing ecosystem processes, land uses, and development patterns are characterized. Descriptions of, shoreline functions and opportunities for restoration, public access, and shoreline use are also provided.

The Shoreline Inventory and Characterization Report accomplishes the following:

- It provides supporting information for determining updated environmental designations. This includes an analysis of existing ecological functions and a detailed inventory of existing physical and biological conditions per WAC 173-26-201(3)(c).
- Establishes the baseline for "no net loss" of ecological conditions and thereby informs current and future policy development, land use planning, and regulatory effectiveness
- Identifies opportunities for protection, improving public access, and supporting water dependent uses
- Identifies degraded areas and restoration opportunities for incorporation into a separate comprehensive restoration plan

1.2. Scope and Organization of Shoreline Inventory and Characterization

The scope of this inventory and characterization includes all Shorelines of the State as defined by RCW 90.58.30. For the Coalition, this includes all land:

- Within 200 feet of the ordinary high water mark of rivers and streams with more than 20 cubic feet per second annual flow
- Within 200 feet of the ordinary high water mark of lakes and reservoirs greater than 20 acres in area
- In the adopted floodway or the 2010 flood channel study area
- In the contiguous floodplain extending 200 feet landward from the adopted floodway or the 2010 flood channel study area
- In associated wetlands. A wetland is associated if any part of it lies within the area 200 feet from the ordinary high water mark or within the floodplain 200 feet landward of the adopted floodway or the 2010 flood channel study area.

The extents of the Coalition SMP jurisdiction are shown on Maps 1A and 1B in Appendix A: Map Folio. In hilly and alpine areas of the county, shorelines typically consist of a 200-foot wide band on either side of streams confined in narrow valleys. In lowland valleys the band of jurisdictional shoreline tends to be wider due to stream meandering, the width of the adopted floodway or the 2010 flood channel study area and the inclusion of associated wetlands. In addition to the lake-like shorelines of the Cowlitz reservoirs, there are a few isolated lakes in both alpine areas and lowlands.

This report is organized as follows:

Section 1: Introduction provides general background information on the state SMA and the larger regulatory framework.

Section 2: Inventory & Characterization Methods discusses the methodology used by the Shoreline Inventory and Characterization

Section 3: Ecosystem-wide Processes is an overview of the Coalition's shoreline ecosystems. This general overview profiles larger scale ecosystem processes observed in the Coalition SMP jurisdiction including physical constraints such as climate, topography, geology, key processes related to shoreline ecosystem functions, and the types of habitats and species present.

Section 4: Discussion of Shoreline Management Areas includes specific discussions of the individual shoreline planning areas, called management areas, and, and the smaller shoreline evaluation units called reaches. Reaches are detailed sections for each management area that characterize physical and biological conditions in nearshore reaches, existing land uses, future uses based on the Comprehensive Plans of the jurisdictions, shoreline modifications, historic and cultural resources, and public access potential. Included within these subsections are an analysis of shoreline reaches and identification of potential restoration opportunities.

Section 5: Shoreline Land Capacity Analysis discusses the current and potential land uses in the shoreline jurisdiction.

Section 6: Public Access Analysis examines current and potential opportunities for public access in the shoreline jurisdiction.

Section 7: Data Gaps identifies data gaps in the Shoreline Inventory and Characterization Report that would be helpful to close for future planning

Section 8: Shoreline Management Recommendations provides guidance for the next phases of the SMP update process

Section 9: References provides bibliographical information on the sources used for the Shoreline Inventory and Characterization

The appendices include the following information:

Appendix A Map Folio

Appendix B Priority Habitats and Species

Appendix C Reach-scale Functional Assessment

Appendix D Reach Data Sheets

1.3. Regulatory Framework

1.3.1. Shoreline Management Act

To manage the shorelines of the state, the state legislature passed the Shoreline Management Act (SMA) in 1971 and citizens of the state adopted it by referendum in 1972. The overarching goal of the SMA is "…to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines." There are three basic policy areas to the SMA: shoreline use, environmental protection, and public access. The SMA emphasizes accommodation of reasonable and appropriate uses, protection of shoreline environmental resources, and protection of the public's right to access and use the state shorelines (see Revised Code of Washington (RCW) 90.58.020).

Under the SMA, each city and county with shorelines of the state must adopt an SMP, based on state laws and regulations, but tailored to the specific geographic, economic, and environmental needs of the community. Cities and counties are the primary regulators. The Department of Ecology (Ecology) acts primarily in a support and review capacity, but is required to approve certain kinds of permits, such as Shoreline Conditional Use Permits and Variances, and must approve new or amended SMPs.

In 2002, the SMA was amended to require that no net loss of shoreline ecological function occurs and that planning for restoration of impaired shoreline functions is provided. The 2002 amendment requires that when local SMPs are updated, the new standards, setbacks, and buffers are not retroactive. Updated SMP requirements will apply only to new activities located in shoreline areas as well as where existing activities are converted to other uses. Additionally, the SMP allows for repair and maintenance of existing structures, subject to building requirements imposed separately by local jurisdictions.

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1.3.4. City of Chehalis

The city of Chehalis' SMP was last amended in 1982. The city adopted its Comprehensive Plan in 1999, with amendments in 2003 and 2011. The goals of the Comprehensive Plan are directed toward ensuring a safe healthful environment, coherent and effective public planning for the future, cost effective public services and facilities, and economic growth and security.

The city updated its critical areas regulations in 2009. In Section 17.25.030 of the Chehalis Municipal Code (CheMC), stream buffers range from 25 to 150 feet depending on the type of the stream, with Type S water bodies (i.e., shorelines of the state) having a 150-foot buffer. In CheMC Section 17.23.030, minimum wetland buffers range from 50 to 225 feet, depending on category and wildlife function. Specific buffers are not established for fish and wildlife habitat conservation areas; however, buffers are based on recommendations provided by the Washington Department of Fish and Wildlife (WDFW) PHS Program or another qualified source.

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1.3.7. State Agencies and Regulations

Aside from the SMA, state regulations most pertinent to development in the Coalition's SMP jurisdiction include the State Hydraulic Code, the GMA, the State Environmental Policy Act (SEPA), the Clean Water Act (CWA), tribal agreements and case law, the Watershed Planning Act, the Water Resources Act, and the Salmon Recovery Act. A number of state agencies implement these regulations or may own shoreline areas. In addition to Ecology's oversight of particular aspects of the SMP, other agency reviews of shoreline developments are triggered by in- or over-water work, discharges of fill or pollutants into the water, or substantial land clearing.

Depending on the nature of the proposed development, state regulations can play an important role in the design and implementation of a shoreline project, ensuring that impacts on shoreline functions and values are avoided, minimized, and/or mitigated. During the SMP update, the Coalition will consider other state regulations to ensure consistency as appropriate and feasible with the goal of streamlining the shoreline permitting process. A summary of some of the key state regulations and/or state agency responsibilities follows.

1.3.7.1. State Environmental Policy Act

SEPA was adopted in 1971 (Chapter 43.21C RCW) to ensure that environmental values were considered during decision-making by state and local agencies. The environmental review process in SEPA is designed to work with other regulations to provide a comprehensive review of a proposal. Most regulations focus on particular aspects of a proposal, while SEPA requires the identification and evaluation of probable impacts on all elements of the built and natural environment. Combining the review processes of SEPA and other laws reduces duplication and delay by combining study needs; combining comment periods and public notices; and allowing agencies, applicants, and the public to consider all aspects of a proposal at the same time.

1.3.7.2. Section 401 Water Quality Certification

Section 401 of the federal CWA allows states to review, condition, and approve or deny certain federal permitted actions that result in discharges to state waters, including wetlands. In Washington, Ecology is the state agency responsible for conducting that review, with their primary review criteria of ensuring that state water quality standards are met. Actions within streams or wetlands within the shoreline jurisdiction that require a Section 404 permit will also need to be reviewed by Ecology.

1.3.7.3. State-Owned Aquatic Lands

The Washington Department of Natural Resources (WDNR) is responsible for protecting and managing use of state-owned aquatic lands. Toward that end, water-dependent uses waterward of the ordinary high water mark require review by WDNR to establish whether the project is on state-owned aquatic lands. Certain project activities, such as single-family or two-party joint-use residential piers, on state-owned aquatic lands are exempt from these requirements. WDNR recommends that all proponents of a project waterward of the ordinary high water mark contact them to determine jurisdiction and requirements.

1.3.7.4. Watershed Planning Act

The Watershed Planning Act (Chapter 90.82 RCW) was passed in 1998 to encourage local planning of local water resources. It recognizes that there are citizens and entities in each watershed that "…have the greatest knowledge of both the resources and the aspirations of those who live and work in the watershed; and who have the greatest stake in the proper, long term management of the resources." There are a number of local watershed planning efforts consistent with the Watershed Planning Act. Examples of these efforts are the Chehalis Basin Partnership and Lower Columbia Fish Recovery Board WRIA planning units, and the development and implementation of plans such as the Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan (NMFS 2012) for managing water resources in partnership with member agencies and organizations. These groups and plans also recognize and help to implement other plans such as those developed to manage total maximum daily load (TMDL) on a watershed scale.

1.3.7.5. Hydraulic Code

The Hydraulic Code (Chapter 77.55 RCW) gives the WDFW the authority to review, condition, and approve or deny "…any construction activity that will use, divert, obstruct, or change the bed or flow of State Waters." These activities may include stream alteration, culvert installation or replacement, pier and bulkhead repair or construction, among others. WDFW can condition projects to avoid, minimize, restore, and compensate adverse impacts.

1.3.7.6. Water Pollution Control Act

The Water Pollution Control Act (Chapter 90.48 RCW) establishes the state's policy "…to maintain the highest possible standards to insure the purity of all waters of the State consistent with public health and public enjoyment thereof, the propagation and protection of wild life, birds, game, fish and other aquatic life, and the industrial development of the State, and to that end require the use of all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the State of

Washington." Ecology is charged with creating and implementing rules and regulations in accordance with this legislation.

1.3.7.7. Growth Management Act

The GMA (Chapter 36.70A RCW) was passed in 1990 and has been amended a number of times since. The GMA provides a framework for regional coordination, and counties planning under the GMA, such as Lewis County, are required to adopt Countywide Planning Policies to guide plan adoption within the county and to establish urban growth areas (UGAs). The Coalition's Comprehensive Plans must include the following elements: land use, housing, capital facilities, utilities, transportation, and, for counties, a rural element. SMP policies are an element of local Comprehensive Plans.

1.3.8. Federal Regulations

Federal regulations most pertinent to development in the shorelines of the Lewis County include the Endangered Species Act (ESA), the CWA, and the Rivers and Harbors Appropriation Act. Other relevant federal laws include the National Environmental Policy Act, tribal agreements and case law, Anadromous Fish Conservation Act, Clean Air Act, and the Migratory Bird Treaty Act. A variety of federal agencies implement these regulations, but review of shoreline development by these agencies would be triggered in most cases by in- or over-water work, or discharges of fill or pollutants into the water.

Depending on the nature of the proposed development, federal regulations can play an important role in the design and implementation of a shoreline project, ensuring that impacts on shoreline functions and values are avoided, minimized, and/or mitigated. During the SMP update, the Coalition will consider these other federal regulations to ensure consistency as appropriate and feasible with the goal of streamlining the shoreline permitting process. A summary of some of the key federal regulations and/or federal agency responsibilities follows.

1.3.8.1. Section 404 – Clean Water Act

Section 404 of the CWA establishes a program to regulate the discharge of dredge or fill material into waters of the United States, including wetlands. Activities in waters of the United States regulated under this program include fill for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports), and mining projects. Section 404 requires a permit before dredged or fill material may be discharged into waters of the United States, unless the activity is exempt from Section 404 regulation, such as certain farming and forestry activities. Key agencies with responsibilities include the U.S. Army Corps of Engineers (Corps), the Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (USFWS), and the National Marine Fisheries Service (NMFS).

1.3.8.2. Section 10 – Rivers and Harbors Appropriation Act

Section 10 of the Rivers and Harbors Appropriation Act of 1899 provides the Corps with authority to regulate activities that may affect navigation of "navigable" waters. Designated "navigable" waters in Lewis County may include the Chehalis River (navigable to river mile 68) and the Cowlitz River (navigable to river mile 34).

Proposals to construct new or modify existing over-water structures (including bridges); to excavate or fill, or to "…alter or modify the course, location, condition, or capacity of…" navigable waters must be reviewed and approved by the Corps.

1.3.8.3. Endangered Species Act

Section 9 of the ESA prohibits "take" of listed species. "Take" has been defined in Section 3 as "…harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The "take" prohibitions of the ESA apply to everyone, so any action that results in a "take" of listed fish or wildlife would be a violation of the ESA and is strictly prohibited. Per Section 7 of the ESA, activities with potential to affect federally listed or proposed species and that either require federal approval, receive federal funding, or occur on federal land must be reviewed by the NMFS and/or USFWS using a process called "consultation."

1.3.8.4. Clean Water Act

The CWA has a number of programs and regulatory components, but of particular relevance to the Coalition is the National Pollutant Discharge Elimination System (NPDES) program. In the state, Ecology has been delegated the responsibility by the EPA for managing implementation of this program. The county is engaged in preparing to comply with the 2012 NPDES Phase II Municipal Stormwater General Permit requirements that address stormwater system discharges to surface waters.

2. INVENTORY & CHARACTERIZATION METHODS

2.1. Inventory Data and Information Sources

Analysis and conclusions presented in this report were based on a review of existing information including published studies, private and agency authored technical reports and databases, GIS-based information and mapping, aerial and oblique photography of the Coalition SMP jurisdiction.

Development of a shoreline inventory is intended to record the existing or baseline conditions upon which the development of SMP provisions will be examined to ensure the adopted regulations provide no net loss of shoreline ecological functions. Table 2.1 lists those inventory elements for which data were available and used in this report. It includes all data elements required by WAC 173-26-201(3)(c). Maps depicting many of the inventory elements listed in Table 2.1 are provided in Appendix A: Map Folio. Note that not all inventory elements listed in Table 2.1 are shown in the map folio.

2.2. GIS Methods

GIS analysis was conducted to create the Map Folio, which displays a wide range of land use, environmental, and ecological conditions along the shoreline jurisdiction. The Map Folio is provided in Appendix A. Datasets listed in Table 2.1 were used to create the inventory maps.

GIS was used to analyze shoreline function at both the broad-scale shoreline management area level and the more refined reach area scale. Analysis was conducted to determine areas of intersect between reaches and the applicable datasets, such as priority habitat species, wetlands, and zoning. Areas of intersection were calculated in acres or linear feet, based on the characteristics of the dataset.

2.3. Determination of Management Areas and Reaches

In accordance with Ecology guidance, the planning area may contain a nested system of management areas and reaches (Ecology 2010). The shorelines in the Coalition SMP jurisdiction were divided into reaches and those reaches were grouped into management areas in order to inventory shorelines and analyze functions. Management areas were grouped based on contributing watersheds, overall intensity, and type of land use patterns, and physical and biological conditions. Each participating city was defined as a single management area, and shorelines in unincorporated Lewis County were grouped in management areas by watershed resource inventory area (WRIA).

There are four WRIAs that contain jurisdictional shorelines within the county: Nisqually (WRIA 11), Deschutes (WRIA 13), Upper Chehalis (WRIA 23), and Cowlitz (WRIA 26). The portions of the Nisqually and Deschutes WRIAs within the county are relatively homogenous with respect to landscape-scale characteristics (e.g., topography, lithology, precipitation,

Table 2.1. Required Shoreline Inventory Elements and Data Sources.

Inventory Element	Information Used	Data Sources	Map No.	1: 48,000	1: 9,600	City
Shoreline Jurisdiction	Shoreline Jurisdiction	USFWS NWI, Ecology, Lewis County, WSDOT, FEMA, NRCS NAIP	1	1A	1B	-
Reach Breaks	1:48,000 Aerial Photograph Maps	NRCS NAIP 2011	2	2A	2B	-
Shoreline and adjacent land use patterns	Public Lands/Ownership	Lewis County Assessor, Department of Natural Resources	3	3A	3B	-
	Planned Land Use	Lewis County, City of Centralia, City of Chehalis, City of Morton, City of Winlock	4	4A	4B	4C
	Current Land Use	Lewis County Assessor	5	5A	5B	-
	Water Oriented Use	Lewis County Assessor, AHBL	6	6A	6B	-
	Sewer	Lewis County	7	7A	7B	-
Transportation	Roads	Washington State Department of Transportation	No Map	-	-	-
Surface Water Systems	Lakes, Streams and Wetlands	Washington State Department of Natural Resources	8	8A	8B	-
	Floodway (adopted and draft), Floodplains, Wetlands	FEMA	8	8A	8B	-
Soils	Soils	USDA NRCS SSURGO Database	9	9A	9B	-
Geology and Geologic Hazards	Surficial Geology	Washington Division of Geology and Earth Resources	10	10A	10B	-
	Mudflow Risk	USGS	11	11A	11B	-
	Rainier Blast Zone	USGS	11	11A	11B	-
	Liquefaction, Seismic Hazards	Washington State Department of Natural Resources	12	12A	12B	-
	Erosion Hazards	USDA NRCS SSURGO Database	13	13A	13B	-
	Landslide Hazards	Washington State Department of Natural Resources	14	14A	14B	-
	Channel Migration Zone	Lewis County, Pierce County, Washington State Dept. of Ecology	28	28A	28B	-
Land Cover	Land and Vegetation Cover	USGS GAP Database	15	15A	15B	-
	Impervious Surfaces	CORE GIS	16	16A	16B	-
Critical Areas	Wetlands	National Wetland Inventory (NWI)	8	8A	8B	-
	Aquifer Recharge Areas	Lewis County, Washington State Department of Health	No Map	-	-	-

	Floodplain	FEMA	8	8A	8B	-

Table 2.1 (continued). Required Shoreline Inventory Elements and Data Sources.

Inventory Element	Information Used	Data Sources	Map No.	1: 48,000	1: 9,600	City
Habitats and Species	Fish and Wildlife Conservation Areas	NWI, Washington Department of Fish and Wildlife (WDFW) Priority Habitat and Species (PHS) Database	8, 17	8A, 17A	8B, 17B	8C, 17C
	Species and Habitat Observations (points and areas)	WDFW PHS Database	17	17A	17B	17C
	Sensitive Fish and Wildlife Information (defined in WDFW Policy 5210)	WDFW PHS Database	No Map	-	-	-
	Fish Distribution and designated critical habitat	WDFW PHS Database, SalmonScape, StreamNet, Federal Register	18	18A	18B	-
	Local Habitat Assessment	WDFW (Carleton and Jacobson 2009)	27	27A	27B	27C
Shoreline Modifications	Dikes/Levees	Washington State Department of Ecology	19	19A	19B	-
	Dams	Ecology (2013)	20	No map	No map	-
Water Quality	303d Listed Waters	Washington State Department of Ecology	21	21A	21B	-
Public Access	Public Access	Lewis County Assessor, AHBL	22	22A	22B	-
	Parks	Lewis County	22	22A	22B	-
	Golf Courses	Lewis County	22	22A	22B	-
Restoration Opportunities	Potential Restoration Actions	PRISM, HWS	23	No map	No map	-
Ecology Permitted Sites	Toxic Sites (State Cleanup Sites, Active Underground Storage Tanks)	Washington State Department of Ecology	24	24A	24B	-
Historical and Cultural Resources	Sites and Structures on the Washington State Heritage Register	Department of Archaeology and Historic Preservation	No Map	-	-	-
Shoreline Environment Designations			26	26A	26B	26C

PRISM = Project Information System
HWS = Habitat Work Schedule

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land cover), but the Upper Chehalis and Cowlitz WRIAs encompass diverse landscapes across which there are substantial differences in ecosystem processes, so these WRIAs were subdivided by US EPA Level IV Ecoregions (Pater et al. 1998), which incorporate landscape-scale ecosystem and geomorphic characteristics (such as the transition from an upper, mountainous watershed to a lower alluvial valley). Table 2.2 lists the 16 management areas characterized and inventoried for this report.

Table 2.2. List of Management Areas.

Number	Descriptive Title	Report Nomenclature
1	Nisqually (WRIA 11)	Nisqually
2	Deschutes (WRIA 13)	Deschutes
3a	Upper Chehalis (WRIA 23) - Coast Range Volcanics	Upper Chehalis - Coast Range
3b	Upper Chehalis (WRIA 23) - Willapa Hills	Upper Chehalis - Willapa Hills
3c	Upper Chehalis (WRIA 23) - Puget Lowland Prairies and Floodplains	Upper Chehalis - Puget Lowlands
3d	Upper Chehalis (WRIA 23) - Cowlitz/Chehalis Foothills	Upper Chehalis - Western Foothills
3e	Upper Chehalis (WRIA 23) - Western Cascade Lowlands and Valleys	Upper Chehalis - Cascade Lowlands
4a	Cowlitz (WRIA 26) - Willapa Hills	Cowlitz - Willapa Hills
4b	Cowlitz (WRIA 26) - Puget Lowland Prairies and Floodplains	Cowlitz - Puget Lowlands
4c	Cowlitz (WRIA 26) - Cowlitz/Chehalis Foothills	Cowlitz - Western Foothills
4d	Cowlitz (WRIA 26) - Western Cascade Lowlands and Valleys	Cowlitz - Cascade Lowlands
4e	Cowlitz (WRIA 26) - Western Cascade Montane Highlands	Cowlitz - Cascade Highlands
CE	City of Centralia	Centralia
CH	City of Chehalis	Chehalis
MO	City of Morton	Morton
WI	City of Winlock	Winlock

Reach boundaries were delineated on 1:48,000 scale maps following general Ecology guidance (Ecology 2010). Lakes with jurisdictional shoreline were defined as a stand-alone reaches. For major streams, reach boundaries were defined based on the following criteria:

- Breaks occur at the confluence of two SMP jurisdictional shoreline streams. Changes in ecosystem processes and shoreline functions tend to occur downstream of stream confluences.
- Breaks occur at significant changes in channel or valley morphology, including changes in gradient, width of floodplain, width of channel migration zone, or transition in channel form.
- Breaks occur at jurisdictional boundaries. Streams in the shoreline jurisdiction that extend into Federal Lands (Gifford Pinchot National Forest lands, for example) are

included in the inventory and have reach breaks. Reach breaks also occur at the city boundaries of Centralia, Chehalis, Morton, and Winlock.

- Breaks occur at significant shifts in land use or land cover.
- Breaks occur at the boundary between management areas.

For minor streams, the same boundary criteria were generally applied, but in some cases a minor stream and its tributaries were treated as a single reach. This was done when the stream and its tributaries are all within one management area and their shorelines are similar in character.

Maps showing reach and management area boundaries are located in Appendix A.

2.4. Approach to Characterizing Ecosystem-Wide Processes and Shoreline Functions

Ecosystem-wide processes are the suite of naturally occurring physical and geologic processes of erosion, transport, and deposition; and specific chemical processes that shape landforms within a specific shoreline ecosystem, and determine both the types of habitat and associated ecological functions (WAC 173-26-020). Ecosystem-wide processes were characterized based on the information provided by reviews of the inventory of data and sources listed in Table 2.1.

As part of this inventory and characterization, shoreline functions were identified and evaluated. Shoreline functions were characterized using the categories described in Ecology's *Comprehensive Process to Prepare or Amend Shoreline Master Programs* (WAC 173-26-201) for rivers, streams, and floodplains (Table 2.3), and for lakes and wetlands (Table 2.4). Functions were assessed based on the presence and conditions of resources found within individual reaches. The available information inventoried for the study area was used to determine the relative performance of each reach, and its potential to provide shoreline functions.

Table 2.3. Shoreline Functions for Streams and Associated Floodplains.

Hydrologic Functions	Vegetation Functions	Hyporheic Functions	Habitat Functions
• Transport of water and sediment across the natural range of flow variability • Attenuating flow energy • Developing pools, riffles, gravel bars, nutrient flux, recruitment and transport of large woody debris and other organic material	• Moderating water and ambient temperature • Removing excessive nutrients and toxic compounds • Sediment removal and stabilization • Attenuation of high stream flow energy • Provision of recruitable woody debris and other organic material	• Removing excessive nutrients and toxic compounds • Storing water and maintaining base flows • Support of vegetation • Sediment storage	• Physical space and conditions to support water-dependent species and life history stages; reproduction; resting, hiding and migration; and food production and delivery

Table 2.4. Shoreline Functions for Lakes and Wetlands.

Hydrologic Functions	Vegetation Functions	Hyporheic (Groundwater / Surface Water Exchange) Functions	Habitat Functions
• Storing water and sediment • Attenuating wave energy • Removing excessive nutrients and toxic compounds • Recruiting large woody debris and other organic material	• Moderating water and ambient temperature • Removing excessive nutrients and toxic compounds • Sediment removal and stabilization • Attenuation of wave energy • Provision of recruitable woody debris and other organic material	• Removing excessive nutrients and toxic compounds • Storing water and maintaining base flows • Support of vegetation • Sediment storage	• Physical space and conditions to support water-dependent species and life history stages; reproduction; resting, hiding and migration; and food production and delivery

In the study area, wetlands are typically associated with floodplains or stream and lake shorelines; thus, they occur in a variety of reaches throughout the shoreline management jurisdiction. Reaches are typically not determined based on the presence or absence of wetlands, but their presence or absence would contribute to the overall functions of the reach. Therefore, for assessing shoreline functions, wetland functions are considered within the context of the stream and lake reaches in which they occur.

Tables 2.3 and 2.4 include all functions identified in WAC 173-26-201(d)(i)(C). In addition, hyporheic functions (the movement of water between the water column and adjacent soils) are included in this assessment for lakes, although they are not included for lakes in the WAC. The relationship between hyporheic processes, and functions such as removing excessive nutrients and sediment, maintaining water temperatures and baseflow in adjacent streams, and providing complex habitat structure are present along lake shorelines; even those with coarse unconsolidated sediments that lack significant wetlands or vegetation.

The primary difference between lake and wetland functions compared to rivers and streams is that lakes and wetlands tend to store water and sediment instead of transporting them. In addition, shoreline structure and vegetation may contribute to attenuation of wave energy in large lakes, but do not generally influence flow energy as they would in streams where flow is a more dominant factor. Large wetlands or wetland complexes associated with stream floodplains could provide functions in terms of wave energy attenuation as well as flow energy. Similarly, functions related to flow energy such as the transport of nutrients, organic material, woody debris, and sediment would only apply to rivers and streams. These flow related functions lead to channel formation and in-stream structure such as pools, riffles, and gravel bars that are important to fish and other animals that require diverse and complex habitats.

Hydrologic functions for lakes and wetlands include removal of excessive nutrients and toxic compounds, and recruitment of wood and other organic material that may be important habitat features or play a role in food production and delivery for a wide range of species. Groundwater recharge and moderation of flows between waterbodies (from lakes and wetlands into streams) are supported by groundwater and surface water exchange flow. Hyporheic functions, or functions related to groundwater and surface water exchange, also include improving water quality, providing water storage, and supporting vegetation communities, which supports habitat structure.

Note that many of the functions listed in Tables 2.3 and 2.4 cross functional groups. For example, shoreline vegetation functions to provide habitat structure as well as the space and conditions to support species and food production. Functions in each reach were evaluated to determine if they were present, altered, or impaired and then scored accordingly. Functions of reaches in the shoreline jurisdiction were rated based on the threshold criteria in Table 2.5. Functional assessment results are included in Appendix C. The functional assessment threshold criteria establish a framework for identifying potential areas for development, restoration, or protection. In general, the higher the score for functions the more likely the site is suitable for protection, while areas with low function scores, in combination with few alterations, are suitable for restoration. Development is typically most suitable for areas with many alterations and low function scores.

The functional assessment is designed to address the processes and functions summarized in WAC 173-26-201(d)(i)(C) and outlined in Tables 2.3 and 2.4. For the purpose of the functional assessment, some hyporheic functions are combined because the same criteria are used to estimate the potential for the functions to be present and unimpaired.

It is also important to note that relatively unimpaired or pristine reaches may not receive a high functions score in each category. Even reaches that are undeveloped can have a relatively low score for certain functions if they do not have the physical space and conditions to support the life history stages of water-dependent species. Low scores may occur when habitat for reproduction or migration or is lacking as well as preferred food or shelter conditions. While a fully functioning shoreline from a physical perspective is possible, and even likely for an ecologically rich reach, owing to the diverse needs of different priority species (which are ranked equally) it is not possible for a reach to be scored perfectly for all conditions.

Table 2.5. Reach-scale Functional Assessment Threshold Criteria.

	Function Code	Function	3 (High)	2 (Moderate)	1 (Low)
Hydrologic (Streams)	1	Transport of water and sediment	No significant armoring or dams present in the reach	Steep slopes present, but not developed, and are well vegetated	Steep slopes present with development
			No steep slopes present	Limited armoring present but no steep slopes present	OR
			If present, creek mouths have natural deltas		Heavy armoring is present
	2	Attenuation of flow energy	Majority of the reach is not armored or protected by levees	Majority of the reach is not armored or protected by levees	Significant armoring or levees present
			Large wetlands or backwaters present	Adopted floodway or the 2010 flood channel study area is 20-50% of area	OR
			Adopted floodway or the 2010 flood channel study area is >50% of area	Few wetlands or backwaters present	Few wetlands or backwaters present
			Wide floodplain	OR	Adopted floodway or the 2010 flood channel study area is <20% of area
			Channel and flow configuration is complex	Adopted floodway or the 2010 flood channel study area is <20% of area but channel is complex and few to moderate wetlands present	Channel and flow configuration is simple
	3	Removing excessive nutrients and toxic compounds	303(d) Category 1, no problems	303(d) Category 2, waters of concern	303(d) Category 4 - Impaired, does not require total maximum daily load (TMDL)
				OR	OR
				Suspected sources of water quality concern	303(d) Category 5 - Impaired, requires TMDL
	4	Developing pools, riffles, gravel bars, nutrient flux, recruitment and transport of large woody debris and other organic material	High level of features are present	Low to moderate level of features are present	Low level of features are present
			OR	OR	OR
			Channel and flow configuration is complex, and not impaired by bank armoring	Channel and flow configuration is moderately complex or simple, but not impaired by bank armoring	Channel and flow configuration is simple primarily because of bank armoring or other development
Hydrologic (Lakes)	1	Storage of water and sediment	Lake or wetland is connected with other water bodies through surface or groundwater flow	Lake or wetland has limited connectivity with other water bodies	Lake or wetland is isolated from other water bodies
	2	Attenuation of wave energy	No armoring is present or it is limited (<10% of reach length)	Majority of the reach is not armored	Significant armoring is present
	3	Removing excessive nutrients and toxic compounds	303(d) Category 1, no problems	303(d) Category 2, waters of concern	303(d) Category 4 - Impaired, does not require total maximum daily load (TMDL)
				OR	OR
				Suspected sources of water quality concern	303(d) Category 5 - Impaired, requires TMDL
	4	Recruiting woody debris and other organic material	Majority (>75%) of shoreline area is vegetated with dense forest, shrub, or emergent vegetation, and not impaired by bank armoring	Shoreline vegetation is moderate (25-75% cover), but majority of shoreline is not impaired by armoring or other development	Shoreline vegetation is limited (<25% cover) and/or shoreline may be impaired by armoring, bulkheads, altered vegetation types, or other development.
Vegetation	5	Maintaining temperature	Dense forest vegetation provides >75% cover in the shoreline area	25-75% forest vegetation cover in the shoreline area	<25% forest vegetation cover in the shoreline area
				OR	
				Wetlands may be a significant source of cool groundwater discharge to other waters	
	6	Removing excessive nutrients, toxic compounds, and sediment	A broad (>50 feet wide) band of vegetation is dominated by dense, ungrazed, herbaceous plants	Vegetation is dominated by dense, ungrazed, herbaceous plants but is generally less than 50 feet wide or the shoreline is steeply sloped	The shoreline is steeply sloped and/or herbaceous vegetation is sparse to moderate density or disturbed if present.
			Shoreline is gently sloped	OR	
				The shoreline has a broad band of vegetation and gentle slope likely to contain herbaceous plants	

Table 2.5 (continued). Reach-scale Functional Assessment Threshold Criteria.

	Function Code	Function	3 (High)	2 (Moderate)	1 (Low)
Vegetation (cont'd	7	Sediment stabilization	A broad band of dense vegetation separates uplands from shoreline	A narrow band of dense vegetation or a broad band of sparse vegetation or grass separates uplands from shoreline	No vegetation or a narrow band of sparse vegetation separates uplands form shoreline
				Vegetation may be disrupted by roadway	OR
			Trees and shrubs stabilize banks	OR	A majority of the reach is armored
				Portion of the shoreline is armored	
	8	Attenuation of high stream flow energy or wave energy in lakes and wetlands	Majority of the reach is not armored or confined by levees	Majority of the reach is not armored or confined by levees	Significant armoring or levees present
			Large wetlands or backwaters present in >50% of area	Few (20-50%) wetlands or backwaters present in area	Few (<20%) wetlands or backwaters present in area
			Large adopted floodway or the 2010 flood channel study area and good floodplain connectivity	Minor to moderate adopted floodway or the 2010 flood channel study area and connectivity to floodplain	Limited adopted floodway or the 2010 flood channel study area and connectivity with floodplain
	9	Provision of recruitable woody debris and other organic material	Dense forest vegetation provides >50% cover in area	Moderate to dense forest, shrub, or grass vegetation provides 25-75% cover in area	<25% vegetation cover in area
Hyporheic (groundwater / surface water exchange in lakes and wetlands)	10	Water storage, sediment storage, maintaining base flows, and removing excessive nutrients and toxic compound	Wetlands are present over >50% of area and not separated from the river or lake by armoring or levees	Few (10-50%) wetlands are present in area or are separated by levees	Wetlands are limited (<10% of area), absent, or largely separated by levees
	11	Support of vegetation	Large wetlands are present	Shoreline supports moderate scrub or forest vegetation	Shoreline supports little to no scrub or forest vegetation
			OR	OR	OR
			Hydric soils comprise >75% of the reach area	Hydric soils comprise 50-75% of the reach area	Hydric soils comprise <50% of the reach area
Habitat	12	Physical space and conditions to support water-dependent species and life history stages; reproduction; resting, hiding and migration; and food production and delivery	High wetland presence	Moderate wetland presence	Few or no wetlands present
			Moderate to high channel sinuosity or bed and bank complexity	Narrow band of dense vegetation or broad band of sparse vegetation	Dense riparian vegetation is absent
			Broad band of moderate to dense riparian vegetation	Moderate to high channel sinuosity or bed and bank complexity	Low channel sinuosity or bed and bank complexity
			OR	OR	Priority habitat features are present but shorelines are highly altered or corridors between habitats are absent or degraded
			Narrow band of dense vegetation	Priority species or habitat features are present	
			High channel sinuosity or bed and bank complexity	Shorelines or floodplains exhibit moderate degree of alterations or corridors between habitats may be degraded	
			Multiple priority species (including breeding areas or regular concentrations of species) are present		
			Habitats are relatively interconnected with corridors between habitats that are free from roads and other development		

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3. ECOSYSTEM-WIDE PROCESSES

3.1. Regional Overview

Lewis County, the largest county in western Washington, extends from the Washington State Coast Range eastward across the Puget-Willamette Lowlands and into the foothills and mountains of the Cascade Range. The major population centers of Chehalis and Centralia are located on the floodplains of the Chehalis River and its tributaries, including the Skookumchuck River and Newaukum River. Lewis County is landlocked; it is the only county in western Washington without a port for oceangoing vessels. The county has an area of about 2,452 square miles (1,569,274 acres), and measures about 90 miles (east to west) by 25 miles (north to south). Approximately one-third of the county is designated as national forest and is federally administered. These lands include portions of the Mt Baker - Snoqualmie and Gifford Pinchot National forests and Mount Rainier National Park. Chehalis, the county seat, is about 25 miles south of Olympia and 70 miles southwest of Seattle.

3.1.1. General Shoreline Description

The vast majority of the shoreline in the county is associated with three major river systems: the Cowlitz River, the Nisqually River, and the Chehalis River and its major tributaries, the Skookumchuck and Newaukum Rivers. Major reservoirs are present on the Cowlitz River: Mayfield Lake, Riffe Lake, and Lake Scanewa. A very small part of the shoreline of Alder Lake, a large impoundment on the Nisqually River, is also within Lewis County. Relatively few natural lakes are present within the county, and are predominantly found in higher elevation regions in the eastern part of the county.

Watershed size, precipitation, presence or absence of headwater glaciers, channel slope, substrate, and channel and floodplain planform morphology all influence shoreline conditions. Low gradient main-stem rivers are typically associated with meandering planform morphology and relatively fine gravel and sand substrates. Here, shorelines consist of cutbanks on the outside of meander bends, sandy point bars on the inside of bends, and relatively gently sloping, often well-vegetated banks in straight sections. Regular flooding of near-shore areas often results in the deposition of mud near the channel margin, particularly in well-vegetated areas. In populated areas and elsewhere, levees and engineered revetments are often used to prevent erosion.

River and stream banks and the associated shoreline are sometimes less well defined in higher elevation gravel-bed rivers and streams. In these settings, channel planform is often characterized by a braided or anabranching pattern, particularly where natural processes are allowed to proceed undisturbed. Channels tend to change position regularly as sediment and large wood accumulates, often leading to the formation of chutes and side channels. These sometimes convey a significant amount of the channel's discharge even at low flow. However, in other settings, chutes and side channels are inundated only during floods. Revetments and levees are often used to confine flood flows and prevent erosion near infrastructure. These

shoreline modifications, coupled with historic removal of large wood and sometimes gravel, have led to a loss of off-channel shorelines in the county (Wade 2000).

Bedrock and large boulders are important features of many river and stream shorelines, particularly outside of the major lowland valleys. In these areas, cobbles, boulders, large wood, and sometimes bedrock interact to create clusters of sediment that lead to characteristic step pool morphology. Shorelines in these settings are characterized by gravel and cobble in pool areas and cobble, boulder, and bedrock in other areas. Where channels impinge upon valley walls, shorelines often consist of bedrock or steep bluffs cut into unconsolidated sediment. The steepest tributaries are strongly influenced processes such as landslides and debris flows that during large events can sometimes bury and/or rework entire valleys. Steps and pools typically return after the event as fine-grained material is winnowed out of the debris flow deposit. In some settings, particularly in upland areas, flow energy can be sufficiently high to completely remove sediment from the channel, resulting in bed and banks that consist entirely of bedrock. In reaches where channel and shoreline habitat is shaped by interactions between bedrock, boulders, cobble, and large woody debris (LWD), maintaining functional habitat requires that shorelines not be simplified by removing those elements, disconnecting the reach from hillslope sources of large sediment and LWD, channel straightening, or construction of revetments.

Lake and reservoir shorelines are less varied than those of rivers and streams. In reservoirs and large lakes, much of the shoreline consists of inundated hillslopes that have been reworked to varying extents by wave action. Where water levels are stable (such as in most natural lakes), sediment production from hillslopes and small tributaries often results in the accumulation of sandy and gravely beaches. Low-energy lake shorelines can contain finer sediments and often support extensive wetland complexes. Because water surface elevations often vary more in reservoirs, shorelines there are usually less well defined and are often poorly vegetated, particularly during periods of reservoir draw down. Deltas usually form where rivers and streams enter lakes and reservoirs. This results in a flat, relatively fine-grained surface, often bisected by one or more branches of the tributary stream. While relatively uncommon in the county, some lakes have been filled completely with sediment, resulting in flat meadow deposits. Lake and reservoir shoreline functionality is highest when the boundary between water and upland areas is well-vegetated and lacks shoreline armoring. Where water levels are stable, highly functional lake shorelines can be preserved or restored but shoreline structures can significantly impair ecological functions. In reservoirs that experience wide fluctuations in water level, ecological functionality is generally lower, and shoreline modifications tend to be less damaging.

3.2. Key Physical Controls

3.2.1. Climate

The climate of the county is maritime and characterized by cool dry summers and wet winters. Precipitation and temperature are slightly variable throughout developed (lowland) portions of county. Mean annual temperature within the lowlands is generally within a few degrees of 50 degrees (Ecology 2007), and annual mean precipitation is between 40 and 60 inches per year. As shown in Figure 3.1, precipitation in the hills and mountains on either

side of the Chehalis Valley is much greater than within the valley proper, with annual total precipitation increasing to over 100 inches near the crest of the Willapa Hills and at higher elevations in the Cascade Range. The largest climate extremes occur in the northeastern part of the county, near Mt Rainier. This area is much colder and wetter than the remainder of the county. For instance at Paradise, just a few hundred yards north of the county line, annual precipitation is over 112 inches per year and mean annual temperature is 37 degrees. Similar relatively cold and wet conditions can be found in other alpine areas in the county such as the Tatoosh Range and Goat Rocks. In contrast, while precipitation is high in the Willapa Hills and lower-elevation portions of the Cascade Range, temperatures are more moderate, meaning that much of these areas are in regions dominated by rain-on-snow hydrology. The amount of runoff that reaches streams during rain-on-snow events is sensitive to forest age, and therefore to forest harvest practices. Peak flows have been found to increase approximately 20 percent for streams draining hillslopes that have been clear-cut or have a high proportion of their area occupied by trees less than 25 years old (Beschta 1993). Slope instability may also increase due to increased rain-on-snow runoff from clear-cut or lightly forested areas, potentially leading to increased sediment delivery to streams, especially if well-developed riparian vegetation is lacking.

3.2.2. Climate Change

There are a number of recent reports in the scientific literature concerning climate change and its impact on the Pacific Northwest (Reclamation 2011). Climate change has been shown to increase stream temperatures (particularly in the summertime (Mantua et al. 2010), compromise habitat restoration success (Battin et al. 2007), and change the hydrology of stream basins (Elsner et al. 2010). In particular, increased stream temperatures are likely to have significant effects (Mantua et al. 2010). Since much of Lewis County is at middle elevations, the hydrology is particularly sensitive to the dynamics of the snow pack. A warming climate would be expected to decrease snowpack across much of the region, resulting in a shift in seasonal runoff patterns toward large late fall and winter events, and away from a late spring and early summer snowmelt-driven freshet. These hydrologic changes will occur in most of the streams in this characterization, particularly those in the western part of the county that originate in mid-elevation upland areas. There is some uncertainty regarding the influence climate change will have on local precipitation patterns. The most likely change is a temperature-driven shift in precipitation form, with less snowfall and more rainfall. However, in general, climate change is also expected to lead to an increase in precipitation intensity during the largest storms, regardless of the form that precipitation takes. This increase occurs because of the increase in available moisture in the atmosphere when temperatures increase, and because storms in a warmer climate are likely to draw moisture from larger areas (Trenberth 2011). This intensification of the hydrologic cycle has likely already begun to occur, as evidenced by global sea-surface salinity measurements that are consistent with increased evaporation rates in areas of the ocean that supply moisture to western North America (Durack et al. 2012).

At national and global scales, data analysis of observed precipitation shows that storms appear to be getting more intense because of increased global temperatures (Min et al. 2011; Pall et al. 2011). However, global circulation models do not presently have the precision to model changes in atmospheric flow at the scale of individual Pacific Northwest watersheds.

This problem can be addressed effectively in the Pacific Northwest by driving higher resolution regional-scale models with coarse-scale global circulation output (Duliere et al. 2011). In Washington, this approach shows increases in precipitation intensities and a shift from snow to rain during transitional seasons (Rosenberg et al. 2010; Elsner et al. 2010). Analysis of observed historic precipitation in the Pacific Northwest has shown increases in precipitation intensities for durations less than 24 hours in the Puget Sound area (Rosenberg et al. 2010) and for maximum 48-hour precipitation across much of Western Washington (Mass et al. 2011). Changes in precipitation intensity can be expected to result in changes in runoff to streams and lakes, as well as possible changes in vegetation. Since unmodified shorelines exist in dynamic equilibrium with stream flow and riparian vegetation, climate change is likely to result in changes in shoreline ecological functions over time, even in the absence of human intervention.

3.2.3. Geography and Hydrologic Processes

Geography in Lewis County has varied topographic forms, from the Coast Range hills in western section of the county to the broad, relatively flat, and low-lying floodplains of the Chehalis and Cowlitz River valleys, to the rugged Cascade Mountains to the east. Roughly, three-quarters of the county is mountainous and forested. While slopes are generally quite steep in these areas, overall elevations are moderate, generally ranging between 1,000 and 5,000 feet. With the exception of several ridgelines near the eastern border of the county, very little area is truly alpine in nature. The remainder of the county is characterized by low rolling hills and flat, relatively wide valley bottoms. For the most part, these valleys are traversed by the rivers and streams of the Chehalis and Cowlitz systems. A short reach of the Nisqually River is also present along the northeastern border of the county, where it forms the border with Pierce County near Elbe. Based on these general landforms, the county is subdivided into three broad geographic regions for purposes of this discussion: Lowland Valleys, Hills, and Alpine areas.

3.2.3.1. Lowland Valleys

Most of the county's population is concentrated in the lowland valleys of the Chehalis and Cowlitz Rivers and their major low-elevation tributaries: the South Fork Chehalis, Newaukum, Skookumchuck, and Tilton Rivers. These valleys can be broadly defined as all areas less than approximately 1,000 feet in elevation, with valley elevation increasing from west to east. Valley bottom elevations are generally below 500 feet in the most populated parts of the basin, near Centralia and Chehalis. For the most part, the climate of the lowland valleys is moderate and slopes are low. The longest valley is that of the Cowlitz River. This glacially carved valley is relatively broad, has steep walls, and extends across almost the entire length of the county, from Packwood to Vader. The many valleys of the Chehalis River and its low elevation tributaries are primarily fluvial in origin and often contain broad floodplains. The lower reaches of the Chehalis River are strongly influenced by glacial infill from Cowlitz and Puget Lobe outwash. Because the lower reaches of the Chehalis were formed by massive water flows that are no longer present, it is exceptionally broad and flat and hosts a number of oxbow lakes and other side channels. Oxbow lakes and side channels are features that result from the meandering of a stream across its floodplain. If connected to the main channel, they can function as valuable rearing habitat for juvenile fish and as refuge from

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Figure 3.1. Lewis County Precipitation Map.

11x17 landscape

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high flow velocities during floods. Their existence is, in the long term, dependent on continued meandering and the absence of impediments to channel mobility such as levees and revetments.

Runoff from lowland prairie and floodplain areas tends to occur as subsurface piping, shallow groundwater flow, and saturation excess overland flow. Depressional ponds and wetlands serve to detain surface runoff and recharge groundwater. Variability of the permeability of soils and sediments can lead to alternation between losing and gaining reaches along streams. In gaining reaches, groundwater serves as a source of stream flow, while in losing reaches groundwater is recharged by water leaving the stream through its bed.

Agricultural Lands

Agricultural development in lowland areas typically produces more rapid conveyance of water to streams and lakes due to less complex vegetation in the landscape (or lack of vegetation, depending on the season) and the presence of drainage ditches and subsurface drain tiles.

Sediment yield to streams flowing through natural prairie and floodplain environments typically comes from erosion at the outside of meander bends, as well as in the form of sediment transported from upstream. In agricultural settings, these processes are augmented by sheet, rill, and gully erosion of fields. In natural prairie and floodplain conditions, regularly recurring peak flows tend to overtop the banks of streams and spread out over the floodplain, depositing fine sediments there. Agricultural development sometimes allows for the continuation of this process, but in many cases dikes are built to control local flooding, which results in more rapid downstream conveyance of flood flows and sediment.

Under natural conditions, even relatively treeless prairies tend to have trees adjacent to streams and lakes, and these trees serve as a source of large woody debris (LWD) when they fall into the stream due to natural mortality or bank erosion. This LWD tends to retain sediment (if large enough to remain in place during seasonal peak flows), promote chute cutoffs, activate side channels, and generally increase channel complexity. Agricultural development tends to reduce the supply of LWD, and consequently the potential complexity of the channel. Channel adjustment to variations in discharge and sediment supply tends toward meander bend migration, the formation of pool-riffle or dune-ripple sequences, and the occupation and reoccupation of side channels. When sediment supplies are elevated, braided reaches may form. Agricultural disturbance tends to involve reductions in channel complexity due to reduced LWD availability, and limitations on channel migration due to the installation of revetments and dikes.

Developed Lands

Developed lands are most frequently found in the lowland/valley areas and are a land use with profound hydrologic impacts. Runoff from developed land is typically flashier than from the natural or agricultural landscape that preceded development. Impervious surfaces and stormwater infrastructure (swales, drains, and pipes) rapidly convey precipitation to receiving water bodies. This results in more rapid onset of and greater discharge during peak flows. Conversely, stream flow and lake water levels during dry intervals tend to be reduced, as groundwater recharge is minimal due to impervious cover and the rapid removal of water

from potential recharge areas. Stream flow in and downstream of developed areas tends to be higher during rainfall events, and lower between them than in otherwise similar but undeveloped areas. Flood protection measures and channelization tend to speed flow through developed areas, leading to less frequent floodplain inundation.

Following an interval of high erosion during construction, sediment yield from developed areas tends to be low, because potential sediment sources are covered up by buildings and other impervious surfaces. Except where excess sediment is supplied from upstream, developed areas tend to have relatively immobile beds, because local supply of sediment is limited and the more frequent and higher peak flows tend to winnow out mobile grains.

Riparian vegetation and LWD are generally much diminished in developed areas. LWD that is transported into developed areas tends to be removed, as it may cause localized flooding, navigation and/or recreation hazards, or infrastructure damage. Streams in developed areas are often channelized, straightened, and interrupted by bridges or culverts. Bank armoring can be extensive. The consequence of these changes is that adjustments in channel form and the local habitat structures they generate tend to be relatively rare, or limited to those locations that are less constrained.

3.2.3.2. Hills

Much of the land area in the county is in this geographic region. The area can be split into two large groups: the Willapa Hills in the west and the foothills of the Cascades in the east. While development in this area is relatively sparse, most of the land is in private ownership, particularly in the Willapa Hills. In the eastern portion of the county, in the Cascade foothills, much of this land is part of the Gifford Pinchot National Forest. The topography within the Cascade Foothills varies regionally, with valleys between hills becoming larger and deeper to the east. In the west, the degree of convolution of the hills and valleys becomes extremely high, with many tributaries of the Chehalis River passing across wide valley fill deposits. Further east, major rivers passing through the foothills of the Cascades include the Tilton and Cispus Rivers, both tributaries of the Cowlitz River, the headwaters of the Skookumchuck River, and the Nisqually River on the county's northeastern border, which also drains alpine portions of Mount Rainier.

Functional relationships between shorelines and uplands in the hills regions of the county fall into two broad classes. Where streams flow through narrow confining valleys, hillslope processes (e.g., runoff, sediment delivery, LWD inputs) affect streams more strongly than stream processes affect adjacent hillslopes. In these environments, shorelines act to buffer streams from hillslope processes. Where streams flow across wide valley fill, this relationship is reversed; channel meandering causes streams to migrate across their valleys over time, mobilizing sediment from the outside of meander bends, periodically depositing sediment across the valley during flood events, and leaving relict depressions in the valley floor in places where the stream once flowed. Anthropogenic modifications tend to decrease the buffering effect of shorelines in confined valleys (through removal of vegetation, or the construction of road crossings), and conversely to separate streams from their floodplains in wider valleys (through channelization and/or the construction of revetments and levees).

In their natural state, forested hillslopes convey water to streams and lakes primarily by subsurface piping and shallow groundwater flow, except during rain-on-snow events when excess overland flow becomes a significant component of runoff. After disturbance (disease, fire, or clear-cutting), overland flow increases at the expense of other flow pathways. As a consequence, peak flows tend to increase in severity and frequency and base flows are reduced.

Sediment yield from forested hillslopes tends to be episodic, resulting primarily from landslides and bank erosion. After road construction and clear-cut harvesting, sediment yields increase for several years due to more frequent and widespread slope failures as the roots that formerly provided cohesion decay, surface erosion from cleared ground, and road embankment erosion. Sediment transport is episodic under naturally forested conditions, as flow depths and velocities tend to be more than sufficient to transport the finer fractions that are occasionally delivered to streams, and the coarsest fractions are only mobilized by infrequent large floods or debris flows. In the period following disturbance, sediment supply to streams tends to increase, as does the frequency of debris flows that scour headwater channels and deliver large quantities of both fine and coarse sediments to channels lower in the basin.

Under naturally forested conditions, riparian areas tend to be heavily forested, with particularly large trees that occasionally fall into or across the channel and form natural grade control and sediment retention structures. LWD tends to be persistent and relatively immobile. Clear-cut forestry has in the past tended to reduce both the in-channel stock and riparian supply of LWD. Channel adjustment in natural forested conditions tends toward punctuated equilibrium, in which the channel adjusts its vertical profile to accommodate regular spatial and temporal patterns of sediment and water supply that are occasionally disrupted by large flood or debris flow events. The presence of large trees within the channel and on the shoreline is an essential structural element; when large trees are removed, sediment storage and channel complexity tends to be reduced.

3.2.3.3. Alpine

Alpine ridgelines occur within the Tatoosh Range, just south of Mount Rainier, and extend south along much of the county's eastern border. Truly alpine areas represent a relatively small portion of the county. This high (greater than 5,000 feet in elevation) steep terrain, typically composed of volcanic or intrusive rocks, is almost exclusively in federal ownership, and is protected from development either because it is designated wilderness or national park land. It is snowbound for much of the year due to its high elevation. While a small part of the south flank of Mount Rainier is within the county, and while alpine portions of Mount Adams and Mount Saint Helens are located within 10 miles of the county's southern border, the vast majority of alpine terrain within the county is separated from Cascade volcanoes by one or more river valleys. Because these alpine areas have experienced many glacial episodes, they are characterized by numerous relatively small glacial lakes and tarns. These are primarily located immediately adjacent to the eastern border of the county, in federally designated wilderness areas. Shorelines in alpine areas are generally the least disturbed shorelines in the county due to their distance from centers of human activity.

Runoff in alpine areas is dominated by winter storms, spring rain-on-snow events and late spring – early summer snowmelt. Despite steep slopes, sediment yield is relatively low due to slow rates of soil production. Glacial deposits can be significant sources of sediment, however. Sediment is delivered to channels episodically by runoff, avalanche, and mass-wasting events. Streams in alpine areas tend to have relatively low discharge, but have adequate capacity to transport available sediment during peak flows due to steep gradients.

Riparian vegetation and LWD tends to be sparse in alpine areas, with steps and cascades formed by larger, relatively immobile sediment, rather than by LWD as tends to be the case at lower elevations. Most streams are confined in narrow valleys, so channel adjustment to disturbance, seasonal variability, and systematic change tends to occur in the vertical dimension, via the formation of stepped profiles and/or variations in bed texture.

3.2.4. Geology and Soils

The geology of Lewis County is diverse. However, within the three geographic regions described above, geology is relatively homogeneous. In general, the major lowland river valleys contain sedimentary deposits that are of glacial or fluvial origin. Both the Willapa Hills and the Cascade foothills contain large volcanic deposits as well as a range of other igneous and sedimentary bedrock types. The larger river valleys within the hills region are strongly influenced by recent glaciation. Alpine areas are the most complex in the county and have been influenced by volcanism, moderate metamorphism, tectonic uplift, and glaciation.

The overall setting for geologic evolution within the county depends on subduction of the Juan De Fuca Plate beneath the North American Plate. Between 35 and 40 million years ago, volcanic eruptions associated with this tectonic process resulted in the placement of extensive volcanic deposits. Subsequent erosion of upland material resulted in the formation of thick layers of sedimentary rock that were deposited in both marine and terrestrial settings. These sedimentary deposits are known as the McIntosh, Lincoln Creek, Astoria, and Montesano formations. They are most commonly exposed in the Willapa Hills and the eastern part of the Cascade Foothills. Coal has been mined commercially from these deposits for over 100 years.

Eruptive episodes continued periodically until roughly 10 million years ago, when volcanism appears to have temporarily waned. Around 12 million years ago, subterranean magmas gradually cooled in place to form the erosion resistant intrusive granodiorite of the Tatoosh Range. Intrusive sills and dikes that are presently exposed throughout the eastern part of the county were also formed where molten rock forced its way between previously placed deposits.

Tectonic uplift began in earnest around 10 million years ago, resulting in folding and dissection of the older deposits. Volcanism resumed more recently, during the Pleistocene, with the development of Mount Rainier beginning approximately one million years ago (Lasmanis 1991). Mount Rainier has been active into historic times, with the most recent eruptions occurring in the 19th century (Pringle 2008). Mount Adams, the second largest volcano in Washington, is located about 12 miles south of the county. While not highly active during the past 10,000 years nor as prone to explosive eruptions as Mount Rainier, Mount

Adams underwent rapid growth, mainly by placement of lava, during a period from 10,000 to 40,000 years ago (Scott et al. 1995).

Aside from the two major volcanoes of Mount Rainier and Mount Adams, there are several other volcanic vents within the county that have been active in the recent geologic past. Perhaps the most prominent is the Goat Rocks volcanic center, located mid-way between Mount Rainier and Mount Adams. Tectonic uplift and volcanism created the high elevations and steep hillslopes that define the topography of alpine and hills regions in the county, but beyond that, they do not usually affect shoreline functions directly. Were volcanism to resume in any of the now dormant locations, the effects on shorelines could be dramatic, but for now, the only county shorelines likely to be affected by volcanic processes are those near Mount Rainier.

During the Pleistocene, county geology was strongly influenced by several major glacial episodes, the most recent of which occurred roughly 20,000 years ago. During these episodes, glaciers formed within the Cascade Range and advanced into the lowland valleys, mantling much of the landscape with alpine glacial drift of variable age. Alpine glaciers had begun to recede by the time the Vashon Ice Sheet had advanced into the Puget Sound area. While the Vashon ice sheet did not quite extend into Lewis County, reaching its maximum extent several miles north of the county line, the valley of the lower Chehalis River to the north formed the main flow path for drainage from the ice sheet. The ice resulted in the formation of a large lake (Glacial Lake Chehalis) that extended across much of the lower Chehalis Valley (Bretz 1913). As the ice receded, discharge from most of the Puget Sound area was routed along the lower Chehalis valley, north of Lewis County. Glacial discharge also occurred through the lower Skookumchuck Valley. The large glacial discharge and the presence of Glacial Lake Chehalis are probably responsible for the broad, flat nature of many of the lower elevation valleys. A stream flowing in a valley that was established long ago by a larger glacial stream is said to be “underfit”, and is generally not expected to migrate across the whole valley floor over time, the way a stream does when it flows in a valley that was formed under conditions similar to those of today.

Glaciation resulted in extensive sedimentary deposits, often referred to as glacial drift, that blanket large areas of the county. The primary types of material are till, advance outwash, and recessional outwash. Till is a dense, relatively impermeable mixture of sediment sizes that range from clay through boulder that is deposited under the ice surface. Outwash generally consists of sand and/or gravel material that is deposited by meltwater adjacent to the glacier. Advance outwash is deposited while the glacier is advancing, and is often deformed by the glacier and capped by a layer of till. Recessional outwash is deposited during a glacial retreat and is thus usually less subject to subsequent glacial reworking. Bluffs composed of glacial outwash can be an important source of sediment for streams in the county. Groundwater and hyporheic flow into and out of streams are often controlled by the differential permeability of glacial drift layers.

Soil development within Lewis County depends strongly on the underlying geological deposits and on glacial history. Lowland valleys are generally characterized by fertile floodplain soils. Many of the hills are mantled by glacial drift. Soil development in these areas depends strongly on the age and nature of the deposit, particularly whether it was laid down during

or prior to the last ice age. Nearer the major volcanoes, and particularly near Mount Saint Helens, volcanic ash is present in surface soils. Soils affect shoreline functions by their influence on subsurface runoff, by their resistance or susceptibility to erosion by upland and fluvial processes, and by their variable suitability as substrate for riparian vegetation.

3.2.4.1. Lowland Valleys

The geology of the lowland valleys is dominated by glacial till, drift, and outwash, primarily from various episodes of alpine glaciation down the Cowlitz valley and, for extreme northern parts of the Chehalis River Valley, possibly by outwash from the Vashon ice sheet. Large expanses of alluvium are also present in these valleys. Much of the glacially derived material and adjacent alluvium has been remobilized, and deposited within the floodplains of the major rivers. The soils of the lowland valleys are generally fertile and support a wide range of agriculture. Floodplain soil development depends strongly on local channel processes, which are described for individual management areas in Section 4.

3.2.4.2. Hills

The bedrock geology of the Willapa Hills and Cascade Range foothills is dominated by sedimentary rocks of Eocene to Miocene age. Volcanic and volcaniclastic rock is also present in both areas. The region has experienced significant folding and erosion, meaning that the major sedimentary formations are sometimes discontinuous and are often characterized by steeply dipping bedding planes. Hillslope development depends to some extent on the underlying geology, with volcanic bedrock resulting in narrower ridgelines and less rounded hillslopes than the more readily weathered sedimentary deposits. While volcanic material is not as common in the Willapa Hills as in the Cascade foothills, basalt flows are present along the south side of Chehalis River in the western part of the county. This is part of a massive basalt deposit that originated on the Columbia Plateau and passed through the Columbia River gorge. Bedrock geology constrains the development of topography, and consequently the nature of streams and lakes in a given area. Where the Chehalis River and its tributaries flow through a landscape underlain by volcanic rocks, for example, streams are confined to relatively narrow valleys, but where they flow through the sedimentary rocks of the Willapa Hills, the valleys are wider and flatter, and the streams are free to migrate across them.

Many of the hillslopes in this area are covered by extensive glacial deposits of variable age. Glacial drift is particularly extensive in the Newaukum River watershed, where the river incision has left behind extensive terraces of glacial material that probably originated from a glacier that advanced down the Cowlitz valley. However, glacial drift is found throughout the area. The age of the deposit influences the properties of the ensuing soil profile. Glacial material deposited during the most recent glaciation is generally relatively unweathered, but older material is often highly weathered, sometimes entirely to clay (Evans and Fibich 1987). The kind and volume of sediment that is delivered to streams and lakes, and that ultimately forms their beds and shorelines, depends on the nature of the soils in upland areas, which is in turn strongly affected by history of glaciation in the area.

Slope failure is an important management issue in this area. Landslides caused by the January 2009 flood event resulted in significant damage and provided vast quantities of sediment to many of the county's rivers (Sarikhan and Contreras 2009). While slope provides the primary

control on slide risk, the lithology of the underlying material influences rates of weathering and the risk of slope failure. In a study of over 600 slides in the Tilton River watershed near Morton, Dragovich (1993a) concluded that shallow slides (of the type that caused the most damage during the 2009 event) are particularly common on old glacial till. In addition, medium-grained intrusive rocks also had a high incidence of sliding since weathering of these materials produces soil with relatively low cohesion. Slide risk is affected by timber harvest and road building, with an increase in slope failure risk for several decades after clear-cutting (Dragovich 1993b). Slope failure is a dominant source of sediment for streams in steep forested landscapes when forest practices increase the rate of slope failure. Such events alter stream and shoreline functionality due to the increased rate of sediment input.

3.2.4.3. Alpine

Volcanic activity at least 50 million years ago is responsible for andesitic and basaltic lava flows and tuff deposits that underlay much of the higher elevation parts of the county. Eocene, Oligocene, and Miocene volcanic rocks are common. Uplifting and folding occurred during the Tertiary, as recently as perhaps 12 million years ago (Swanson 1996a). Tertiary deposits have been intruded by sills and larger bodies of gabbro and quartz diorite. Many of the earlier volcanic and volcaniclastic deposits have been reworked fluvially or have experienced low-grade metamorphism (Swanson 1991, 1993). Volcanism appears to have resumed in the mid-Pleistocene at Goat Rocks volcano, with eruptive events possibly having occurred as recently as 20,000 to 140,000 years ago (Swanson 1996a).

Extremely large landslides have occurred within alpine areas of the county. Two such landslides blocked entire valleys, and are responsible for the formation of both Glacier and Packwood lakes, probably within the past several thousand years (Swanson 1996b).

Areas downwind from Mount Saint Helens are mantled with tephra that is younger than about 50,000 years (Swanson 1991; Evarts and Ashley 1993). Soils in other upland areas of the county usually contain tephra from other sources including Mount Rainier and Mount Mazama, Oregon. Tephras that were placed on the surface of Pleistocene glaciers are often present near the surface of the soil profile, although tephras that are more recent are also common. Pleistocene tephra is often highly weathered.

The entire alpine area has been glaciated at least twice and probably many times, and glacial drift covers underlying bedrock throughout the region. Volcanism in the area was probably active even during times when glaciation was much more extensive than at present, leading to complex interactions between growing volcanoes and the overlying glaciers. Eruptions of lava from a vent at the base of Mount Adams may have occurred as recently as 21,000 to 22,000 years ago. Volcanic rocks from these eruptions fill much of the Cispus River valley, but are now covered in many places by glacial outwash (Swanson 1991).

Interaction between glacial ice and volcanism is particularly important on Mount Rainier, just north of the county, where hydrothermal alteration of volcanic rock has led to massive slope failures and lahars during the Holocene. Many of the valleys draining Mount Rainier, including the Nisqually down to at least Alder Lake, contain major lahar deposits. However, the hydrothermally altered rock that tends to lead to such events is not as common on the eastern side of the volcano as on its west face, potentially explaining the fact that lahar

deposits in the Cowlitz valley are typically limited to the Park. However, a large lahar on either the Nisqually or Cowlitz remains a possibility, and both valleys are within documented lahar zones (Hoblitt et al. 1998). There is also some risk that a lahar originating on the north side of Mount Adams could enter the Cispus River valley, but the major lahar risk from Mount Adams is along its southern slopes (Scott et al. 1995).

3.2.5. Lahars

Lahars are large, infrequent flows of mixed water and sediment that occur on the slopes of volcanoes and the river valleys that drain them. They are initiated by a variety of mechanisms, some associated with eruptions, and some that can occur at any time. Lahars resemble wet concrete in consistency and flow behavior, and are sometimes called mudflows. The salient differences between lahars and debris flows, which are similar in consistency and origin, are that lahars are greater in volume, travel farther and faster, and tend to inundate entire valleys. Lahars from Mount Rainier are estimated to have traveled as fast as 50 miles per hour and to have filled valleys all the way to Puget Sound with deposits tens to hundreds of feet deep (Hoblitt et al. 1998).

Lahars are recurring events in the valleys that drain Mount Rainier. At least 60 lahars have occurred over the past 10,000 years, and all of the elements conducive to future lahars are still present on Mount Rainier (Hoblitt et al. 1998). In terms of ecosystem processes and shoreline functions, lahars can be considered a catastrophic disturbance mechanism; they essentially destroy the shorelines along their path, filling valleys with sediment into which streams subsequently cut new channels and develop new shorelines. The influence of a lahar can extend far downstream of its initial runout extent, as sediment deposited by the lahar is carried downstream in the days, months, and years following the event.

Lahars are considered to be “a greater threat to communities downvalley from Mount Rainier than any other volcanic phenomenon” (Hoblitt et al. 1998). Although the total value of property at risk from lahars in the Cowlitz and Nisqually valleys is much lower than in the other valleys that drain Mount Rainier, the consequence of a lahar is expected to be complete destruction of property and the death of anyone who remains in its path (Cakir and Walsh 2012). Mount Rainier lahar hazard zones have been mapped for three cases, corresponding to expected recurrence intervals of 500 to 1,000 years for Case I, 100 to 500 years for Case II, and 1 to 100 years for Case III. Tables within each management area section list the reaches that are overlapped to any extent by these mapped lahar hazards. The reach data sheets contained in Appendix D list the percent area of each shoreline reach that is within each lahar hazard zone.

Reaches in the Nisqually and Cowlitz management areas are within lahar hazard zones. In both drainages, mapped lahar hazard zones extend downstream to the head of reservoirs. A large lahar entering one of these reservoirs could cause breaching or overtopping of the impounding dam (Hoblitt et al. 1998), with potentially devastating consequences for downstream shorelines and communities. Areas downstream of the reservoir that could be so affected are not included in the mapped hazard zones along the Cowlitz River.

3.3. Key Ecosystem Processes

Ecosystem processes are the dynamic physical, chemical, and biological interactions that form and maintain natural landscapes. Ecosystem-wide processes are "the suite of naturally occurring physical and geologic processes of erosion, transport, and deposition; and specific chemical processes that shape landforms within a specific shoreline ecosystem and determine both the types of habitat and the associated ecological functions" (WAC 173-26-020(12)). In Lewis County, ecosystem-wide processes influence, and are influenced by the ecosystem structure such as stream channel form, wetland presence, and vegetation communities. This in turn, affects the functions within a specific watershed, management area, or reach considered in this characterization report; and there is considerable overlap between the processes and functions defined in WAC 173-26-201. Processes and functions in the Coalition SMP jurisdiction are related to the rivers, streams, lakes, and associated wetlands that are present throughout Lewis County. Table 3.1 provides an overview of the relationships between ecosystem processes and functions within the Coalition SMP jurisdiction. A more comprehensive list of functions considered in this inventory and characterization was provided in Section 2.4.

Table 3.1. Overview of Ecosystem Processes and Associated Functions.

Ecosystem Process	Associated Functions
Hydrologic – Movement of surface and subsurface water, erosion, and sediment transport and deposition	Water quantity functions; storage of surface water in floodplains and depressional wetlands
Energy and nutrient cycling – Movement of sediment, toxics, nutrients and pathogens	Water quality functions; removal/replenishment of sediment, toxics, nutrients and pathogens through dispersion and sequestration
Habitat development – Vegetation development and succession; movement of water, sediment and large woody debris	Habitat functions; aquatic habitat for invertebrates, native fish, amphibians, birds, and mammals; development of structure that supports vegetation communities which, in turn, support water quantity and water quality functions on a landscape scale

Ecosystem processes are characterized by the physical constraints described previously (*Key Physical Controls*) including variables such as precipitation, climate change, geology, topography, and soils. Additionally, ecosystem processes are characterized by variables such as land use (e.g., residential, commercial, and forestry), and land cover including dominant vegetation community, impervious surface, and development or other disturbances. Ecosystem processes are dependent on natural and anthropogenic controlling factors or ecosystem stressors. In a properly functioning ecosystem, the controlling factors occur within the naturally occurring range under which the ecosystem evolved, and the ecosystem in turn provides the suite of naturally occurring associated functions.

Within the Coalition SMP jurisdiction, primary ecosystem processes are associated with the flow and movement of water from the mountain and hill regions through vast alluvial valleys and floodplains. This contributes to channel formation and structure to support associated functions. Dynamic interactions between process and structure are both naturally and human caused. For example, the ecological impacts of flow control and water quality and quantity

can significantly influence salmon population success and production. Salmon, in turn, have an indirect relationship with to the entire food web and ecosystem processes through biofeedback (i.e., movement of nutrients) and related consequences for vegetation production and success of other water dependent populations of species. As a "keystone" species, the ranges of salmon populations that occur in the Coalition SMP jurisdiction (described later) have an important role, and perhaps a disproportionate influence on other species, in the ecosystem (Knight 2009).

Ecosystem processes and the associated functions can be influenced or impaired by stressors including the following:

- Ground clearing or excavation
- Shoreline filling
- Channel or bank alteration (e.g., armoring)
- Impervious surfaces
- In-water structures
- Point source pollution
- Non-point source pollution
- Riparian vegetation removal
- Invasive species
- Freshwater sources, withdrawals, and flow controls

Key impairments to ecological processes in the Coalition SMP jurisdiction are likely associated with development (e.g., shoreline filling and impervious surfaces) in floodplains, which can alter the flow and movement of water; vegetation alteration including forestry and agricultural practices, which can alter vegetation development and succession, and eliminate native habitats; and the presence of dams or flow controls and pollution sources on local and landscape scales. With 53 dams, Lewis County ranked fifth in number of dams among 39 counties inventoried by Ecology (Ecology 2013). Many of these (32) are associated with mine tailing storage, stormwater management and water quality protection for the Centralia Coal Mine, while others are larger structures used for hydroelectric, recreation, or hatcheries. The overall loss of salmonid habitat due to these dams is significant since multiple reaches can be affected by one dam.

The ecosystem processes and impairments relevant to each management area are considered and described in the assessment of shoreline functions found in Section 4.

3.4. Land Use and Land Cover

3.4.1. Land Use Patterns and SMA Use Preferences

3.4.1.1. General SMA Requirements

The shoreline inventory reviews current and planned land use within the shoreline jurisdiction to provide the basis, along with the ecological functions identified earlier, for establishing environment designations within the Coalition SMP jurisdiction that consider current uses, ecological conditions, and the community visions expressed in the Coalitions' Comprehensive Plans. In addition, it identifies current or planned preferred uses in the shoreline jurisdiction

to protect or promote in order to meet SMA goals for water-oriented uses, shoreline access, and ecological protection, as well as identify potential use conflicts. The SMA promotes the following use preferences (RCW 90.58.020) for shorelines of statewide significance in the following order:

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

Shorelines of statewide significance (WAC 173-18-250 and WAC 173-20-460) in Lewis County include:

- Chehalis River
- Cispus River
- Nisqually River
- Mayfield Reservoir (Mayfield Lake)
- Mossyrock Reservoir (Riffe Lake)
- Alder Reservoir (Alder Lake)

For all other shorelines of the state, the following use preferences from WAC 173-26-201(2)(d) apply:

1. Reserve appropriate areas for protecting and restoring ecological functions to control pollution and prevent damage to the natural environment and public health. In reserving areas, the Coalition should consider areas that are ecologically intact from the uplands through the aquatic zone of the area, aquatic areas that adjoin

permanently protected uplands, and tidelands in public ownership. The Coalition should ensure that these areas are reserved consistent with constitutional limits.

2. Reserve shoreline areas for water-dependent and associated water-related uses unless the Coalition can demonstrate that adequate shoreline is reserved for future water-dependent and water-related uses and unless protection of the existing natural resource values of such areas preclude such uses. The Coalition may prepare SMP provisions to allow mixed-use developments that include and support water-dependent uses and address specific conditions that affect water-dependent uses.
3. Reserve shoreline areas for other water-related and water-enjoyment uses that are compatible with ecological protection and restoration objectives.
4. Locate single-family residential uses where they are appropriate and can be developed without significant impact to ecological functions or displacement of water-dependent uses
5. Limit nonwater-oriented uses to those locations where the above-described uses are inappropriate or where nonwater-oriented uses demonstrably contribute to the objectives of the SMA.

3.4.1.2. Water-Oriented Uses

The SMP Guidelines (WAC 173-26-020) state "…'water-oriented use' means a use that is water-dependent, water-related, or water-enjoyment, or a combination of such uses." The SMA (RCW 90.58.020) promotes uses that are "…unique to or dependent upon use of the state's shoreline" as well as:

> *"…ports, shoreline recreational uses including but not limited to parks, marinas, piers, and other improvements facilitating public access to shorelines of the state, industrial and commercial developments which are particularly dependent on their location on or use of the shorelines of the state and other development that will provide an opportunity for substantial numbers of the people to enjoy the shorelines of the state."*

Definitions and examples of water-oriented uses are included in Table 3.2.

The following current land use categories may include uses that meet the definition of water-oriented uses in Table 3.2:

- Boat Launches
- Fishing Activities
- Recreation
- Industrial
- Commercial
- Transportation

However, a comprehensive inventory of water-oriented uses in the Coalition SMP jurisdiction could not be assembled from available data sources. The primary reason for this is that whether a particular use meets the definition as "water-dependent," "water-related," or "water-enjoyment" is often determined on a case-by-case basis. For example, a restaurant with an expansive view of the Cowlitz River would likely qualify as a water-enjoyment use, while a restaurant with windows oriented towards a road would not.

Consequently, the water-oriented uses sections of this report should not be considered comprehensive. These sections only selectively identify certain water-oriented uses that are either significant or more obvious. These sections identify only certain water-dependent and water-related uses. Water-enjoyment uses, including those accessible through public access points, are discussed by management area in the sections in Section 4 entitled *Existing Shoreline Public Access*.

Table 3.2. Examples of Water-Oriented Uses.

Water-Oriented Use Definitions	Examples
"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. (WAC 173-26-020(39))	Examples of water-dependent uses may include barge loading facilities, shipbuilding and dry-docking, marinas, aquaculture, floatplane facilities, and sewer outfalls.
"Water-related use" means 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: The use has a functional requirement for a waterfront location such as the arrival or shipment of materials by water or the need for large quantities of water; or The use provides a necessary service supportive of the water-dependent uses and the proximity of the use to its customers makes its services less expensive and/or more convenient. (WAC 173-26-020(43))	Examples of water-related uses may include warehousing of goods transported by water, seafood processing plants, hydroelectric generating plants, gravel storage when transported by barge, oil refineries where transport is by tanker, and log storage.
"Water-enjoyment use" means 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. (WAC 173-26-020(40))	Primary water-enjoyment uses may include, but are not limited to, parks, piers and other improvements facilitating public access to the shorelines of the state; and general water-enjoyment uses may include, but are not limited to restaurants, museums, aquariums, ecological reserves, golf courses, and resorts/hotels.

Water-dependent and water-related uses were not mapped in the shoreline inventory map folio; however, many water-enjoyment uses are shown on Public Access maps.

3.4.2. Current Land Use Patterns

Existing land use information provides a baseline understanding of land use intensity, character, and land cover found within the shoreline jurisdiction. Existing land use data for the Coalition SMP jurisdiction was obtained from Lewis County's parcel data. County land use types were aggregated into broader land use categories for conveying information relevant to the SMA priorities, including single-family residential and water-dependent uses.

Aggregated land use categories include the following:

- Single-family Residential
- Multi-family Residential
- Commercial
- Industrial
- Undeveloped
- Railroad
- Airport
- Right-of-Way
- Ports
- Auto Parking
- Utilities
- Diking Right-of-Way
- Public/Education/Assembly
- Church
- Open Space
- Agriculture
- Fishing Activities
- Forestland
- Other

Parcels not characterized as resource lands, such as open space, agriculture, forestland, fishing activities; or other land uses not associated with likely future development; nor publicly held and with an assessed improvement value of less than $10,000; were identified as vacant. These parcels provide an indication of the distribution of potentially developable areas within the Coalition SMP jurisdiction.

3.4.3. Comprehensive Plan Land Use Patterns

[…]

3.4.3.3. City of Chehalis

The city of Chehalis adopted its current Comprehensive Plan on July 12, 1999, and has made two amendments since then, the latest being on April 11, 2011. The city's existing land use pattern responds to the opportunities and constraints presented by natural features of the land, and to the economic opportunities presented by rail and highway transportation corridors. Access to rail has attracted manufacturing and distribution uses, while highway access and visibility has also promoted these activities, as well as commercial uses. Housing development has followed economic opportunity.

The city developed in a north-south pattern along what is now the Burlington Northern-Santa Fe (BNSF) Railroad. The later construction of Interstate 5 along this same general corridor reinforced this alignment. Commercial and industrial development is concentrated along this highway/rail corridor, with much of the new industrial growth occurring immediately to the south of the city. The high visibility from the highway attracts the commercial growth along this corridor. The economic energy of the city's traditional downtown has eroded over time because of competition from highway commercial development. However, most city and county government offices and facilities have remained close to the city's central core.

Residential uses vary within the city, with the highest densities located close to the downtown. In outlying areas, lower densities predominate.

The floodplains of Coal Creek, Salzer Creek, and the Chehalis River present significant constraints to development in the northern and western portions of the city. Frequent flooding in these areas has resulted in limited development opportunities.

Land uses within the city are allocated between residential, commercial, industrial, and essential public facility uses. The city’s land use designations include:

1. Residential, Low-Density:

   Residential, Low-Density constitutes 22.89 percent of the total land area in the city. The amount of land designated for single-family development according to current city land use designation is approximately 813 acres. The vision of future residential development in the city includes both single-family and multi-family development, subdivided further by development densities.

2. Residential, High-Density:

   The higher residential densities permitted for multi-family housing are typically the most common method of promoting more affordable housing. The amount of area set aside for Residential, High-Density is approximately 401 acres, which represents approximately 11.29 percent of the total land area in the city. The intent of Residential, High-Density is to provide an area for a variety of housing types at a limited density, including institutional, with adequate public facilities and zoning controls designed to protect the residential living.

3. Industrial:

   The economy of an area generally relies on industry to provide its greatest employment opportunities. The city contains approximately 377 acres of land set aside for industrial use. In general, this land is located in areas that can take advantage of proximity to the airport, or access to rail lines.

4. Commercial:

   Another important factor in the local economy is the availability of land for commercial purposes. Whether for offices, retail establishments, or similar uses, commercial property provides jobs and tax revenues that are essential to the community's economic health. In the city, commercial land approximately 1,463 acres are designated commercial, which is 40 percent of the city's land area.

5. Planned Unit Development (PUD):

   There are three PUD designations throughout the city: Golden Age Mobile Home Park, Tauscher Mobile Home Park, and Willow Glen Mobile Home Park. The amount of land currently developed as PUD is approximately 6.80 acres. Any mobile home park that is within the city's UGA would become a PUD upon annexation to the city. The intent of the PUD district is to encourage new development not limited by the strict application of normal underlying zoning codes.

6. Airport Service District (ASD):

   The ASD is a special overlay district that provides for the appropriate development of the airport and surrounding properties. The intent of this designation is to ensure that development at and around the airport occurs in a manner that is compatible with the continued and expanding operation of the airport facility. The ASD contains approximately 295 acres. A majority of the ASD is also within the 100-year floodplain.

7. Historic District (HIS):

   The Historic Districts define the early architectural heart of the city. Currently, the city has three Historical Districts: the Westside Historical District (approximately 80 acres), the Downtown Historical District (approximately 38 acres), and the Hillside Historical District (approximately 78 acres). The total approximate acreage for the combined Historic Districts is approximately 196 acres.

8. Foreign Trade Zone (FTZ):

   The Department of Commerce created an FTZ covering approximately 90 acres along the southern portion of the airport and crossing Interstate 5 to the northern most Light Industrial designated area.

9. Industrial Development District (IDD):

   The city's Industrial Development district is under the auspices of the Port of Chehalis. The Port has two industrial Parks:

   - The Chehalis Industrial Park is located next to Interstate 5. It has over 700 acres with more than 200 acres available for new development. It is also in close

proximity to U.S. Route 12, this provides year-round access east over the Cascades. The Park is served by both the BNSF and Union Pacific Railroad (UPRR) railroads.

- The Curtis Industrial Park is located 10 miles west of Interstate 5 and the city via State Route 6. The park has 357 acres and available short line railroad providing service to BNSF and UPRR railroads.

10. Essential Public Facilities (EPF):

    The intent of the EPF land use designation is to provide an area for development of public or semi-public facilities determined by the city to be essential to the well-being and function of the community. Such facilities generally require strategic locations, which may necessitate unique zoning controls.

    The Essential Public Facilities is subdivided into the following categories:

    - EPF(A): airport
    - EPF(C): cemetery
    - EPF(F): fairgrounds
    - EPF(G): government
    - EPF(H): hospital
    - EPF(I): institution
    - EPF(P): park/playground
    - EPF(S): school
    - EPF(U): utility
    - EPF(W): wetland

11. Open Spaces and Natural Lands:

    This category generally includes private outdoor recreation areas, wooded areas, pastures and fields, and land upon which development cannot occur due to physical constraints such as steep slopes, wetlands, and adopted floodways.

12. UGAs:

    On February 1, 2006, the county and the city entered into an interlocal agreement for the purpose to provide an expeditious way for permit applicants in the unincorporated portion of the city's UGA to secure development review, approval, and inspections. Five separate areas make up the city's UGA. The largest area, located to the south of the city, includes all of the land designated for industrial use, a significant amount of land for commercial use, and a small amount of residential land. The remaining areas include residential land to the east of the city, and two nodes of commercial land located north of the airport, and south of the Interstate 5 interchange at Parkland Drive and a park off Riverside Road that is designated as an essential public facility EPF (P).

[…]

3.5. Existing Public Access

Existing, formally established recreational areas with shoreline public access are identified by shoreline management area in Section 4 in the *Existing Shoreline Public Access* sections, in Section 6 in the *Potential Gaps and Opportunities* sections, and on Public Access Maps in Appendix A. Recreational areas identified include those provided by local, state, and federal government agencies, as well as private recreational areas that are open to the public.

Potential shoreline public access opportunities were gathered principally by reviewing pertinent park and recreation planning documents.

An important component of public access in the Cowlitz River basin, the Cowlitz Wildlife Area consists of lands owned by Tacoma Power and is managed by the WDFW as wildlife mitigation for Mayfield and Mossyrock dams. Almost all mitigation lands (14,095 acres) are adjacent to Mayfield and Riffe Lakes. The only exceptions are small parcels located at Davis Lake east of Morton (Davis Lake Unit – 273 acres), 280 acres near the Cowlitz Trout Hatchery (Cowlitz Trout Hatchery Unit), 418 acres south of Randle (Spears Unit), and 415 acres off Savio Road west of Randle (Kiona Creek Unit). These units are discussed in more detail in Section 4 in the *Existing Shoreline Public Access* sections for the relevant management areas.

Management goals for the Cowlitz Wildlife Area, as stated in the Cowlitz Wildlife Management Plan, are to preserve habitat and species diversity for both fish and wildlife resources, maintain healthy populations of game and non-game species, protect and restore native plant communities, and provide diverse opportunities for the public to encounter, utilize, and appreciate wildlife and wild areas. The WDFW is pursuing ongoing acquisitions of additional property.

3.6. Historical and Cultural Resources

3.6.1. Native Americans

Native peoples that historically inhabited the area now within Lewis County were primarily the Upper Chehalis and Cowlitz tribes of the Southwestern Coast Salish (Hajda 1990). The Meshal and Nisqually tribes, which lived in the northeastern part of present-day Lewis County, were Southern Coast Salish (Suttles and Lane 1990). The Suwal tribe of the Kwalhioqua people lived in the western part of the county; they shared territory with the Cowlitz and Upper Chehalis tribes (Krauss 1990).

Salmon was a significant food source for all of these tribes. Tribe members also gathered nuts, berries, and tubers from the forest and prairies. Most villages were located at the mouths of rivers and creeks. In general, native people lived near fishing streams in cedar longhouses during the winter months (Chehalis Tribe 2009; Irwin 2011). In spring, they would move to prairies to dig camas and wapato. Some of the tribes would move to higher ground in summer and fall to harvest berries, and hunt game.

The Upper Chehalis lived along the banks of the Chehalis River (Wilma 2008; Chehalis Tribe 2008). They were expert fishers and paddlers of shallow shovelnose canoes. In addition to salmon, their primary staple, they harvested steelhead, eels, freshwater clams, and crayfish. They also used the Chehalis and Cowlitz River systems as trading routes, and they traded

among the several bands of both Upper and Lower Chehalis tribes, as well as with other peoples (U-S-History.com, undated).

The Cowlitz people inhabited an area south of the Cowlitz River—and south of the Upper Chehalis, Meshal, and Nisqually people (Irwin 2011). The Cowlitz people are divided into two main groups: the Upper Cowlitz and Lower Cowlitz. The Upper Cowlitz occupied villages east of present-day Mossyrock, and camped at higher elevations in the Cascades. They were known for their hunting expertise (Irwin 2011). The more populous Lower Cowlitz occupied numerous villages along the Cowlitz River from Mossyrock southward to within 1 or 2 miles of the Columbia River. The Cowlitz were horse people and, like other peoples in the region, they used trails and rivers (canoes) to visit and trade with other tribes.

The Meshal people lived near the Chehalis River headwaters in the Cascade Range. Having horses, they often traded with tribes east of the mountains (Wilma 2008).

According to legend, the Nisqually people came north from the Great Basin, crossed the Cascades, and settled their first village in the Skate Creek basin (within the Cowlitz River watershed), just south of the Mashel River watershed (Nisqually Indian Tribe 2010). Later, they settled near the Mashel River. Their lands extended to Puget Sound. Salmon and fishing are culturally significant, and salmon remains the mainstay of their diet (Nisqually Indian Tribe 2010).

Little has been recorded about the Suwal (Kwalhioqua) (Krauss 1990). They hunted game, gathered berries and roots, and also fished. Their relations with other tribes and Europeans "were beset with conflict" (Krauss 1990). By the mid-1850s, most of the Kwalhioqua had disappeared.

3.6.2. Euro-American Settlement

Between 1818 and 1846, the United States and Great Britain jointly occupied the Pacific Northwest. The Hudson's Bay Company established trading posts at Fort Nisqually on Puget Sound and at Fort Vancouver on the Columbia River. By the early 1800s, Hudson's Bay Company traders were using the Cowlitz Trail to travel between Fort Vancouver and Fort Nisqually (Wilma 2008). The Cowlitz Trail was originally a Native American portage between the Chehalis and Cowlitz Rivers (Wilma 2008) and had been used for hundreds of years as part of the natives' trading routes (Tumwater 2005). In 1845, the first European settlers traveled from Fort Vancouver to the mouth of the Deschutes River near present-day Tumwater, Washington (Tumwater 2005). To do so, they built a wagon road along the Cowlitz Trail, beginning at Cowlitz Landing, near present-day Toledo (Yakima Valley Historical Society, undated). Today, most of the Cowlitz Trail has disappeared due to road construction and other human activities (Tumwater 2005).

In Lewis County, communities with good water access developed first. By the 1850s, there was a small settlement at Cowlitz Landing that catered to settlers traveling north to Puget Sound (Tumwater 2005). In the 1860s, Cowlitz Landing had a store, a hotel, a post office (first post office in the county), and several other buildings. Because of the dynamic nature of the Cowlitz River, which has altered its course so much during the past 150 years, no trace of Cowlitz Landing remains.

In 1851, Stuart Schuyler Saunders settled near the Chehalis River at what would become Saundersville; and then, in 1872, renamed Chehalis (Winlock 2008, Wall 2008), and Chehalis 2013). Chehalis became the county seat in 1873, shortly after the Northern Pacific Railroad was built from Kalama, on the Columbia River, through Chehalis. The railroad extended from Kalama, on the Columbia River, to the Chehalis River in 1872 and on to Tacoma in 1873 that same year. The first town center was on West Main Street, near the railroad. The town center shifted down West Main Street to the corner of Chehalis Avenue and West Main; that second town center was destroyed by fires in 1892 (Chehalis 2013). The third city center was built along Market Boulevard, and is the city's present historic downtown central business district (Chehalis 2013).

In 1875, after having lived in the area since 1851, African American George Washington filed a plat on a town he called Centerville. The town was on the Northern Pacific Railroad line at the confluence of the Chehalis and Skookumchuck Rivers (Ott 2008). The town was renamed Centralia in 1883 (Ott 2008) and was incorporated as Centralia in 1886 (Wilma 2008).

The first two settlers in Winlock, C.C. Pagget and Jacky Nealy, arrived in 1871 (Wall 1952). They acquired land on both sides of the railroad line (which was not yet built) in the town's present location. The town was founded in 1873 (Wall 1952).

Morton was first settled by James Fletcher in 1871. It was named Morton in 1889 and was incorporated in 1913 (Wikipedia 2013). In the 1950s, the world's longest railroad tie dock ran along the railroad tracks east of Morton (Sparkman 1994), and the town was known as the "tie mill capital of the world" (Wikipedia 2013).

By 1883, the towns in Lewis County included Centralia, Chehalis, Morton, Mossyrock, Napavine, Pe Ell, Toledo, Vader, and Winlock.

In the 1880s, the US Army Corps of Engineers cleared snags from the Chehalis River, which allowed steamers to travel from Grays Harbor as far upstream as the railroad connection at Chehalis (Wilma 2008). The river dredging and railroad made it possible to exploit the county's timber resource. Lumbering became the principal industry in Lewis County, attracting new immigrants to the region (Wilma 2008). Although the US government preserved large tracts from settlement in 1897 (later the Gifford Pinchot National Forest), timber could be cut on those lands. Logging and milling operations attracted thousands of workers in the early 1900s. The timber industry dropped off in the 1920s, followed by the Great Depression in the 1930s. The county economy rebounded in the 1940s as World War II increased demand for wood and agricultural products (Wilma 2008).

3.6.3. Properties on the Washington State Heritage Register

A search of the Washington State Department of Archaeology and Historic Preservation (DAHP) online database, WISAARD, revealed 58 historic sites in Lewis County. Two previously listed sites, the Doty and Pe Ell covered bridges, were removed from the Washington and National historic registers (DAHP 2013). The currently listed sites, their listing status, site address, and date of listing, are presented in Table 3.3.

Table 3.3. Sites and Structures Listed on the Washington Heritage Register.

Register Status	Site/Structure Name	Site Address	City	Date Listed	Management Area
WHR	Armistice Day Riot (Centralia Massacre Site)	807 North Tower	Centralia	11/15/1974	Centralia
NHR+WHR	Birge, George E.; House	715 E Street	Centralia	12/1/1986	Centralia
NHR+WHR	Borst, Joseph; House	302 Bryden Avenue	Centralia	12/27/1977	Centralia
NHR+WHR	Centralia Downtown Historic District	Bounded by Center Street, BNSF right-of-way, Walnut Street, Pearl Street	Centralia	8/18/2003	Centralia
NHR+WHR	Centralia Main Post Office	214 W Locust	Centralia	8/7/1991	Centralia
NHR+WHR	Centralia Union Depot	210 Railroad Street	Centralia	5/19/1988	Centralia
NHR+WHR	Everest, Wesley; Gravesite	Sticklin-Greenwood Memorial Park, 1905 Johnson Road	Centralia	12/17/1991	Centralia
WHR	Fort Borst Block House	Borst Avenue	Centralia	11/19/1971	Centralia
NHR+WHR	Hubbard Bungalow	717 N Washington Avenue	Centralia	8/24/2005	Centralia
NHR+WHR	Olympic Club Saloon (Olympic Club)	112 North Tower	Centralia	3/10/1980	Centralia
NHR+WHR	The Sentinel	Washington Park (bounded by Main, Pearl, Locust, Silver)	Centralia	12/17/1991	Centralia
WH Barn	Barn (VT Farm)	114 Clinton Road	Chehalis	11/2/2007	Chehalis
NHR+WHR	Burlington Northern Santa Fe Depot (Chehalis Passenger Station)	Off US 99	Chehalis	11/6/1974	Chehalis
NHR+WHR	Chehalis Downtown Historic District (Third Civic Center)	Bounded by Park Street, Front Street, Washington Avenue, Cascade Avenue	Chehalis	11/21/1997	Chehalis
NHR+WHR	Chehalis Main Post Office	225 NW Cascade Avenue	Chehalis	5/30/1991	Chehalis
NHR+WHR	Claquato Church	Off WA 12	Claquato	4/24/1973	Chehalis
NHR+WHR	Hillside Historic District	Bounded by Jefferson Avenue, Hill Street, Washington Avenue, 9th Street	Chehalis	8/1/1996	Chehalis

Table 3.3 (continued). Sites and Structures Listed on the Washington Heritage Register.

Register Status	Site/Structure Name	Site Address	City	Date Listed	Management Area
NHR+WHR	McFadden, O. B.; House	1639 Chehalis Avenue	Chehalis	4/1/1975	Chehalis
NHR+WHR	Palmer, O. K.; House	673 NW Pennsylvania	Chehalis	5/15/1986	Chehalis
NHR+WHR	Pennsylvania Avenue - West Side Historic District	600 Block NW St Helens; 440-723 Pennsylvania Avenue	Chehalis	12/3/1991	Chehalis
WH Barn	Rackske, Augusta; Barn (Rosecrest Farm)	439 Spooner Road	Chehalis	11/2/2007	Chehalis
NHR+WHR	Scout Lodge	278 SE Adams Avenue	Chehalis	6/24/2004	Chehalis
NHR+WHR	St. Helens Hotel (St. Helens Inn)	440 North Market Boulevard	Chehalis	10/8/1991	Chehalis
WH Barn	Tramm, H. L.; Barn (Gregory Farms)	345 Bunker Creek Road	Chehalis	1/25/2008	Chehalis
NHR+WHR	La Wis Wis Guard Station No. 1165	Gifford Pinchot National Forest	Packwood	4/8/1986	Cowlitz-Cascade Highlands
NHR+WHR	Ohanapecosh Comfort Station No. O-302	Mt. Rainier National Park	Ohanapecosh	3/13/1991	Cowlitz-Cascade Highlands
NHR+WHR	Ohanapecosh Comfort Station No. O-303	Mt. Rainier National Park	Ohanapecosh	3/13/1991	Cowlitz-Cascade Highlands
WHR	Packwood Lake Guard Cabin (Old Packwood Lake Guard Station)	Packwood Lake, Gifford Pinchot National Forest	Packwood	7/28/1982	Cowlitz-Cascade Highlands
NHR+WHR	Three Lakes Patrol Cabin	Mt. Rainier National Park	Ohanapecosh	3/13/1991	Cowlitz-Cascade Highlands
WH Barn	Barn (The Morris Farm)	146 Bartley Road	Mossyrock	2/24/2011	Cowlitz-Cascade Lowlands
NHR+WHR	North Fork Guard Station No. 1142	Gifford Pinchot National Forest	Randle	4/11/1986	Cowlitz-Cascade Lowlands
NHR+WHR	Randle Ranger Station - Work Center	Gifford Pinchot National Forest	Randle	4/8/1986	Cowlitz-Cascade Lowlands

Table 3.3 (continued). Sites and Structures Listed on the Washington Heritage Register.

Register Status	Site/Structure Name	Site Address	City	Date Listed	Management Area
WH Barn	Barnes, Elmer and Clara; Barn (Harmony Hill)	202 Schmit Road	Toledo	10/17/2008	Cowlitz-Puget Lowlands
NHR+WHR	Grace Evangelical Church of Vader (Grace United Methodist Church of Vader)	618 D Street	Vader	3/28/2003	Cowlitz-Puget Lowlands
NHR+WHR	Jackson, John R.; House (Jackson Court House)	Mary's Corner, 11 miles south of Chehalis on Jackson Highway	Chehalis	1/11/1974	Cowlitz-Puget Lowlands
WHR	Lindeman, Paul C.; House	Lacamas Prairie	Ethel	2/25/1977	Cowlitz-Puget Lowlands
WH Barn	Lucas, Henry and Flossie; Farm (Wood Duck Haven)	722 Highway 12	Chehalis	2/21/2013	Cowlitz-Puget Lowlands
NHR+WHR	Olsen, Ben; House	South end of D Street	Vader	11/7/1976	Cowlitz-Puget Lowlands
WH Barn	Roth, Frederick; Barn	193 Roth Road	Winlock	11/2/2007	Cowlitz-Puget Lowlands
NHR+WHR	Longmire Campground Comfort Station No. L-302	Mt. Rainier National Park	Longmire	3/13/1991	Nisqually
NHR+WHR	Longmire Campground Comfort Station No. L-303	Mt. Rainier National Park	Longmire	3/13/1991	Nisqually
NHR+WHR	Longmire Campground Comfort Station No. L-304	Mt. Rainier National Park	Longmire	3/13/1991	Nisqually
NHR+WHR	Longmire Historic District	Mt. Rainier National Park	Longmire	3/13/1991	Nisqually
NHR+WHR	Mineral Log Lodge	East side of Mineral Lake on Hill Rd	Mineral	3/26/1975	Nisqually
NHR+WHR	Narada Falls Bridge (First Crossing of the Paradise River)	Mt. Rainier National Park	Paradise	3/13/1991	Nisqually
NHR+WHR	Narada Falls Comfort Station	Mt. Rainier National Park	Paradise	3/13/1991	Nisqually
WH Barn	Barn (Feldman Ranch)	1750 North Fork Road	Chehalis	11/3/2011	Upper Chehalis - Western Foothills

Table 3.3 (continued). Sites and Structures Listed on the Washington Heritage Register.

Register Status	Site/Structure Name	Site Address	City	Date Listed	Management Area
WH Barn	Barn (Vietta's Farm LLC)	193 Flickett Road	Onalaska	1/25/2008	Upper Chehalis-Puget Lowlands
WH Barn	Myer Barn (Myer Farm)	3381 Centralia-Alpha Road	Onalaska	1/25/2008	Upper Chehalis-Puget Lowlands
WH Barn	Barn (Boistfort Valley Farm)	426 Boistfort Road	Curtis	11/2/2007	Upper Chehalis-Willapa Hills
NHR+WHR	Boistfort High School	983 Boistfort Road	Curtis	8/6/1987	Upper Chehalis-Willapa Hills
WH Barn	Chehalis River Hatchery Barn	237 Hatchery Road	Chehalis	1/25/2008	Upper Chehalis-Willapa Hills
NHR+WHR	Holy Cross Polish National Catholic Church	Third and Queen	Pe Ell	9/2/1987	Upper Chehalis-Willapa Hills
WHR	McCormick Logging Railroad Tunnel	2 miles NW of Pe Ell	Pe Ell	6/5/1987	Upper Chehalis-Willapa Hills
WH Barn	Stannek Farm (Willapa Hills Sheep Dairy and Farmstead Cheese)	4680 State Route	Doty	11/5/2009	Upper Chehalis-Willapa Hills
NHR+WHR	Wolfenbarger Site (archaeological site)	(address restricted)	Curtis	5/2/1977	Upper Chehalis-Willapa Hills
WH Barn	Unterwegner Barn (Homestead Farm)	429 Penning Road	Chehalis	11/2/2007	Upper Chehalis-Willapa Hills[a]
WHR	Adams, John; House	710 SE Front	Winlock	6/6/1997	Winlock

Table 3.3 (continued). Sites and Structures Listed on the Washington Heritage Register.

Register Status	Site/Structure Name	Site Address	City	Date Listed	Management Area

Source: DAHP (2013)
BNSF = Burlington Northern Santa Fe Railroad
NHR+WHR = National Historic Register and Washington Heritage Register
WH Barn = Washington Heritage Barn Register
WHR = Washington Heritage Register
[a]On or near the boundary with Chehalis Management Area

3.7. Shoreline Modifications

The following types of shoreline modifications are found in the Coalition's SMP jurisdiction; however, only databases of dams, dikes, and levees were available for the inventory:

- Dikes or levees are raised berms intended to limit or direct overbank flows during flood events. They reduce the ability of the floodplain to store water and delay the passage of flood peaks, and are typically accompanied by the removal of shoreline vegetation.
- Bridges and culverts constrict flow during flood events and locally restrict channel migration. Culverts can be perched, in which case there is an elevation break at the downstream side of the culvert that often acts as a barrier to migrating fish. Culverts can also be undersized, in which case peak flows back up behind them and high velocities through the culvert impede fish passage.
- Dams can significantly change downstream hydrology, except when operated in run-of-the-river mode (i.e., with negligible changes in water storage and consequent effects on peak or low flows). Dams impound large wood and sediment along with water. Dams often cause degradation, erosion, and armoring downstream due to reduced sediment supply. They create lake-like conditions along what were previously stream shorelines, and usually result in the formation of deltas where streams flow into the impoundment.
- Revetments are erosion resistant structures, usually made of rock, that are placed to eliminate bank erosion where it threatens property or infrastructure. Revetments tend to reduce the structural complexity of shorelines, are typically accompanied by the removal of shoreline vegetation and, by design, eliminate the banks' ability to provide sediment to the stream.
- Bulkheads are retaining walls along shorelines. Their effects are similar to those of revetments.
- Fill is the placement of earthen materials in a water body to create new land area and shoreline. The characteristics of that shoreline depend on how it is constructed; often fill is accompanied by the construction of revetments and/or bulkheads.
- Overwater structures such as piers and docks are generally found on lakes rather than streams. They are often associated with bulkheads and/or revetments, and can serve to provide shade and cover in the absence of well-developed shoreline vegetation.
- Flow-directing structures such as pilings, barbs, and groins are not common in the streams of Lewis County. Where present, they can increase bank and bed complexity compared to simple revetments.
- Channelization and straightening tend to increase the conveyance capacity of streams, at the cost of hydraulic and shoreline complexity. Channelization is often combined with or effected by the installation of revetments and/or dikes.

3.8. Critical Areas and Priority Habitat and Species

This section describes critical areas and priority habitat and species (PHS) of state and local concern including in-stream habitat, wetlands, riparian habitat, fish, and other wildlife dependent on water and shoreline environments in the shoreline jurisdiction. Critical areas within the shoreline jurisdiction include:

- Frequently flooded areas
- Wetlands
- Geologically hazardous areas
- Fish and wildlife habitat conservation areas
- Critical aquifer recharge areas

There is considerable overlap between critical areas and priority habitat and species. Fish and wildlife habitat conservation areas typically include Washington State designated PHS. For example, fish and wildlife conservation areas, which are designated critical areas in Lewis County, include PHS areas (LCC 17.35A.195). Wetlands, also designated critical areas, are similarly designated by WDFW as priority habitats. Additional critical areas described in this section include geologic hazard areas and sensitive aquifer recharge areas.

Fish and wildlife conservation areas in the Coalition SMP jurisdiction are assumed to include the following:

(a) Areas where endangered, threatened, and sensitive species have a primary association;

(b) Habitats and species of local importance, as determined locally (assumed to include all state designated priority species and habitats potentially occurring in the county pursuant with LCC 17.35A.195);

(d) Forage fish (Pacific eulachon) spawning areas;

(e) Naturally occurring ponds under twenty acres and their submerged aquatic beds that provide fish or wildlife habitat;

(f) Waters of the state;

(g) Lakes, ponds, streams, and rivers planted with game fish as defined by RCW 77.08.020, including fish planted under the auspices of federal, state, local, or tribal programs, or which support priority fish species as identified by WDFW (LCC 17.35A.195); and

(h) State natural area preserves, natural resource conservation areas, and state wildlife areas.

These features are discussed within the context of PHS in this section. In accordance with state requirements for amending SMPs, WAC 173-26-201(3)(c) and 173-26-221, this section

focuses on species that are listed as endangered, threatened, or sensitive, as well as priority habitats that are primarily associated with the shoreline and aquatic environment. Appendix B contains the PHS list for the habitats and species identified by WDFW for Lewis County that have a high likelihood of presence in the county. However, the state code requires that critical areas, including fish and wildlife conservation areas, be considered in managing shorelines. Therefore, all species and habitat considered priority by WDFW and identified as locally important according to Lewis County Code regarding habitat conservation areas (LCC 17.35A.195) should be considered in shoreline planning. On this basis, the same is true for ponds less than 20 acres that provide habitat, and waters planted with game fish such as largemouth bass. These should be considered in shoreline planning to the extent that they are present in the shoreline jurisdiction. The species and habitats for which PHS data were available are therefore included in the functional assessment for the purpose of this characterization and reach level functional assessment. However, they are not all described in detail in this section due to their listing status or association with the terrestrial environment. The species and habitats identified by WDFW as priority should also be considered on a site-specific scale during individual project review.

In terms of priority fish species, this characterization focuses on salmon and trout due to the availability of mapped data and their important role as a fisheries resource, as well as fish species that have a federal or state status of endangered, threatened, or sensitive. Other designated priority species such as pacific lamprey and river lamprey have a status of "candidate" or "species of concern" and also occur in the shoreline jurisdiction. Species and habitats listed in Appendix B may require consideration on a site-specific scale during review of development projects on a local level. Although they are not specifically described in this characterization, they are considered in the reach level functional assessment where data were available.

3.8.1. Streams

In-stream areas are a priority aquatic habitat designated by WDFW. In-stream habitat is defined as the combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for in-stream fish and wildlife resources. This priority habitat occurs throughout most of the shoreline jurisdiction, which is dominated by river and stream water features. Exceptions would be limited to reaches dominated by lake or wetland habitats representing another priority aquatic habitat types.

3.8.2. Wetlands and Deepwater

WDFW designates freshwater wetlands and fresh deepwater as priority aquatic habitats in Washington State. Wetlands are also designated critical areas. Mapped wetlands in the shoreline jurisdiction include those identified in the Lewis County GIS database for wetlands, which is based on the National Wetland Inventory (NWI), and from the PHS database. In Lewis County, most wetlands are not shown in the PHS database so the NWI is the primary source of information for this priority habitat in the county. Other wetlands could potentially be present because, in general, many wetlands are not identified in these sources. Conversely, some wetlands identified may not meet wetland criteria. Therefore, actual wetland boundaries should determine the associated shoreline jurisdiction boundary on a site-specific

scale during local project reviews. Wetland and deepwater priority habitats are defined as follows:

- **Freshwater Wetlands -** Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands must have one or more of the following attributes: the land supports, at least periodically, predominantly hydrophytic plants; substrate is predominantly undrained hydric soils; and/or the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year.
- **Fresh Deepwater -** Permanently flooded lands lying below the deepwater boundary of wetlands. Deepwater habitats include environments where surface water is permanent and often deep, so that water, rather than air, is the principal medium within which the dominant organisms live. The dominant plants are hydrophytes; however, the substrates are considered non-soil because the water is too deep to support emergent vegetation. These habitats include all underwater structures and features (e.g., woody debris, rock piles, and caverns).

There are many other types of wetlands found within Lewis County besides the types identified as priority habitats by WDFW. From a hydrogeomorphic perspective, other wetlands types likely present in the shoreline jurisdiction include those associated with rivers and streams, slope wetlands, and depressional wetlands. Each of these wetland types functions differently and all have important roles in the landscape.

Significant deepwater lakes in the shoreline jurisdiction include Mayfield Lake, Riffe Lake, Lake Scanewa, and Mineral Lake.

3.8.3. Riparian Habitat

Riparian habitat in a variety of forms ranging from low slope, valley bottom grasslands to steeply sloped, mountain forest are also common throughout the shoreline jurisdiction. Riparian habitat that is a designated priority habitat in Washington State is the area adjacent to flowing or standing freshwater aquatic systems. It encompasses the area beginning at the ordinary high water mark and extends to that portion of the terrestrial landscape that is influenced by, or that directly influences, the aquatic ecosystem. For example, hyporheic zones associated with riparian habitats can influence the vegetative structure and subsequently affect food production and food web interactions for fish and other aquatic organisms.

In riparian systems, the vegetation, water tables, soils, microclimate, and wildlife inhabitants of terrestrial ecosystems are often influenced by perennial or intermittent water. Simultaneously, adjacent vegetation, nutrient and sediment loading, terrestrial wildlife, as well as organic and inorganic debris influence the biological and physical properties of the aquatic ecosystem.

Riparian habitat includes the entire extent of the floodplain and riparian areas of wetlands that are directly connected to stream courses or other freshwater. Therefore, it is present

throughout the entire shoreline jurisdiction, albeit at various levels of development and functional quality or value.

3.8.4. Snags and Logs

Snags and logs are habitat features that are designated by WDFW as priority habitat in Washington State. Snags and logs may be present in the designated priority habitats described in the previous sections to the extent that those habitats support trees or the transport of large wood through the aquatic system.

Priority snag and log habitat includes individual snags and/or logs, or groups of snags and/or logs of exceptional value to wildlife due to their scarcity or location in a particular landscape. Areas with abundant, well-distributed snags and logs are also considered priority snag and log habitat. Examples include large, sturdy snags adjacent to open water, remnant snags in developed or urbanized settings, and areas with a relatively high density of snags.

Priority snags have a diameter at breast height of greater than 51 cm (20 inches) in western Washington and greater than 30 cm (12 inches) in eastern Washington, and are greater than 2 m (6.5 feet) in height. Priority logs are greater than 30 cm (12 inches) in diameter at the largest end, and greater than 6 m (20 feet) long.

3.8.5. Salmon and Trout

Salmon and trout populations in the county are separated by major ecological regions, which for the purpose of this inventory and characterization can be described as Washington Coast, Puget Sound, and Lower Columbia River Basin. Salmon recovery regions, populations, and ESA units generally correspond to these regions. SMP management areas are also generally divided between these regions. Fish species and listing status are summarized in Tables 3.4, 3.5, and 3.6 in the sections below. Critical habitat for salmon in the Lower Columbia River Basin has been designated in the Cowlitz River and its tributaries, and all of the streams in the shoreline jurisdiction that support Chinook or coho salmon are considered "essential fish habitat" protected by the Magnuson-Stevens Fishery Conservation and Management Act under the jurisdiction of NMFS.

Table 3.4. Priority Salmon and Bull Trout in Washington Coast Region.

Species	Endangered Species Act Unit	Federal Listing Status	State Listing Status
Chinook	Washington Coast ESU	Unwarranted	Candidate
Coho	Southwest Washington ESU	Unwarranted	None
Steelhead	Southwest Washington DPS	Undetermined	Candidate
Bull Trout	Olympic Peninsula RU	Threatened / designated critical habitat [a]	Candidate

[a] Critical habitat for bull trout is not designated within the Coalition SMP jurisdiction.

In addition to the salmon and bull trout that have distinct populations with different listing status in the three regions, there are also the resident form of coastal cutthroat trout and rainbow trout in all three geographic regions described below. Coastal resident cutthroat

trout is a federal listed species of concern, and both cutthroat and rainbow trout are WDFW designated priority species due to their recreational value.

Table 3.5. Priority Salmon and Bull Trout in Puget Sound Region.

Species	Endangered Species Act Unit	Federal Listing Status	State Listing Status
Chinook	Puget Sound ESU	Threatened / designated critical habitat [a]	Candidate
Coho	Puget Sound / Strait of Georgia ESU	Species of Concern	None
Steelhead	Puget Sound ESU	Threatened / proposed designated critical habitat [b]	Candidate
Bull Trout	Puget Sound RU	Threatened / designated critical habitat	Candidate

[a] Critical habitat for Chinook has not been designated in the Coalition SMP jurisdiction.
[b] Critical habitat for steelhead has not been proposed in Coalition SMP jurisdiction.
[c] Critical habitat for bull trout is not designated in Coalition SMP jurisdiction.

Table 3.6. Priority Salmon and Bull Trout in Lower Columbia River Region.

Species	Endangered Species Act Unit	Federal Listing Status	State Listing Status
Chinook	Lower Columbia River Spring Run ESU	Threatened / designated critical habitat	Candidate
Chum	Columbia River	Threatened / designated critical habitat	Candidate
Coho	Lower Columbia River ESU	Threatened / proposed designated critical habitat	None
Steelhead	Lower Columbia River DPS	Threatened / designated critical habitat	Candidate
Bull Trout	Lower Columbia River Basin RU	Threatened / designated critical habitat[a]	Candidate

[a] Critical habitat for bull trout is not designated in the Coalition SMP jurisdiction.

3.8.5.1. Washington Coast

In the county, the Washington Coast region includes WRIA 23, the Upper Chehalis basin in the west and northwest portion of the county, Centralia, Chehalis, and Napavine. In the Washington Coast region, bull trout is the only species listed as threatened or endangered. However, other state priority salmon and trout shown in Table 3.4 use many of the watershed's streams for migration, rearing, and spawning. Although bull trout are a priority species listed by WDFW as potentially occurring in Lewis County, presence of bull trout in the county is undocumented (WDFW 2004, 2013). Critical habitat for bull trout has not been designated in the county. However, critical habitat is designated in the Chehalis River in Grays Harbor County, approximately 6 miles downstream from the Independence Creek confluence. Critical habitat should be considered to the extent that land use and activities occurring upstream in the county may influence downstream habitats.

3.8.5.2. Puget Sound

For salmon, this region is limited to a small area in the north central portion of the county including the Deschutes River and its tributaries in WRIA 13 and the Nisqually River and tributaries in WRIA 11. Salmon in this region include threatened Chinook and steelhead ESUs, and coho, which is a federal species of concern. However, salmon in WRIA 13 are generally not documented in the small tributaries in the county. The ESU populations only extend to an area in WRIA 11 that is north of the county boundary and includes tributaries that enter the Nisqually River below Alder Lake. Critical habitat for Chinook and proposed critical habitat for steelhead have not been designated in the Coalition SMP jurisdiction. The Puget Sound bull trout RU covers a larger geographic area in the county including the Deschutes River and Nisqually River above Alder Lake. Presence of Puget Sound bull trout, however, is undocumented in the county. Also, as stated before, critical habitat for bull trout has not been designated in the Coalition SMP jurisdiction. Historic presence is mapped in the Nisqually River downstream of Alder Lake in Thurston County. It is unknown whether small tributaries in the county supported that population in the Nisqually River historically (WDFW 2004). Coastal resident cutthroat trout, a Washington State designated priority species is present in both the Deschutes and Nisqually watersheds in the county.

3.8.5.3. Lower Columbia River Basin

The Lower Columbia River Basin includes WRIA 26, and the Cowlitz River watershed in the southern and eastern portions of the county. Summer run steelhead is documented in the Cowlitz River up to the salmon hatchery Barrier Dam below Mayfield Lake. Fall chum are also documented up to Mayfield Lake, while winter steelhead and other salmon species including two Chinook runs (Spring and Fall), coho, and winter steelhead are documented throughout the mainstream and many tributaries of the Cowlitz River where spawning and rearing habitat are also common. Chinook, coho, steelhead, and cutthroat trout that return upstream to the Cowlitz salmon hatchery are captured, trucked, and released at various locations above Cowlitz Falls. The fish often distribute into tributaries and headwaters that are important spawning and rearing habitat for the reintroduced fish. Smolts often migrate to Riffe Lake where there is a popular fishery. However, specific data on spawning distribution in the Upper Cowlitz River system is lacking (G. Fornes, WDFW, personal communication, June 19, 2013).

Although the Cowlitz River watershed is located within the Lower Columbia River Basin RU for bull trout, bull trout populations in the Lower Columbia River Basin RU are not documented in the Cowlitz River or in Lewis County (WDFW 2004, 2013), nor is there designated critical habitat in Lewis County streams. However, in the absence of significant barriers it may be presumed that bull trout are potentially present or populations could be reintroduced in the future.

Critical habitat for Chinook has been designated in the lower and upper subbasins of the Cowlitz River including the mainstem to a point upstream from the Ohanapecosh River, the Cispus River, and other tributaries such as Olequa Creek and Lacamas Creek. Critical habitat for steelhead has been designated in Cowlitz River basin including the same areas designated for Chinook, in addition to smaller tributary streams than those containing critical habitat for Chinook. Critical habitat for chum is designated in the Cowlitz River basin up to Mayfield reservoir including Lacamas Creek and portions of tributary streams.

The majority of proposed critical habitat for coho in the county is within two subbasins, the lower and upper Cowlitz River, including the mainstem Cowlitz River and tributary watersheds. In the mainstem, critical habitat extends up to, and including, portions of the Muddy Fork and Clear Fork Cowlitz River. In addition to the mainstem Cowlitz River, tributary watersheds that are occupied by coho and contain proposed designated critical habitat include the Cispus River and Tilton River. Devils Creek and Elk Creek. Tributary streams of the North Fork Toutle River also contain proposed designated critical habitat for coho.

3.8.6. Pacific Eulachon

Pacific eulachon are anadromous forage fish that spawn in freshwater natal streams. The Columbia River basin is the origin of most Pacific Eulachon in the continental United States, and one of the primary spawning runs occurs in the Cowlitz River (NMFS 2013). Spawning grounds are typically in the lower reaches of larger rivers fed by snowmelt (Hay and McCarter 2000). On average, the highest incidence of spawning in the Columbia River basin occurs in the Cowlitz River, although eulachon may avoid the Cowlitz entirely on occasion due to unfavorable environmental conditions (Gustafson et al. 2010). In the Cowlitz River, spawning generally occurs at temperatures from 4 degrees to 7 degrees Celsius (Smith and Saalfeld 1955) between late winter and mid spring (NMFS 2013). Preferred spawning habitat consists of course, sandy substrates (WDFW and ODFW 2001; NMFS 2013). Spawning has been observed in the mainstem of the Cowlitz River up to RM 38, upstream from the city of Toledo (personal communication with C. Olds, Cowlitz Tribe, May 10, 2013), but could extend farther upstream to approximately RM 50.

Pacific eulachon are federally listed as threatened. In the county, critical habitat for eulachon is designated in the Cowlitz River mainstem from the county boundary upstream to the Cowlitz River salmon hatchery Barrier Dam below Mayfield Lake at approximately RM 50 (76 FR 65324).

Threats to this species include habitat loss and degradation. Dredging activities in the Cowlitz River during spawning runs may entrain and kill fish or otherwise result in decreased spawning success (NMFS 2013). In addition to fishing restrictions, conservation efforts include habitat restoration or enhancements that generally improve conditions for eulachon, salmon, and other native species.

3.8.7. Olympic Mudminnow

Olympic mudminnow (*Novumbra hubbsi*) is a species endemic to Washington where it is listed as sensitive, meaning it is native to the state of Washington, is vulnerable or declining, and is likely to become endangered or threatened in a significant portion of its range without cooperative management or removal of threats (WAC 232-12-297). Within their range, which includes the Chehalis and Deschutes river drainages, they are usually found in slow-moving streams, wetlands, ponds, ditches, or sloughs with muddy substrate, still or slow moving water, and abundant aquatic vegetation. Olympic mudminnow presence is not well documented in the Coalition SMP jurisdiction. General locations of known presence in the county were illustrated by Mongillo and Hallock (1999) but data on specific locations were not identified in the PHS dataset.

Population decline in Washington has been attributed to wetland habitat loss (Mongillo and Hallock 1999, WDFW 2012). Wetland protection is considered essential for the conservation of the species (WDFW 2012).

3.8.8. Pacific Pond Turtle

Pacific pond turtle, also known as western pond turtle, is a priority endangered species in Washington State, and is identified by WDFW as potentially occurring in the county. The range of the western pond turtle extends from the Puget Sound lowlands in Washington south to Baja California. However, western pond turtles were essentially extirpated in the Puget lowlands by the 1980s. In 1999, their range in Washington was thought to be composed of two small populations in Skamania and Klickitat counties, and a small pond complex in Pierce County where they were recently reintroduced from captive bred stock (Hays et al. 1999). A recent status report (WDFW 2012) did not show any reintroduction attempts in the county. Although these factors limit the potential for presence, Pacific pond turtles may be present in the county currently or may be reintroduced in the future. Presence of Pacific pond turtle was not documented in the PHS dataset.

3.8.9. Bald Eagle

Bald eagles are commonly associated with shorelines where they are often attracted by the presence of live or dead fish and other prey items. They nest in tall trees (generally greater than 85 feet in height) usually within 0.25 mile of shorelines. While the bald eagle was delisted from a federal ESA status of threatened in 2008, it is still protected under the Bald and Golden Eagle Protection Act, and is a state sensitive species. Bald Eagle Management Plans are no longer required by the State for their protection. Landowners, however, should consult the USFWS to determine if a permit is required when proposing land use activities within 660 feet of an eagle nest. Depending on the type of land use activity being proposed, the USFWS may recommend differing strategies for protection (USFWS 2013). At least five nest sites were identified in the county, primarily associated with the Chehalis and Newaukum Rivers.

3.8.10. Peregrine Falcon

Similarly to bald eagles, peregrine falcon is a state listed sensitive species. Although they use a wide variety of open habitats, peregrine falcons are similar to bald eagles in that they are associated with lake and open water shorelines where waterfowl concentrate and provide foraging opportunities. They are considered to potentially occur in the county. However, WDFW PHS data obtained for this characterization did not include known locations of peregrine falcon.

3.8.11. Cavity Nesting Ducks and Waterfowl Concentrations

Cavity nesting ducks and waterfowl concentrations are also commonly associated with freshwater shorelines, and are documented throughout many of the shorelines in the Coalition SMP jurisdiction, primarily in the lowland valleys where suitable habitats such as forested riparian areas and open wetlands are common. Breeding areas of cavity nesting ducks are a priority area designated by WDFW and include breeding areas for the following species:

- Barrow's Goldeneye (*Bucephala islandica*)
- Common Goldeneye (*Bucephala clangula*)
- Bufflehead (*Bucephala albeola*)
- Hooded Merganser (*Lophodytes cucullatus*)

Waterfowl (family *Anatidae*) concentrations including significant breeding areas and regular winter concentrations are also designated priority areas. Regular concentrations of Canada geese in urban areas are excluded from the priority area designation.

3.8.12. Geologic Hazard Areas

Areas that are susceptible to one or more of the following types of hazards are classified as geologically hazardous areas (WAC 365-190-120):

- Erosion hazard
- Landslide hazard
- Seismic hazard
- Areas subject to other geological events such as coal mine hazards and volcanic hazards including: mass wasting, debris flows, rock falls, and differential settlement

In Lewis County, seismic hazards are associated with soils that have high liquefaction potential, typically located in valley bottoms, while landslide and erosion hazards tend to be associated with steep slopes. Volcanic hazards affect shorelines in the Nisqually and Cowlitz drainages; both valleys are in lahar zones documented by WDNR (https://fortress.wa.gov/dnr/geology/?Theme=lahar).

3.8.13. Channel Migration Zones

Channel migration zones (CMZs) are the areas along streams within which the channel can reasonably be expected to migrate over time as a result of normally occurring processes. They encompass the area of lateral channel movement that is subject to erosion, bank destabilization, rapid stream incision, and/or channel shifting, as well as adjacent areas that are susceptible to channel erosion. CMZs have been mapped for the Nisqually River between Berry Creek and Alder Lake, the Cowlitz River from the Muddy Fork confluence to Lake Scanewa, and the Cispus River from 0.75 miles upstream of Yellowjacket Creek to Greenhorn Creek. Mapped CMZs are shown in Map Series 28; reaches that are partially or wholly within mapped CMZs are listed in Tables 4.4 (Nisqually CMZ), 4.51, and 4.56 (Cowlitz and Cispus CMZs). Although mapped CMZs were not available for the Chehalis, South Fork Chehalis, and South Fork Newaukum rivers, channel migration was inferred from reported bank erosion (Reckendorf et al. 2012, Olson and Cramer 2009, King5.com 2012); as noted in Tables 4.17 and 4.22.

Additional channel migration zone mapping was not part of this inventory. There are literally many hundreds of miles of stream in the county, which are not easily accessible and have a myriad of potential human modifications that could affect channel migration. Because a CMZ

boundary can have regulatory power, similar to a floodplain boundary, conducting a less than complete (i.e., remotely sensed) assessment has implications for future development on sites that may be inappropriately included on a map, as well as other consequences for property owners. Further, because of the more limited extent of shoreline jurisdiction in the county and cities (generally only 200 feet from the ordinary high water mark, adopted floodways or the 2010 flood channel study area, portions of floodplains, and associated wetlands), CMZs where they exist may extend well outside of the shoreline jurisdiction, particularly in the more rural portions of the county.

Although the risks associated with planning based on incomplete CMZ mapping precluded its inclusion as part of this inventory, there are also risks associated with not having a comprehensive inventory of channel migration and associated hazards within Coalition jurisdiction. Compliance with the SMP Guidelines requires balancing the risks associated with the use of incomplete CMZ information against those associated with failure to recognize CMZ related hazards that may not yet have been formally mapped. Interference with the natural process of channel migration often has unintended consequences, such as increased or changed flood, sedimentation and erosion patterns, and can have adverse effects on fish and wildlife through loss of critical habitat for river and riparian dependent species. Furthermore, failure to recognize and adapt to channel migration can lead to property damage and the loss of life. SMP Guidelines (WAC 173-26-221) direct local SMPs to include provisions limiting development and shoreline modifications that would interfere with the process of channel migration to avoid significant adverse impacts to property or public improvements and to avoid loss of shoreline ecological functions. The need for additional CMZ mapping is discussed in *Chapter 7 Data Gaps*; future SMP updates should include updated and more extensive CMZ maps.

3.8.14. Aquifer Recharge Areas

Where no specific studies have been done, counties and cities may use existing soil and surficial geologic information to determine where recharge areas exist. To determine the threat to groundwater quality, existing land use activities and their potential to lead to contamination should be evaluated (WAC 365-190-100). Aquifer recharge areas have been mapped by the county throughout many of the shorelines in the Coalition SMP jurisdiction. These critical areas are mapped throughout much of the Chehalis River including a large area of the floodplain and the city of Centralia, along the Cowlitz River below Mayfield Lake and upstream from Lake Scanewa, and along Rainey Creek and Silver Creek. Significant aquifer recharge areas are also present along the Nisqually River valley and Mineral Creek. Much of the cities of Morton and Winlock also contain aquifer recharge areas.

3.8.15. Frequently Flooded Areas

Frequently Flooded Areas (FFAs) are critical areas that are currently or are expected in the future to be subject to frequent flooding. Areas classified as FFA are to include at a minimum the 100-year floodplain as designated by FEMA and the National Flood Insurance Program, and should take into account the likely effects of flooding on health and safety and on public facilities and services, the potential for increased surface runoff due to expected increases in impervious surface area, the future floodplain at build out, and the potential effects of

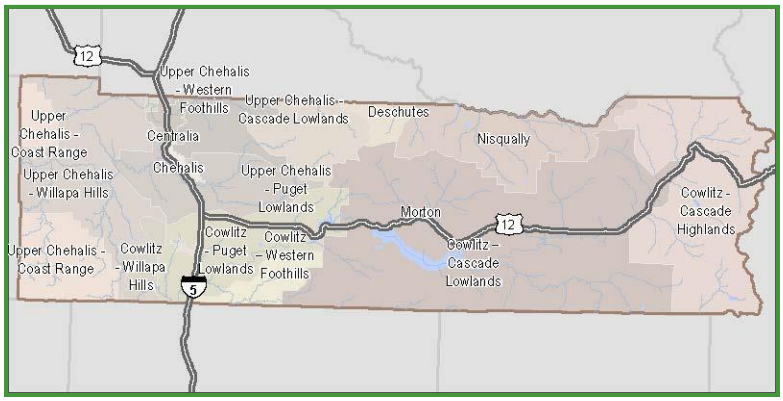
extreme events and climate change (WAC 365-190-110). FFAs are relevant to shoreline management because shoreline activities or development can alter flood conveyance and thus increase or decrease the size of FFAs, and because shoreline activities or development can be more or less compatible with frequent flooding. Map series 8 shows the FEMA 100-year floodplain, which is the minimum extent of FFA within the shoreline jurisdiction; areas outside of the FEMA 100-year floodplain may in the future be classified as a FFA per WAC-365-190-110.

3.9. Water Quality

Ecology's 303 (d) list was used as the primary source for water quality information in this characterization, and to evaluate water quality conditions. The 303(d) list assigns a category to each water body based on its condition as evidenced by water quality or biological data. There are five different categories included in the list. Water bodies or reaches that are listed under Category 1 by Ecology are those for which there are no known water quality problems. Those listed as Category 2 are waters of concern; indicating there may be some threat to water quality or some evidence of possible deterioration but they are not considered polluted. Category 3 waters have insufficient data to make a determination. Category 4 waters are known to be polluted but there is a plan or program in place to address the problem. Last, Category 5 waters are known to be polluted but no plan or program is yet in place to address the problem.

The descriptions in the next section, *Discussion of Shoreline Management Areas* focus on those reaches that are known to be polluted (Category 4 and 5 waters) and those for which there is some concern or threat (Category 2 waters).

4. DISCUSSION OF SHORELINE MANAGEMENT AREAS



The following sections discuss conditions and characteristics of each of the 16 shoreline management areas with respect to physical processes, the presence of streams and lakes, shoreline use patterns including land use, documented shoreline modifications, existing and potential public access, land cover, wetlands, water quality, critical areas, and priority species and habitats. A reach assessment for each management area is provided, and known restoration projects are identified.

Table 4.1 provides summaries of the reach assessment for the shoreline jurisdiction of each management area. The table describes physical and biological conditions directly related to habitat function only within the shoreline jurisdiction. Appendix D contains data sheets that provide the specific assessment data for individual reaches.

In addition to summary data for the shoreline jurisdiction of each management area, an overview of management area characteristics that describe the broader landscape adjacent to the shoreline jurisdiction is provided. Land use and development patterns within the broader landscape are relevant to the shoreline characterization in that they provide a geographic and ecological context for patterns or conditions that are present within the shoreline jurisdiction.

Subsequent sections under each management area heading then focus on characteristics and conditions within the shoreline jurisdiction exclusively. Tables provide summaries of physical characteristics, geologic hazards, comprehensive plan land-use designations, current land use, zoning, and shoreline modifications.

For the tables showing geologic hazards within each management area, entries in the left-hand column represent the proportion of the entire management area that is mapped as a given geologic hazard. Entries are provided only for those geologic hazards that have the potential to affect shorelines through watershed-scale ecosystem processes (for example erosion hazard areas may affect sediment delivery to streams thus affecting specific reaches). The right hand column lists the reaches within the management area that *could* be affected by each type of mapped geologic hazard.

The reach assessment for each management area used the shoreline inventory to evaluate the specific physical and biological conditions of individual shoreline segments. Based on

the rating of the function (low to high), a numerical number was applied to each function (low=1, medium=2, high=3) to arrive at a total score within a possible range of 12 to 36 for each reach. These data were then analyzed and summarized for each management area in terms of the total score for ecological functions and the primary reasons for the range of scores in individual reaches. The functional assessment results are included in Appendix C and summarized for each management area in the following sections.

The results from the ecosystem-wide characterization and conditions scored in the reach assessment are discussed below. The discussions of critical and priority habitat and species, including salmonids rely primarily on the most recent PHS data on species presence (see Table 2.1). All of the management areas have priority species present. To avoid redundancy, the data source is not cited in each case. However, where other sources are referenced, citations are provided.

[…]

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Table 4.1. Summary of Shoreline Characteristics by Management Area.

Management Area	Number of Stream/ Lake Reaches Length of Stream / Lake Shoreline (miles)	Land Ownership	Land Cover	Shoreline Modifications Water Quality Impairments	Critical Areas
Chehalis	5 / 1 3 / 4	74% Private 23% Other Government 20% State 10% Municipal 7% Federal 0.5% County	31% Agriculture 27% Forest/Woodland 17% Shrubland/Grassland 15% Developed/Human Use 11% Recently Disturbed/Modified	0.6 miles Leveed 0.7 acres Dioxin	**Habitat Conservation Areas / Priority Habitat and Species** Chinook Salmon, Coastal Resident Cutthroat, Coho Salmon, Steelhead Trout Cavity-nesting Ducks, Oak Woodland, Roosevelt Elk, Waterfowl Concentrations **Geologic Hazards** 90% Moderate to High Seismic/Liquefaction Hazard

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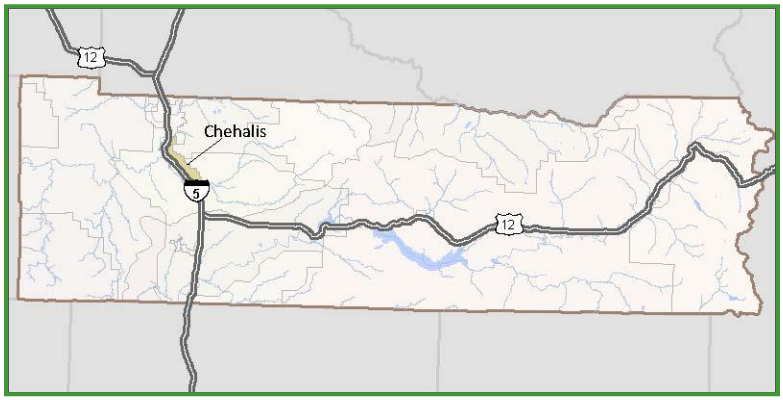
4.6. City of Chehalis



The city of Chehalis is located south of Centralia, surrounded by the Upper Chehalis – Puget Lowlands management area. The city of Chehalis shoreline management area is defined primarily by the city's municipal boundary including its UGA, and by the relative difference in development and land use compared to more rural areas in the county. It encompasses 10.5 square miles of developed floodplain and low hills. Shoreline jurisdiction includes 1,027 acres along five stream reaches and one lake. These include the Chehalis River (reach CH-02), the lower portion of Salzer Creek downstream from the city of Centralia shoreline management area (reach CH-01), Newaukum River (reach CH-03), Berwick Creek (reach CH-04), Upper Berwick Creek (reach CH-05), and an unnamed lake located between Berwick Creek near its confluence with the Chehalis River and Interstate 5 (reach CH-06).

4.6.1. Citywide Physical and Biological Characterization

Chehalis is located in the Puget Lowland section of the Chehalis basin. Prior to development, it would have experienced ecosystem processes similar to those in adjacent undeveloped lowland prairie/floodplain areas. Urban and agricultural development has altered those processes. Section 3.2.3.1 gives a general description of the physical processes that influence shorelines in both pre-development and developed states in the city's shoreline management area.

Land cover in the city's shoreline management area is 35 percent developed, 33 percent agricultural vegetation or grassland, 18 percent forest or woodland, and 14 percent recently disturbed. Ninety-two percent of the land is privately owned; the remaining 11 percent is municipal, county, or state land. Table 4.67 summarizes the physical characteristics of the city's shoreline management area and the ecoregion in which it is located. Table 4.68 lists the reaches in the city's shoreline management area.

Table 4.67. Physical Characteristics of the Chehalis (City of Chehalis) Management Area.

Physiography [a]	Rolling terraces and floodplains with meandering streams and oxbow lakes
Elevation (feet) [b]	150-580
Lithology [a]	Holocene alluvial deposits
Mean Annual Precipitation (inches) [b]	47

Natural Vegetation [a]	Western red cedar, western hemlock; some Douglas fir, bigleaf maple, oak woodlands, prairies
Land Use / Land Cover [a]	Pastureland, cropland, rural residential development, some coniferous and deciduous forests, forestry

[a] Level IV Ecoregion characteristics from Pater et al. (1998)
[b] Management area characteristics (see Table 2.1 for specific data sources)

Table 4.68. City of Chehalis Management Area (City of Chehalis) Shoreline Reaches (Map Series 2).

Reach Number	Primary Waterbody Name	Shoreline Area (acres)	Map Reference (Township-Range)
CH-01	Salzer Creek	262.1	T14N-R02W
CH-02	Chehalis River	336.6	T14N-R02W, T14N-R03W
CH-03	Newaukum River	67.5	T13N-R02W
CH-04	Berwick Creek	3.7	T13N-R02W
CH-05	Berwick Creek	190.4	T13N-R02W
CH-06	Unnamed Lake	166.9	T13N-R02W, T14N-R02W

Presence is documented for four priority fish species in all reaches except for upper Berwick Creek, including Chinook, coho, steelhead, and coastal resident cutthroat trout. The upper Berwick Creek reach may provide cavity nesting duck habitat, which is also present along the Chehalis River mainstem. There are large areas of waterfowl habitat and significant wetlands present throughout the city's shoreline management area. Small (less than 2 acres) patches of oak woodland commonly associated with low valley shorelines are also present. Riparian areas and habitat corridors are generally degraded by roads, other infrastructure, and agriculture.

There are 13 listings for polluted conditions affecting four of the six reaches in the city's shoreline management area, all of these reaches are listed as polluted due to more than one pollutant. Pollution due to fecal coliform bacteria is the cause of six of the listings, temperature exceedance is the cause of two listings, and dissolved oxygen four listings. There is also one listing for dioxin.

Table 4.69 summarizes known geologic hazard critical areas for the city's shoreline management area as whole and lists the shoreline reaches in which land subject to each hazard is found.

Table 4.69. Chehalis Management Area (City of Chehalis) Geologic Hazards (Map Series 11 – 14, 28).

Hazard Type	Percentage of Total Area	Reaches Affected
Erosion Hazard [a]	0%	-
Seismic/Liquefaction [b]	90%	01-06
Rainier Blast Zone	0%	-
Mudflow/Lahar	0%	-

Channel Migration	Not mapped, but occurs in this management area.	-
Landslide Hazard	0%	-

[a] Severe or Very Severe Erosion Hazard
[b] Moderate to High Liquefactions Susceptibility

4.6.2. Shoreline Use Patterns

4.6.2.1. Existing Shoreline Land Use and Designations

The Comprehensive Land Use designations from the city of Chehalis Comprehensive Plan in the city's shoreline management area are provided in Tables 4.70a and 4.70b. Land use designations reflect the community's goals and they will be used in the process of determining the environment designations for the city's shoreline jurisdiction.

Table 4.70a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in City of Chehalis – Citywide.

Description	Typical Uses	Percentage of Management Area
Residential, Low Density	Single-family development	3.5%
Industrial	Manufacturing and warehousing	21.6%
Commercial	Offices, retail establishments, or similar uses	51.4%
Essential Public Facilities (EPF)	Airport, Cemetery, Fairgrounds, Government, Hospital, Institution, Park/Playground, School, Utility, and Wetlands	23.3%
Urban Growth Areas	Residential, Commercial, and Industrial lands	0.2%

The current land use patterns that are found in the city's shoreline management area are provided in Tables 4.70c and 4.70d. Existing land use patterns will be used in the process of determining the environment designations for the city's shoreline jurisdiction. Land use data was from the Lewis County Assessor's office records. A review of shoreline permit history over the past 10 years within the city was not available for this report.

The zoning designations from the city of Chehalis Code (CheMC Title 17 - Uniform Development Regulations) that are found in the city's shoreline management area are provided in Tables 4.70e and 4.70f. Zoning designations reflect the community's goals as enacted by its Comprehensive Plan and they will be used in the process of determining the environment designations for the city's shoreline jurisdiction.

Table 4.70b. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in City of Chehalis by Reach.

Description	Reach					
	CH-01	CH-02	CH-03	CH-04	CH-05	CH-06
Residential, Low Density	0%	3%	0%	0%	0%	16%
Industrial	29%	2%	0%	0%	41%	38%

Table 4.70b. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in City of Chehalis by Reach.						
	Reach					
Description	**CH-01**	**CH-02**	**CH-03**	**CH-04**	**CH-05**	**CH-06**
Commercial	38%	88%	0%	100%	58%	12%
Essential Public Facilities (EPF)	33%	8%	100%	0%	0%	34%
Urban Growth Areas	0%	0%	0%	0%	1%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 4.70c. Current Land Use Patterns in City of Chehalis – Citywide.	
Current Land Use Patterns	**Percentage of Management Area**
Single-Family Residential	9.4%
Multi-Family Residential	0.4%
Commercial	5.8%
Industrial	2.4%
Utilities	0.9%
Right-of-Way	9.6%
Railroad	2.6%
Service/Government	5.5%
Cultural/Recreational	9.6%
Open Space	11.3%
Agriculture	15.3%
Water	3.9%
Vacant/Undeveloped	21.3%
Unknown	2.0%

Table 4.70d. Current Land Use Patterns in City of Chehalis by Reach.						
	Reach Number					
Current Land Use Patterns	**CH-01**	**CH-02**	**CH-03**	**CH-04**	**CH-05**	**CH-06**
SF Residential	2%	16%	0%	0%	19%	11%
All other Residential	0%	0%	0%	0%	3%	0%
Manufacturing	7%	0%	0%	0%	5%	0%
Transportation/Utilities	7%	2%	0%	0%	2%	8%
Commercial	7%	1%	0%	0%	5%	2%
Government/Services	1%	3%	0%	6%	16%	39%
Cultural/Recreational	9%	3%	96%	0%	0%	2%
Agriculture	2%	41%	4%	85%	15%	0%
Mining	0%	0%	0%	0%	0%	0%
Forest	0%	0%	0%	0%	0%	0%
Residential Land - Undivided	58%	3%	0%	9%	35%	9%
Open Water	0%	0%	0%	0%	0%	29%
Open Space	8%	32%	0%	0%	0%	0%
Timber	0%	0%	0%	0%	0%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 4.70e. Current Zoning Designations in City of Chehalis - Citywide.			
Description	**Symbol**	**Typical Uses**	**Percentage of Management Area**
Single -Family Residential – Medium Density	R2	Single-family residence, maximum of 4 units per 10 acres	3.5%
General Commercial	CG	Office, retail, or similar uses	48.7%
Freeway-Oriented Commercial	CF	Commercial services located near major transportation routes	2.7%
Essential Public Facilities Fairgrounds	EPF (F)	Fairgrounds	2.1%
Essential Public Facilities Institution	EPF (I)	Institutions	4.8%
Essential Public Facilities Park/Playground	EPF (P)	Park or playground	8.8%
Essential Public Facilities Utility	EPF (U)	Utilities	1.2%
Essential Public Facilities Wetland	EPF (W)	Wetlands	6.4%
Heavy Industrial/General Commercial	IH / CG	High intensity industrial uses including manufacturing	7.3%
Light Industrial	IL	Industrial or commercial retail activity, light intensity	7.6%
Light Industrial/General Commercial	IL / CG	Industrial or commercial retail activity, light intensity	6.7%
Urban Growth Area Residential	RUGA	Residential uses located within the Chehalis UGA	0.2%

Table 4.70f. Current Zoning Designations City of Chehalis by Reach.						
	Reach Number					
Description	CH-01	CH-02	CH-03	CH-04	CH-05	CH-06
CF	2%	0%	0%	100%	0%	11%
CG	36%	88%	0%	0%	58%	0%
EPF (F)	8%	0%	0%	0%	0%	0%
EPF (I)	0%	0%	0%	0%	0%	30%
EPF (P)	0%	5%	100%	0%	0%	5%
EPF (U)	0%	4%	0%	0%	0%	0%
EPF (W)	25%	0%	0%	0%	0%	0%
IH / CG	29%	0%	0%	0%	0%	0%
IL	0%	0%	0%	0%	41%	0%
IL / CG	0%	2%	0%	0%	0%	38%
R2	0%	3%	0%	0%	0%	16%
RUGA	0%	0%	0%	0%	1%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 4.71 summarizes the average parcel information for each of the six reaches within the city of Chehalis.

Table 4.71. City of Chehalis Management Area (City of Chehalis). Average Parcel Information.				
Primary Waterbody Name	Reach Number	Average Parcel Size (acre)	Average Parcel Width (feet)	Average Parcel Depth (feet)
Salzer Creek	CH-01	6.40	333	978
Chehalis River	CH-02	3.36	245	446
Newaukum River	CH-03	29.13	901	2,013
Berwick Creek	CH-04	17.38	672	1,307
Berwick Creek	CH-05	5.46	370	687
Unnamed Lake	CH-06	4.79	213	721

Reach CH-01 – Chehalis – Salzer Creek

Current Land Use: The reach is characterized by undeveloped land and commercial land uses. Salzer Creek runs through the northern portion of the reach and Coal Creek, which is not a shoreline of the state as designated by RCE 90.58.030(2), flows north through the reach. The entire reach is within the floodway or the 2010 flood channel study area and the majority of acreage is wetlands. As such, there is limited development within the reach that includes portions of a car lot and a shopping center.

Water-dependent Uses and Water-related Uses: There are no water-dependent or water-related uses in this reach.

Future Land Use: The Comprehensive Plan includes industrial, commercial, and essential public facilities (EPF) uses within this reach. A limited level of redevelopment is expected in this reach subject to flood hazard limitations.

Reach CH-02 – Chehalis – Chehalis River

Current Land Use: The reach is characterized by uncultivated agricultural land, parks and open space, and single-family residential land uses. The Chehalis River bounds the reach to the west. Riverside Golf Course is located at the northern part of the reach and Robert J. Lintott/Alexander Park is located at the southernmost portion. The city of Chehalis Wastewater Treatment Plant is located in this reach on Northwest Shoreline Drive.

Water-dependent Uses and Water-related Uses: There are no water-dependent uses in this reach. Shoreline parkland with access to the river, Robert J. Lintott/Alexander Park, Riverside Country Club, and Airport Levee Trail, represent water-related uses within the reach.

Future Land Use: The Comprehensive Plan includes low-density residential, industrial, commercial, and essential public facilities (EPF) uses within this reach. A limited level of redevelopment is expected in this reach subject to flood hazard limitations.

Reach CH-03 – Chehalis – Newaukum River

Current Land Use: The majority of land within the reach is part of Stan Hedwall Park. A small portion of land is designated agricultural use. As a result, the reach is characterized by parks with shoreline access. There are no structures or development in the reach.

Water-dependent Uses and Water-related Uses: There are no water-dependent uses in this reach. The shoreline parkland with access to the river, Stan Hedwall Park, represents water-related uses within the reach.

Future Land Use: The Comprehensive Plan includes essential public facilities (EPF) uses within this reach. Little new development is expected in this reach.

Reach CH-04 – Chehalis – Berwick Creek

Current Land Use: The reach is very small, approximately 3.75 acres and is characterized by undeveloped agricultural and residential land. It is located to the west of Interstate 5 and Berwick Creek. The reach has no existing development.

Water-dependent Uses and Water-related Uses: There are no water-dependent or water-related uses in this reach, as the reach does not provide direct shoreline access.

Future Land Use: The Comprehensive Plan includes commercial uses within this reach. A limited level of redevelopment is expected in this reach subject to flood hazard limitations.

Reach CH-05 – Chehalis – Berwick Creek

Current Land Use: The reach is characterized by industrial and commercial land uses. The reach includes Berwick Creek and Dillenbaugh Creek, which is not designated as a shoreline of the state. The reach intersects Interstate 5 and portions of commercial and industrial land uses in the southern area of Chehalis. The reach also includes a railroad spur north of Hardel Mutual Plywood Corporation. As the reach is located in a commercial and industrial district, there is no public access to the shoreline.

Water-dependent Uses and Water-related Uses: There are no water-dependent or water-related uses in this reach.

Future Land Use: The Comprehensive Plan includes industrial, commercial, and urban growth area uses within this reach. A limited level of redevelopment is expected in this reach subject to flood hazard limitations.

Reach CH-06 – Chehalis – Unnamed Lake

Current Land Use: The reach contains two unnamed lakes directly east of Interstate 5. The reach is characterized by low-density residential, government services, and professional services. The majority of land within the reach is undeveloped due to the presence of the unnamed lakes and wetlands. Developed portions of the reach include a part of the Green Hill Academic School as well as single-family residential parcels.

Water-dependent Uses and Water-related Uses: There are no water-dependent or water-related uses in this reach.

Future Land Use: The Comprehensive Plan includes low-density residential, industrial, commercial, and essential public facilities (EPF) uses within this reach. A limited level of redevelopment is expected in this reach subject to flood hazard limitations.

Transportation and Utilities

Interstate 5 intersects with the city's shoreline jurisdiction in reaches CH-01, CH-02, CH-05, and CH-06. A portion of North National Street and Northeast Kresky Avenue intersects the city's shoreline jurisdiction within reach CH-01 while Main Street (State Route 6) intersects with the city's shoreline jurisdiction within reach CH-02 and the Jackson Highway intersects with the city's shoreline jurisdiction within reach CH-05.

In addition to these larger roads, many local roads are present within the city's shoreline jurisdiction. In the city, there is one existing bridge across the Chehalis River at Main Street (State Route), one existing bridge over Berwick Creek at Jackson Highway, and two bridges over Salzer Creek at North National Street and Northeast Kresky Avenue.

The mainline of the BNSF intersects with the city's shoreline jurisdiction within reaches CH-01, CH-03, and CH-06.

4.6.2.2. Existing and Potential Public Access

The city of Chehalis shoreline management area has 7.5 miles of shoreline jurisdiction. There are a number of public access points in the shoreline management area.

Reach CH-01 – Chehalis – Salzer Creek

No existing or planned formal public access opportunities were identified in this reach.

Reach CH-02 – Chehalis – Chehalis River

Public access opportunities in the reach include:

- The **Riverside Country Club** golf course provides water-enjoyment use through visual access to the Chehalis River adjacent to the course.
- The **Robert J. Lintott/Alexander Park** is located on Riverside Road West within a bend of the Chehalis River. The Alexander family donated 5.75 acres of land to the city in 1906 for park development. The park was restored in 2004 using a grant from Jim Lintott in honor of his father. The park has two covered kitchens, picnic sites, a restroom, and informal access to the river.
- The **Airport Levee Trail** is 3.5 miles in length with a surface of 2 miles compacted gravel on the levee and 1.5 miles of sidewalk and pavement along retail area. From the parking lot on Louisiana Avenue, the trail begins on top of the levee. It continues for 2 miles along Airport Road past Riverside golf course, with a view of farmland on one side and the airport on the other. As it heads towards the freeway, it leaves the levee and goes through the retail section back to the parking area. The levee, protecting the airport from flooding, is an important link in the TransAlta Trail that will eventually connect Centralia and Chehalis with a motorized traffic-free walking/biking route.

Reach CH-03 – Chehalis – Newaukum River

Public access opportunities in the reach include:

- The **Stan Hedwall Park** is on Rice Road on 204 acres on the Newaukum River. It is the largest and newest of the city's parks. The park was named in honor of Stan Hedwall, who was a former park superintendent and city commissioner. The park has approximately 104 acres of wooded land and about 100 acres of open terrain. The Newaukum River flows through the wooded area, giving the park 2.25 miles of shoreline. The river provides fishing and is a popular site for rockhounding. There is a bridge over the river as well as 3 miles of trails.

  The park also has a number of sports fields, a 29-site RV Area with restrooms and showers, and covered sheltered areas for group picnics.

Reach CH-04 – Chehalis – Berwick Creek

No existing or planned formal public access opportunities were identified in this reach.

Reach CH-05 – Chehalis – Berwick Creek

No existing or planned formal public access opportunities were identified in this reach.

Reach CH-06 – Chehalis – Unnamed Lake

No existing or planned formal public access opportunities were identified in this reach.

4.6.3. Shoreline Modifications

Table 4.72 lists the total length of dikes and levees for reaches where they are found in the available data, along with other shoreline modifications observed on aerial photographs in the course of doing reach functional assessments. Comprehensive information on shoreline modifications other than dikes and levees is not available for the city's shoreline management area.

Table 4.72. Chehalis Management Area (City of Chehalis) Shoreline Modifications (Map Series 19 to 20).

Reach Number	Sum of Dike and Levee Length (feet) [a]	Other Shoreline Modifications [b]
CH-01	3,261	Dikes and infrastructure
CH-05	–	Adjacent agriculture, roads, and other development

[a] Data Source: Lewis County Dikes and Levees shapefile
[b] Aerial Photography: Google Earth, May 2013.

Table 4.73 summarizes the percent impervious surface for the six reaches within the city of Chehalis.

Table 4.73. City of Chehalis Management Area (City of Chehalis) Additional Shoreline Modifications (Map Series 16).

Primary Waterbody Name	Reach Number	Length of Stream Shorelines (miles)	Impervious Percentage
CH-01	Salzer Creek	0.95	11.8%
CH-02	Chehalis River	0.56	5.1%
CH-03	Newaukum River	0.61	2.9%
CH-04	Berwick Creek	–	0.3%
CH-05	Berwick Creek	1.20	20.2%
CH-06	Unnamed Lake	–	9.4%

4.6.4. Reach Functional Assessment

The functions scores in the Chehalis management area varied between 20 and 32. Similarly to some reaches in the city's shoreline management area, dikes and infrastructure impair hydrologic and habitat connectivity. Lack of riparian vegetation is characteristic along Salzer Creek (CH-01), the stream that scored lowest. In contrast, the Newaukum River (CH-03) has the highest score and exhibits relatively high functional value due to wetland presence, in-stream channel features, and complexity that provide habitat diversity, and good riparian vegetation condition. LWD is limited. The unnamed lake and wetlands associated with Dillenbaugh Creek (reach CH-06) has moderate to high functions score of 27. As discussed previously for reach 3C-20, this reach within the city's shoreline management area has impaired water quality due to dioxin detected in fish tissue.

Although much of the shoreline jurisdiction is currently vegetated (75 percent is agriculture, forest, shrub, or grassland land cover), impervious surface associated with new development should be addressed in the SMP provisions to minimize impacts on the shoreline and aquatic environment. With 73 percent of the city's shoreline management area designated for industrial and commercial land uses, future impervious surface associated with new development will likely require SMP provisions to limit the amount and extent within the shoreline jurisdiction. Such provisions could be used to encourage low impact development techniques or other conservation and protection measures.

Table 4.74 summarizes the functional scores for the six reaches within the city of Chehalis.

Table 4.74. City of Chehalis Management Area (City of Chehalis) Functional Scores for Reaches.

Primary Waterbody Name	Reach Number	Hydrologic				Vegetation			Hyporheic			Habitat		Total Score
		1	2	3	4	5	6	7	8	9	10	11	12	
Salzer Creek	CH-01	1	1	3	1	2	2	1	1	2	2	2	2	**20**
Chehalis River	CH-02	3	3	3	2	1	1	2	1	2	2	2	2	**24**
Newaukum River	CH-03	3	3	3	2	3	1	3	3	3	3	3	2	**32**
Berwick Creek	CH-04	3	3	3	2	1	2	2	3	1	3	3	2	**28**
Berwick Creek	CH-05	3	2	3	2	1	1	2	2	1	2	2	1	**22**
Unnamed Lake	CH-06	2	3	1	2	1	3	2	3	2	3	3	2	**27**
Chehalis Average														**25.5**

Table 4.75 summarizes the reach characteristics for parcels within the six reaches within the city of Chehalis.

Table 4.75. City of Chehalis Management Area (City of Chehalis) Reach Functional Assessment and Characteristics (Map Series 8).

Primary Waterbody Name	Reach Number	Reach Functional Assessment	% Public Ownership	% Wetland	% Floodway	% 100 Year
Salzer Creek	CH-01	20	40.3%	78%	N/A	99%
Chehalis River	CH-02	24	9.8%	19%	N/A	100%
Newaukum River	CH-03	32	100%	79%	N/A	100%
Berwick Creek	CH-04	28	0%	100%	N/A	100%
Berwick Creek	CH-05	22	1.6%	49%	N/A	20%
Unnamed Lake	CH-06	27	36.5%	75%	N/A	93%

4.6.5. Restoration Opportunities

One restoration priority for the city of Chehalis is to improve tributary stream habitat for salmonids. A conceptual project proposed by the city of Chehalis for Dillenbaugh Creek would improve habitat conditions greatly. The current configuration of lower Dillenbaugh Creek passes under Interstate 5 at two locations, under railroads in two locations, under State Route 6, and a county road. In addition, lower Dillenbaugh Creek is heavily channelized and

overgrown with reed canarygrass; the habitat conditions for this reach are considered poor, and elevated water temperatures during the summer are likely problematic for juvenile salmonids. Finally, the proposed levee system for the city of Chehalis would require a tide gate on Dillenbaugh Creek near its confluence with the Chehalis River (Habitat Work Schedule 2013). The proposed project would actually reduce the length of Dillenbaugh Creek by approximately 1.9 miles, and divert the creek into the Newaukum River through Stan Hedwall Park. The creek would no longer have to pass under Interstate 5 and other structures, and would have higher stream velocities. The new creek configuration would also provide salmonids permanent access to an abandoned oxbow lake nearby, offering excellent habitat for juvenile salmonid rearing. As part of any restoration action involving Dillenbaugh Creek, it may be beneficial to monitor dioxin levels and other pollutants, and to evaluate possible pollutant sources and possible corrective actions.

These suggested restoration opportunities are conceptual and could conflict with other proposals for the same waterbodies. As such, restoration priorities and design details will need to be coordinated as projects move forward.

Another restoration priority for the city's shoreline management area is the correction of barrier culverts in tributary creeks, including Coal Creek, Dillenbaugh Creek, and Berwick Creek. When designed properly, upgrading culverts can have the added benefit of reducing clogging problems and minimizing the chances of catastrophic road failure during large storm events.

[…]

5. SHORELINE LAND CAPACITY ANALYSIS

A shoreline Land Capacity Analysis was completed to support the Coalition's SMP update. The purpose of the shoreline Land Capacity Analysis is to estimate future development that may occur along shorelines based on existing zoning and development standards. Other considerations will be addressed in detail during the process of determining Shoreline Environment Designation. Shoreline Environment Designation by reach and management area will be shown in Map Series 26, once shoreline environments are determined.

5.1. Methods

This section describes the methodology used in the Land Capacity Analysis for the Coalition's SMP Update. It is based in part on the land capacity analysis methods discussed in the Washington State Department of Commerce's *Urban Growth Area Guidebook: Reviewing, Updating and Implementing Your Urban Growth Area* published in 2012.

5.1.1. Geographic and Time Parameters

- Base Point in Time

  The SMP map inventory using parcel data from June 2012 was used as the baseline for the Land Capacity Analysis.

- Study Area Boundaries

  The boundaries of the study area was defined as those parcels either fully within or intersecting the SMPs shoreline jurisdiction. Parcels that were within associated wetlands but not in the shoreline jurisdiction were excluded.

5.1.2. Gross Developable Land Inventory

The following steps were taken to estimate Gross Developable Land within the Coalition shoreline jurisdiction. All parcels intersecting the shoreline jurisdiction were included. Both public and private lands in the Study Area Boundaries were included since all lands may have shoreline uses. Public or reserved lands were removed after Section 5.1.3(5) - *Deduct Land Set Aside for Conservation Purposes* as needed. Portions of parcels within the shoreline jurisdiction were deducted to account for critical areas, infrastructure and public purposes, and market factors. The gross developable land inventory provides an estimate of land available for development or redevelopment within the next 20 years.

Single-family and Commercial developable land analysis was not conducted for public or reserved lands. Parcels that spanned multiple density designations were assigned to the categories described in Sections 5.1.2(1)) - *Single-Family Residential Developable Land* and (2) – *Multi-Family, Commercial, and Industrial Developable Land* in a case-by-case assessment.

Final – City of Chehalis Abridged Version

Please See Complete SIC for Complete Information

1. Single-Family Residential Developable Land:

    a. Vacant Land That Can Be Subdivided

    Vacant land was defined as parcels with a Lewis County Assessor building value of less than $10,000. This land then had density provisions in the Coalition codes applied after the deductions noted below in order to arrive at future development capacity.

    b. Vacant Land Too Small for Subdivision

    Vacant land was defined as parcels with a Lewis County Assessor building value of less than $10,000. Parcels where the ratio of allowed density to parcel size is more than 0.5 were considered not subdividable. Lots less than 2,500 square feet were not included in this category. After deducting lands as described in the sections below, the remainder of this category was used in Section 5.1.6(3) – *Vacant Lands* under the assumption that these properties have a legal right to develop, despite their non-conformance with density requirements.

    c. Partially-Used Land

    Partially used land was defined as parcels with a Lewis County Assessor building value of greater than or equal to $10,000. Parcels where the ratio of allowed density to parcel size is less than or equal to 0.5 were considered subdividable and defined as only partially used. This land then had density provisions in the Coalition's codes applied after the deductions noted below in order to arrive at future development capacity.

2. Multi-Family, Commercial, And Industrial Developable Land:

    a. Under-Utilized

    Multi-Family, commercial, industrial designated parcels were defined as "under-utilized" if vacant, occupied by a single-family residential use as indicated by the assessor land use code; or if the ratio of building value to land value is less than 1.0.

    This was applied to the following zones that allow a wider range of industrial and commercial uses but not single-family residential:

    - **[…]**
    - **Chehalis**: C-O – Commercial Office/Mixed Use, C-N – Neighborhood Commercial, C-G – General Commercial, C-F – Freeway Commercial, CBD – Central Business District, I-L – Light Industrial, and I-H – Heavy Industrial
    - **[…]**

    In addition, this was applied to the following zones, which allow both multi-family and single-family uses:

    - **[…]**

- **Chehalis**: R-3 – Multifamily, Medium Density, R-4 – Multifamily, High Density, and R-UGA – Urban Growth Area Residential
- **[…]**

5.1.3. Deduct Critical Areas

1. Lakes and Wetlands

   Lakes and wetlands were deducted from the gross developable land inventory. Lakes and wetlands were identified in the WDNR wetlands and lakes GIS shape files.

2. Rivers and Streams

   Rivers and streams were deducted from the gross developable land inventory. Rivers and streams identified in the WDNR rivers and streams GIS shape files.

3. Adopted Floodway or the 2010 Flood Channel Study Area and Floodplain

   All land in the adopted floodway or the 2010 flood channel study area was removed from the inventory. All lands within 100-year floodplains of unincorporated Lewis County were removed from the inventory.

4. Critical Area Buffers

   Critical area buffers were deducted from the gross developable land inventory based on the following criteria:

   - Critical area buffers were not deducted from residential parcels due to the variety of clustering options available on these parcels.
   - Critical area buffers for commercial and industrial parcels were deducted from these areas. Given the lack of data on potential classes of wetlands, buffer distances were based on an average of the 75-foot buffers required for Class A and Class B wetlands for high intensity uses found in Lewis County Code 17.35.610(1).

5. Deduct Land Set Aside for Conservation Purposes

   Identified fish and wildlife habitat conservation areas were deducted from the gross developable land inventory. These included Lewis County Parks, Washington State Parks, WDFW state natural area preserves, natural resource conservation areas managed by the WDNR, National Wildlife Refuges, National Parks, Wilderness Areas, other Federal lands, and private conservation areas such as the Nature Conservancy.

5.1.4. Deduct Infrastructure and Public Uses

1. Deduct Lands Identified for Public Purposes

   Lands identified for public purposes such as schools, boat ramps, police and fire stations, water and sewer facilities, port-owned properties, power line easements, and recreation and open space not deducted in Section 5.1.3(5)) - *Deduct Land Set*

Aside for Conservation Purposes. Parcels with land use codes of "Government services," "Educational services," or "Park" were deducted.

2. Right-of-Way and Other Development Requirements

   A percentage reduction was deducted to account for future right-of-way, public and private vehicular access (including driveways), and other development requirements (i.e., stormwater, utilities, and similar facilities). Most jurisdictions included a deduction in the 5 to 15 percent range. The 8 percent deduction used by this Land Capacity Analysis was within that range and on the slightly lower end because this Land Capacity Analysis considered only the shoreline jurisdiction only, where likely fewer new roads and vehicle access would be found.

3. Determine Developable Acres by Planned Land Use Category (Zoning District)

   Developable acres (vacant, partially used, and under-utilized with critical area deductions) were calculated by zoning district. This does not include the subtotal of Sections 5.1.4(1) - *Deduct Lands Identified for Public Purposes* and (2) *Right-Of-Way and Other Development Requirements*.

5.1.5. Market Factor Deduction

1. Vacant Lands

   A market factor was included to account for vacant lands that do not develop within planning timeframe. A 15 percent market factor was used for vacant residential and commercial/industrial zones.

2. Partially-Used and Under-Utilized Lands

   A market factor was included to account for partially used and under-utilized lands that do not develop within planning timeframe. A 25 percent market factor was used for vacant residential and commercial/industrial zones.

5.1.6. Determine Development Capacity

1. Development Type

   Development was assumed either as residential or commercial based upon the zoning district. Zones listed as commercial were identified as such in Section 5.1.2(2) – *Multi-Family, Commercial, and Industrial Developable Land*.

2. Determine Total Dwelling Units Capacity by Zone

   The net acres of developable land in each zone were multiplied by assumed density of each zone to determine total dwelling units of capacity. Existing dwelling units were subtracted they exist. If the number of existing dwelling units exceeded capacity within a zoning district, no dwelling units were added to the total capacity. Comprehensive Plan densities as identified on the Comprehensive Plan Official maps were applied for shoreline and upland portions of parcels. Use data was found in available GIS layers provided by the county.

3. Number of Vacant Parcels

   The subtotal of number of vacant parcels that cannot be subdivided by zoning district was included from Section 5.1.2(1)(a) - *Vacant Land Too Small for Subdivision*.

5.2. Results by Shoreline Management Area

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5.2.6. City of Chehalis

The city of Chehalis shoreline jurisdiction contains 320 parcels. Of these parcels, 51 percent are vacant and public or conservation group ownership, conservation easements, local government ownership, or similar mechanisms protect approximately 17 percent from development. It was not possible to determine what parcels have a non-conforming use.

The city's shoreline jurisdiction is designated entirely for urban land uses. The city's land use designations in the shoreline jurisdiction include Residential, Low Density, Industrial, Commercial, Essential Public Facilities (EPF), and Urban Growth Areas. Based on these designations, the most intense use of property appears to be the Commercial and Industrial designations found along the Chehalis River. There is approximately 237 acres of vacant or underutilized commercial and industrial land within the city's shoreline jurisdiction with the potential to develop or redevelop.

The majority of new residential development capacity in the city's shoreline jurisdiction exists in Single-Family Residential-Medium Density designation. Although approximately 12 percent of the residential development capacity occurs on lots too small to be subdivided under the current city code, some larger subdivision opportunities exist in the city's shoreline jurisdiction to the west of the established residential development south of the downtown core.

The existing city zoning allows some opportunity for nonwater-oriented uses in the city's shoreline jurisdiction, particularly in the commercial and industrial zoning districts found along the Chehalis River. These zones allow a wide variety of uses, providing potential for future use conflicts. A significant amount of light industrial land on the south side of the city allows industrial priority uses within the shoreline jurisdiction and the area provides ample redevelopment opportunity.

The city's shoreline jurisdiction contains land for shoreline uses such as single-family residential and water-enjoyment uses associated with recreation at Stan Hedwall Park and other city parks.

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6. PUBLIC ACCESS ANALYSIS

6.1. Parks and Recreation Plans

Existing public shoreline access has been discussed in the context of management areas throughout this document. For all the cities that make up the Coalition, the elements of shoreline public access opportunities included in each of the Parks and Recreation Plans relevant to the shoreline jurisdiction were discussed in Section 4.

This section builds on the visions, goals, and policies of the county's Comprehensive Plan and the cities' Parks and Recreation Plans to arrive at the following action items and strategies have the most potential for improving opportunities for shoreline public access in the Coalition SMP jurisdiction:

- Protect lands valuable for shoreline access, views, and habitat. Protect high-priority lands – including high-habitat-value lands – using a variety of methods such as purchase of development rights or donation.
- Develop new and improve existing water access opportunities. Develop road ends as water access points where feasible. Enhance water access opportunities on existing public lands. Invest in signage and basic infrastructure at public access sites.
- Provide for all users. Plan to use upgrades and future development to meet disability access standards.
- Provide connectivity between sites and facilities. Identify and prioritize priority trail projects. Acquire the land and provide the resources required to implement those projects.
- Coordinate to maximize impact of resources. Improve coordination between federal, state, utility, and local agencies and other organizations with land protection and park open/space interests to identify common opportunities and leverage resources. Identify resource-sharing opportunities to improve service and delivery.
- Provide adequate funding for public access development and maintenance efforts. Provide adequate funding for acquisitions and maintenance through the variety of identified funding mechanisms in the Parks and Recreation Plans.
- Educate and inform public of access opportunities. Develop park and trail maps. Implement environmental education programs at high use parks. Inform pubic of project progress updates, events, and volunteer opportunities.
- Work with private and public landowners to protect high-priority lands using a variety of tools such as land or development right purchase, exchange, and private donation.

6.2. Public Access Opportunities

The public access analysis relies on GIS data and existing technical reports such as current Comprehensive Plans, Parks Plans, and other available information from the Coalition, Tacoma Power, the Lewis County Public Utility District, the Chehalis Basin Land Trust, state agencies, and other community organizations.

Many of the public access opportunities located within the shoreline of the Coalition SMP jurisdiction are associated with open space in the natural environment, particularly rivers, lakes, and streams in publicly owned land or national forest lands. Approximately one-third of the county is national forest. The county contains portions of Mount Baker-Snoqualmie and Gifford Pinchot National Forests, portions of the Mount Saint Helens National Volcanic Monument and the Mount Rainier National Park, as well as the William Douglas, Tatoosh, and Goat Rocks Wilderness areas.

The Coalition's vision for natural areas is to have interconnected natural areas that balance public access with the protection of the water and natural areas. This vision recognizes the importance of open space corridors linking regions of the county and providing physical and visual relief to the built environment. The character of rural Lewis County is derived from its association with large acreage of park, wilderness, or resource lands in both the eastern and western portions of the county. Connecting these large blocks of land are corridors, which flow to and through the rural and urban areas, defining and separating the developed lands, defining the cities, and providing access and habitat for wildlife. The corridors follow shoreline areas in stream and river valleys and are comprised of steep slopes, agricultural resource land, and flood hazard areas.

Open space lands may be either in public or private ownership and are often not generally available to public access. Privately owned lands in flood hazard areas (over 40,000 acres), and lands currently managed by Tacoma Power under conservation easements (over 15,000 acres) are part of this latter category.

Five key open space areas in the county provide varying levels of existing or potential public access opportunities to the shoreline of the Coalition SMP jurisdiction:

1. Park and recreation facilities, including national parks, national forests, and wilderness areas, state parks, city and county parks, power company recreational areas, and private parks and recreational areas
2. Resource lands, including designated timberlands and agricultural lands
3. Hazard and critical areas, including steep slopes over 40 percent, flood hazard areas, and wetlands
4. Lands, which shape the county urban centers, including steep slopes, river flood hazard areas, and resource lands

5. Lands, which provide visual and physical corridors to protect the rural character of the county and provide physical habitat and corridors for wildlife, including steep slopes, designated farmlands, and flood hazard areas in urban and rural settings.

The Lewis County Park and Recreation Plan was adopted in 1995 and it will likely require updating. The park plans for Centralia, Chehalis, Morton, and Winlock are more current and detailed.

The plans are supplemented by the activities of the county and city Park and Recreation Departments, the State Park system, WDFW facilities, WDNR lands, Tacoma Power and Lewis County PUD facilities, the Chehalis Basin Land Trust, the U.S. Forest Service, and other federal agencies. From expanding public access to the shoreline through road ends and shoreline parks to acquiring new waterfront lands to land conservation for protecting sensitive habitat, the activities of all these organizations play a role in improving public access to the shoreline.

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Proposed trails properties are owned by public and private entities. Implementation of trails plans to increase public access opportunities depend on coordination between public property owners of transportation and utility corridors with private property owners. This is a key to implementing shoreline public access. While shoreline access road ends currently provide some level of informal public access to the water, most of them need to be surveyed to delineate ownership boundaries and many need to be enhanced to accommodate parking and provide more controlled public access.

Given the lack of public funding available on the local level for parks and trails, expanding funding options for parks, trails, and natural areas and continuing to improve stewardship and maintenance of existing facilities needs to be explored.

6.2.1. Shoreline Management Areas

Based on shoreline public access needs and existing shoreline public access, this section describes opportunities for improving public access in each management area. Opportunities include active or passive public access to rivers, streams, and lakes by trails, road ends, docks, floats, viewpoints, easements, and other means.

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6.2.1.6. City of Chehalis

The implementation chapter of the city of Chehalis Draft Park, Recreation & Open Space (PROS) Plan, dated March 2010, specifies that the city will use funds generated from adjusted program fees and schedules, possible impact fees, and the proposed levy to start acquiring and conserving significant wildlife, forestland, and open spaces listed in the PROS Plan.

Section 4.1 discusses and maps the existing parks and resource conservancy areas within the city's shoreline jurisdiction:

- **Robert J. Lintott/Alexander Park** - 5.8-acre park contains riparian corridor and high bank shoreline along the Newaukum River.
- **National Avenue Wetlands** – 66-acre significant wetlands complex and proposed mitigation bank located adjacent to Coal and Salzer Creeks.
- **Stan Hedwall Park Multipurpose Park** – Park contains 104 acres of woodlands and 100 acres of open field along the Newaukum River providing about 2.25 miles of shoreline.
- **Airport Stormwater Pond** – 10 acres of airport runway stormwater collection pond located at the north end of the runways abutting NW Airport Way.
- **Airport Mitigation** – 100 acres including Airport wetland and floodplain levy mitigation acquisition extending west of NW Airport Road to the Chehalis River with wetlands, riparian corridor along the Chehalis River shoreline, and some woodland on a former farm.

In addition, the following proposed parks and resource conservancy areas within the city's shoreline jurisdiction can serve as both active and passive public access opportunities:

- **National Ave Wetlands Addition** – 10-acre additional property west along Coal and Salzer Creeks and across BNSF railroad tracks to Interstate 5 would be preserved to link the National Avenue Wetlands and mitigation site with the stormwater ponds on the Airport.
- **Dillenbaugh Creek Station** – 10 acres would be set aside to preserve the significant wetlands along Dillenbaugh Creek south of Main Street and between Interstate 5 and the BNSF railroad tracks to create a wetland park and potential wetland mitigation bank and stormwater detention system.
- **Hillbarger Road Ponds** – 20 acres would be set aside to preserve the large freshwater ponds located between SW Hillbarger Road, Interstate 5, and the Willapa Hills Rails-to-Trails corridor to provide wildlife habitat and scenic values.
- **Interstate Ave Wetlands** – 5 acres would be set aside to preserve the open space and isolated wetlands between Interstate 5 and Interstate Avenue for wildlife habitat and scenic buffer from adjacent residential and industrial uses.
- **Dillenbaugh Creek South** – 10 acres would be set aside to preserve the riparian corridor along Dillenbaugh Creek from Interstate 5 and Bishop Road east to Jackson Highway for wildlife habitat and scenic buffer.
- **Bishop Road Wetlands** – 10 acres would be set aside to preserve the wetlands and riparian corridor along Berwick Creek from Interstate 5 and Bishop Road east to Jackson Highway for wildlife habitat and scenic buffer.
- **Berwick Creek Wetlands** – 10 acres would be set aside to preserve the wetlands located north of and draining into Berwick Creek for wildlife habitat and scenic buffer.

- **Coal Creek Stormwater** – 10 acres would be set aside to preserve the drainage corridor extending from the ridge to north down the hillside into Coal Creek Valley to the stormwater collection system or wildlife habitat, trail access, and scenic definition.

The Draft PROS Plan indicates that the city will work with the county, state agencies, and non-profit organizations on significant projects and seek to combine funding where possible. Chapter 6.4 of the PROS Plan states:

> *"Depending on schedules and availabilities, initial acquisitions of development rights or fee title may include the riparian corridors and buffers, freshwater wetlands and ponds, agricultural fields and farms, and historical and cultural landscapes indicated in this PROS Plan."*

Opportunities exist for improving public access to the shoreline jurisdiction within the city through limited street end improvements.

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7. Data Gaps

Some non-salmonid species such as Pacific lamprey, eulachon, and Olympic mudminnow are not included in the PHS dataset. This is a data gap in terms of mapping their known distribution or habitats and evaluating potentially sensitive sites. The Cowlitz Tribe, under a NOAA grant, has been conducting Eulachon surveys annually since 2010. In the Cowlitz River, adults are known to migrate up to Barrier Dam, and spawning has been observed up to RM 38 (Personal communication with C. Olds, Cowlitz Tribe, May 10, 2013). Site-specific data from these surveys were not obtained for this characterization, but could be useful for determining areas that need special provisions or protection to conserve and restore this sensitive priority species. Olympic mudminnow presence is not well documented in the county. General locations of known presence were illustrated by Mongillo and Hallock (1999) but data on specific locations and possibly more recent observations may be available from WDFW but not included in the PHS dataset.

Comprehensive inventories of shoreline modifications and overwater structures were not available for the study area. Detailed information regarding overwater structures, shoreline modifications such as bank armoring, water diversion inlets and outlets, and other areas of altered bank or bed conditions could be collected and compiled into a georeferenced database. A compilation of relevant public agency management plans (e.g., Tacoma Power and WSDOT) are currently lacking, and would improve the inventory of existing and planned shoreline modifications. This information could then be used to make informed decisions on protection and restoration opportunities along the shorelines. The information could also be used to monitor development overtime and determine net increases/reductions. Similarly, a survey of habitat features such LWD, substrate types, and riparian vegetation could inform site-specific management decisions for protection, restoration, and enhancement activities.

High resolution geologic maps are needed for much of the county. These maps provide valuable information with regards to historic and existing physical conditions that are important for sound shoreline management decisions.

Alluvial fans are defined as a potential critical hazard areas per Lewis County Code 17.35A.080. Alluvial fans are low, outspread, relatively flat to gently sloping deposit of sediment and organic debris, shaped like an open fan or segment of a cone, deposited by streams or debris flows where they issue from narrow, steep valleys upon a plain or broad valley or wherever the gradient of the stream suddenly decreases. Either as an element of a comprehensive set of detailed surface geology maps, or as a product of a stand-alone study, a map showing the location and extent of active alluvial fans would assist with identifying high risk areas for development.

As discussed in Section 3.8.13, CMZs have been mapped for portions of the Cowlitz, Nisqually, and Cispus Rivers, and for a portion of Rainey Creek, but have not been mapped for other streams in the County. Because SMA guidelines require available CMZ information to be compiled (WAC 173-26-201(3)(c)(vii)) and because CMZs are recognized as critical freshwater

habitats (WAC 173-26-221(2)(c)(iv)(A)), comprehensive CMZ mapping is needed for incorporation in future shoreline inventory updates.

Improved hydrologic gauging of small tributaries in both the Cowlitz and Chehalis basins could also improve flood forecasting and the design of restoration projects throughout the county.

8. SHORELINE MANAGEMENT RECOMMENDATIONS

The following are recommended actions for translating the inventory and characterization findings into draft SMP policies, regulations, environment designations, and restoration strategies for areas within the shoreline jurisdiction. In addition to the following analysis-specific recommendations, the updated SMP should incorporate all other requirements of the SMA (Chapter 90.58 RCW) and the SMP Guidelines (Chapter 173-26 WAC).

8.1. Environment Designations

8.1.1. Background

As outlined in WAC 173-26-191(1)(d),

> *"Shoreline management must address a wide range of physical conditions and development settings along shoreline areas. Effective shoreline management requires that the shoreline master program prescribe different sets of environmental protection measures, allowable use provisions, and development standards for each of these shoreline segments."*

In WAC 173-26-211(2)(a), the SMP Guidelines further direct development and assignment of environment designations based on "…the existing use pattern, the biological and physical character of the shoreline, and the goals and aspirations of the community as expressed through Comprehensive Plans as well as the criteria in this section." The methodology discussion in Section 8.1.3 describes how the function analysis scores in this report may be considered as a component in assigning preliminary environment designations.

- **Ecology Recommended Classification System**

  The SMP Guidelines recommend the use of six basic environments: Natural, Rural Conservancy, Aquatic, High-intensity, Urban Conservancy, and Shoreline Residential. The purpose and designation criteria of these six environments are as follows:

  1. Natural Environment:

     Purpose: The purpose of the "natural" environment is to protect those shoreline areas that are relatively free of human influence or that include intact or minimally degraded shoreline functions intolerant of human use. These systems require that only very low intensity uses be allowed in order to maintain the ecological functions and ecosystem-wide processes. Consistent with the policies of the designation, local government should include planning for restoration of degraded shorelines within this environment.

     Designation Criteria: A "natural" environment designation should be assigned to shoreline areas if any of the following characteristics apply:

- The shoreline is ecologically intact and therefore currently performing an important, irreplaceable function or ecosystem-wide process that would be damaged by human activity;
- The shoreline is considered to represent ecosystems and geologic types that are of particular scientific and educational interest; or
- The shoreline is unable to support new development or uses without significant adverse impacts on ecological functions or risk to human safety.

2. Rural Conservancy Environment:

   Purpose: The purpose of the "rural conservancy" environment is to protect ecological functions, conserve existing natural resources and valuable historic and cultural areas in order to provide for sustained resource use, achieve natural floodplain processes, and provide recreational opportunities. Examples of uses that are appropriate in a "rural conservancy" environment include low-impact outdoor recreation uses, timber harvesting on a sustained-yield basis, agricultural uses, aquaculture, low-intensity residential development, and other natural resource based low-intensity uses.

   Designation Criteria: Assign a "rural conservancy" environment designation to shoreline areas outside incorporated municipalities and outside UGAs, as defined by RCW 36.70A.110, if any of the following characteristics applies:

   - The shoreline is currently supporting lesser-intensity resource-based uses, such as agriculture, forestry, or recreational uses, or is designated agricultural or forest lands pursuant to RCW 36.70A.170;
   - The shoreline is currently accommodating residential uses outside UGAs and incorporated cities or towns;
   - The shoreline is supporting human uses but subject to environmental limitations, such as properties that include or are adjacent to steep banks, feeder bluffs, or floodplains or other flood-prone areas;
   - The shoreline is of high recreational value or with unique historic or cultural resources; or
   - The shoreline has low-intensity water-dependent uses.

3. Aquatic Environment:

   Purpose: The purpose of the "aquatic" environment is to protect, restore, and manage the unique characteristics and resources of the areas waterward of the ordinary high water mark.

   Designation Criteria: Assign an "aquatic" environment designation to lands waterward of the ordinary high water mark. Local governments may designate submerged and intertidal lands with shoreland designations (e.g., "high-intensity" or "rural conservancy") if the management policies and objectives for aquatic areas

are met. In this case, the designation system used must provide regulations for managing submerged and intertidal lands that are clear and consistent with the "aquatic" environment management policies in this section. Additionally, local governments may assign an "aquatic" environment designation to wetlands.

4. High-intensity Environment:

   Purpose: The purpose of the "high-intensity" environment is to provide for high-intensity water-oriented commercial, transportation, and industrial uses while protecting existing ecological functions and restoring ecological functions in areas that have been previously degraded.

   Designation Criteria: Assign a "high-intensity" environment designation to shoreline areas within incorporated municipalities, UGAs, and industrial or commercial LAMIRDs as described by RCW 36.70A.070, if they currently support high-intensity uses related to commerce, transportation, or navigation; or are suitable and planned for high-intensity water-oriented uses.

5. Urban Conservancy Environment:

   Purpose: The purpose of the "urban conservancy" environment is to protect and restore ecological functions of open space, floodplain, and other sensitive lands where they exist in urban and developed settings, while allowing a variety of compatible uses.

   Designation Criteria: Assign an "urban conservancy" environment designation to shoreline areas appropriate and planned for development that is compatible with maintaining or restoring of the ecological functions of the area, that are not generally suitable for water-dependent uses and that lie in incorporated municipalities, UGAs, or commercial or industrial LAMIRDs if any of the following characteristics apply:

   - They are suitable for water-related or water-enjoyment uses;
   - They are open space, floodplain, or other sensitive areas that should not be more intensively developed;
   - They have potential for ecological restoration;
   - They retain important ecological functions, even though partially developed; or
   - They have the potential for development that is compatible with ecological restoration.

6. Shoreline Residential Environment:

   Purpose: The purpose of the "shoreline residential" environment is to accommodate residential development and appurtenant structures that are consistent with this section. An additional purpose is to provide appropriate public access and recreational uses.

Designation Criteria: Assign a "shoreline residential" environment designation to shoreline areas inside UGAs, as defined in RCW 36.70A.110, incorporated municipalities, "rural areas of more intense development," or "master planned resorts," as described in RCW 36.70A.360, if they are predominantly single-family or multi-family residential development or are planned and platted for residential development.

8.1.2. Existing County Shoreline Designations

As discussed previously in Section 1, while different versions of the original Lewis County SMP have been adopted and amended at various times by the members of the Coalition, they all use the same system of four environment designations: Urban, Rural, Conservancy, and Natural. These environment designations are listed in order of decreasing level of intensity and allowed uses.

Table 8.1 illustrates how the Coalition's existing four primary shoreline designations relate to Ecology's recommended classification system. Each of the Coalition's existing primary shoreline designations is paired with the most comparable Ecology designation. A brief comparison of the two designations is then provided. This comparison is intended to help illustrate whether the county's guidelines currently or could potentially comply with the SMP Guidelines. Note that the SMP Guidelines stipulate "…local governments may establish a different designation system or may retain their current environment designations, provided it is consistent with the purposes and policies of WAC 173-26-211."

8.1.3. Methodology

The intent of an environment designation is to preserve and enhance shoreline ecological functions and to encourage development that will improve the present or desired future character of the shoreline jurisdiction. The SMP Guidelines (WAC 173-26-211(2)(a)) require that the county and the cities in the Coalition classify and map the area within its shoreline jurisdiction into environment designations based on these four criteria:

1. **Existing land use patterns** – What land uses have developed in the shoreline jurisdiction to date, as documented in the Shoreline Inventory and Characterization and the SMP map folio.

2. **Biological and physical character of the shoreline jurisdiction** – The range of ecological characteristics and functions identified in the shoreline jurisdiction as documented in the Shoreline Inventory and Characterization.

3. **The goals and aspirations of the county and the cities in the Coalition as expressed through their Comprehensive Plans** – The Comprehensive Plans' goals and policies, land use designations, its various elements, as well as its development code and zoning code, the Parks and Recreation Plan, and so forth.

4. Specific criteria for each environment designation found in WAC 173-26-211(5).

Table 8.1. Comparison of Existing Coalition's Shoreline Designations and Ecology's Recommended Classification System.

Existing Coalition Shoreline Designation	Summary of Lewis County Shoreline Designation Purpose and Criteria shared by the SMPs of the individual jurisdiction in the Coalition	Comparable Ecology Designation	Summary of Ecology Shoreline Designation Purpose and Criteria (WAC 173-26-211)	Comparison
Urban	**Purpose**: "The urban environments are those areas of intensive residential, commercial, or industrial use, or which area anticipating such intensive development in the near future." **Criteria**: "The urban environment is an area of high intensity land use including residential, commercial, and industrial development. It is particularly suitable to those areas presently subjected to extremely intensive use pressure, as well as areas planned to accommodate urban expansion. Shorelines planned for future urban expansion should present few biophysical; limitations for urban activities and not have a high priority for designation as an alternative environment."	High Intensity	**Purpose**: "to provide for high intensity water-oriented commercial, transportation, and industrial use while protecting existing ecological functions and restoring ecological functions in areas that have been previously degraded" **Criteria**: "shoreline areas within incorporated municipalities, UGAs, and industrial or commercial 'limited areas of more intense rural development'…if they currently support high-intensity uses related to commerce, transportation or navigation; or are suitable and planned for high-intensity water-oriented uses."	Compared to Ecology's High Intensity designation, the Coalition's Urban designation includes a broader scope of uses (e.g., residential and institutional). The Coalition's Urban designation also includes less-intense uses (e.g., medium density residential).
Rural	**Purpose**: "The rural environments are those areas predominately for agriculture and low-density residential development and which are not anticipating immediate expansion." **Criteria**: "The rural environment is intended for those areas characterized by intensive agricultural and recreational uses and those areas having a high capacity to support active agricultural practices and intensive recreational development. Hence, those areas that are already used for agricultural purposes, or which have agricultural potential should be maintained for present and future agricultural needs. Designation of rural environments should also seek to alleviate pressures of urban expansion on prime farming areas."	Rural Conservancy	**Purpose**: "…to protect ecological functions, conserve existing natural resources and valuable historic and cultural areas in order to provide for sustained resource use…and provide recreational opportunities. Examples of uses that are appropriate…include low-impact outdoor recreation uses, timber harvesting on a sustained-yield basis, agricultural uses, aquaculture, low-intensity residential development and other natural resource-based low-intensity uses." **Criteria**: "…if any of the following characteristics apply…currently supporting lesser-intensity resource-based uses, such as agriculture, forestry, or recreational uses, or is designated agricultural or forest lands…; …currently accommodating residential uses outside UGAs and incorporated cities or towns; …supporting human uses but subject to environmental limitations, such as properties that include or are adjacent to steep banks, feeder bluffs, or floodplains or other flood-prone areas; …high recreational value or with unique historic or cultural resources…; …has low-intensity water-dependent uses."	Compared to Ecology's Rural Conservancy designation, the Coalition's Rural designation has a narrower focus. Specifically, the Coalition's Rural designation particularly fits with the Ecology Rural Conservancy criterion that the shoreline is "…currently supporting lesser intensity resource-based uses, such as agricultural… or recreational uses, or is designated agricultural… lands" and less so in regard to conservation and protection of resources.
Conservancy	**Purpose**: "The conservancy environment is intended to provide for multiple use activities, although the intensity of uses will be limited because of extensive commercial forest areas, steep slopes, desirability for low-intensity recreational use and wildlife habitat values." **Criteria**: "The conservancy environment is for those areas which as intended to maintain their existing character. The preferred uses are those, which are non-consumptive of the physical and biological resources of the area. Non-consumptive uses are those uses, which can utilize resources on a sustained basis while minimally reducing opportunities for other future use of the resources in the area. Activities and uses of a non-permanent nature, which do not substantially degrade the existing character of an area, are appropriate uses for a conservancy environment. Examples of uses that might be predominant in a conservancy environment include diffuse outdoor recreation activities, passive agricultural uses such as pasture and rangelands, and other related uses and activities."	Rural Conservancy	**Purpose**: "…to protect ecological functions, conserve existing natural resources and valuable historic and cultural areas in order to provide for sustained resource use…and provide recreational opportunities. Examples of uses that are appropriate…include low-impact outdoor recreation uses, timber harvesting on a sustained-yield basis, agricultural uses, aquaculture, low-intensity residential development and other natural resource-based low-intensity uses." **Criteria**: "…if any of the following characteristics apply…currently supporting lesser-intensity resource-based uses, such as agriculture, forestry, or recreational uses, or is designated agricultural or forest lands…; …currently accommodating residential uses outside UGAs and incorporated cities or towns; …supporting human uses but subject to environmental limitations, such as properties that include or are adjacent to steep banks, feeder bluffs, or floodplains or other flood-prone areas; …high recreational value or with unique historic or cultural resources…; …has low-intensity water-dependent uses."	The Coalition's Conservancy and Ecology's Rural Conservancy designations are similar.

Table 8.1 (continued). Comparison of Existing Coalition Shoreline Designations and Ecology's Recommended Classification System.

Existing Coalition Shoreline Designation	Summary of Lewis County Shoreline Designation Purpose and Criteria shared by the SMPs of the individual jurisdiction in the Coalition	Comparable Ecology Designation	Summary of Ecology Shoreline Designation Purpose and Criteria (WAC 173-26-211)	Comparison
Natural	**Purpose**: "The natural environment identifies those resource systems and features which are key to the maintenance of natural, physical, and biological processes." **Criteria**: "The primary determinant for designating an area as a natural environment is the actual presence of some unique natural or cultural features considered valuable in their natural or original condition which are relatively intolerant of intensive human use. Such features should be defined, identified, and quantified in the shoreline inventory. The relative value of the resources is to be based on local citizen opinion and the needs and desires of other people in the rest of state. There are no areas designated as natural environments in Coalition and there is little likelihood that any areas shall be designated. Consequently, no regulations have been adopted for natural environments in the following sections."	Natural	**Purpose**: "…to protect those shoreline areas that are relatively free of human influence or that include intact or minimally degraded shoreline functions intolerant of human use. These systems require that only very low intensity uses be allowed..." **Criteria**: "…if any of the following characteristics apply…shoreline is ecologically intact and therefore currently performing an important, irreplaceable function or ecosystem-wide process that would be damaged by human activity; …considered to represent ecosystems and geologic types that are of particular scientific and educational interest; …unable to support new development or uses without significant adverse impacts on ecological functions or risk to human safety."	The Coalition's and Ecology's Natural designations are similar, however the Coalition does not apply this designation anywhere and has not developed supporting regulations. However, Mt. Rainier National Park and the Goat Rock, Tatoosh, and William O. Douglas Wildernesses are locales within the Coalition that are already protected in this manner by the federal government. Therefore, it is recommended that these areas be considered for Natural designation.

Final – City of Chehalis Abridged Version
Please See Complete SIC for Complete Information

In general, the SMP Guidelines criteria will be used and further informed by the following GIS data:

- Current land use
- Planned land use
- Ownership
- Wetlands
- Floodplains
- Channel migration zones
- Vegetation
- Impervious surface
- Ecological function scores

While current and future land use, and ownership provide the basic context for a given segment of land, for rural development the recommended environment designations do not always correlate strongly with those parameters. Parcels are often quite large and extend well beyond the shoreline jurisdiction. For example, while the current land use may indicate a single-family residential use, the actual development may not be in the shoreline jurisdiction and would therefore not have necessarily resulted in adverse impacts on shoreline condition. The vegetation and impervious surface data may be better gauge of alteration in the shoreline jurisdiction, as well as the ecological function scores.

For this reason, parcels that have a current or planned land use of residential (or other designation allowing alteration) may ultimately have a Conservancy environment designation within the shoreline jurisdiction. The parcel can still accommodate the residential use, perhaps even in the shoreline jurisdiction, and satisfy the WAC requirements for consistency between the environment designations and the Comprehensive Plan (see WAC 173-26-211(3) for additional detail about consistency requirements). In areas with smaller parcel sizes, current land use will be more strongly correlated with level of alteration and the resulting environment designation because more often the entire parcel or a large portion of the parcel is in the shoreline jurisdiction.

The following are the general guidelines that will be used by the Coalition for assigning various shoreline designations. There may be opportunities to propose custom shoreline designations that respond to a particular set of unique conditions that the standard environment designations do not properly address:

- **Aquatic** will be the recommended designation for all the shoreline jurisdiction areas that are waterward of the ordinary high water mark.
- In general, **Natural** will be the recommended designation when impervious surface percentages are very low; when wetlands and/or floodplain percentages are high; when vegetation is primarily forest, scrub-shrub or various types of wetlands; and when the function score is high.

- **Rural Conservancy** may generally be applied to rural lands consistent with the Ecology criteria and when impervious surface percentages are low (often less than 10); when wetlands and floodplain percentages are low to moderate (absence of these does not indicate alteration or poor function); when vegetation is primarily forest, scrub-shrub or various types of wetlands; and when function scores are typically above average.
- **High-intensity** will be applied to urban areas of intensive development, and it will be limited to some areas of more intensive rural development. Current land use, particularly in areas of more intensive rural development, and a low function score correlate strongly with appropriate assignment of this designation.
- The **Shoreline Residential** designation might be applied in areas of urban residential development, more intensive rural development, and master planned resorts that are designated for residential use only. This designation is driven primarily by existing and planned land use, as outlined in the Ecology criteria above.
- **Urban Conservancy** might be applied in urban areas that are consistent with the Ecology criteria and when impervious surface percentages are low (often less than 10 percent); when wetlands and floodplain percentages are low to moderate (absence of these does not indicate alteration or poor function); when vegetation is primarily forest, scrub-shrub or various types of wetlands; and when function scores are typically above average.

8.1.4. Recommendations

Based on the Background and Methodology outlined above, the following specific recommendations are provided for future development and assignment of environment designations in the county and its subareas:

- Consider utilizing the basic six-category environment designation scheme in the SMP Guidelines in applying designations appropriately to county lands.
- Consider whether additional environment designations would be appropriate to delineate unique areas further that might warrant designation-specific use or modification regulations, such as waterfront parks.
- Utilize inventory and characterization findings, such as GIS information and/or function scores, in this report to inform assignment of environment designations, as outlined in Methodology.

8.2. General Policies and Regulations

8.2.1. Critical Areas

- Consider whether the critical areas regulations used by the jurisdictions in the Coalition should be incorporated into the SMP by reference or through direct inclusion. Either method of inclusion may require modification of the jurisdiction's critical areas regulations to meet SMA criteria (e.g., exceptions and exemptions).

8.2.2. Flood Hazard Reduction

- Consistent with the WAC provisions in the SMP Guidelines, provide maximum flexibility for developing and maintaining flood hazard reduction measures as needed to improve protection of existing developed areas.
- Incorporate flood hazard reduction provisions from existing watershed management, comprehensive flood hazard management, and other applicable plans.
- Recognize that development guidelines consistent with the flood hazard reduction provisions in the SMP Guidelines can limit exposure to flood hazards within active CMZs and other flood-prone areas.
- Recognize that flooding and channel migration are natural processes and ensure that future uses and development, including subdivisions, do not require structural flood hazard reduction measures within the channel migration zone or floodway consistent with WAC 173-26-221(3)(c)(i).

8.2.3. Public Access

- Recognize vision of the jurisdictions in the Coalition for parks, trails, and natural areas as a shoreline public access plan.
- Emphasize the importance of public access to the shoreline as one of the primary intents of the SMA.

8.2.4. Vegetation Conservation (Clearing and Grading)

- Build on the existing protections provided the critical areas regulations and current SMP of the jurisdictions in the Coalition, paying special attention to measures that will promote retention of shoreline vegetation and development of a well-functioning shoreline, which provides both physical and habitat processes.
- Ensure clear regulations for selective pruning of trees for safety and view protection as may be allowed per WAC 173-26-221(5)(c).

8.2.5. Water Quality

- Include policies and regulations that appropriately incorporate recommendations of the water quality-related studies prepared for the jurisdictions in the Coalition, particularly as related to impaired parameters listed by Ecology.
- Ensure that regulations allow for placement of any structures or facilities in the shoreline jurisdiction for improving water quality, as long as impacts are identified and mitigated, if necessary.
- Consider adding clarifying statements noting that the policies of the SMP are also policies of the Comprehensive Plans of each of the jurisdictions in the Coalition, and that the policies also apply to activities outside the shoreline jurisdiction that affect water quality within the shoreline jurisdiction. However, the regulations apply only within the shoreline jurisdiction.

- Consider policies which seek to improve water quality, quantity (the amount of water in a given system, with the objective of providing for ecological functions and human use), and flow characteristics in order to protect and restore ecological functions and ecosystem-wide processes of shorelines within the shoreline jurisdiction.

8.3. Shoreline Modification Provisions

8.3.1. Shoreline Stabilization

- Ensure that the definitions and standards for replacement and repair are consistent with WAC 173-26-231(3)(a). "Repair" activities should be defined to include a replacement threshold so that applicants and staff will know when "replacement' requirements need to be met.
- Fully implement the intent and principles of the SMP Guidelines. Reference appropriate exemptions found in the WAC related to normal maintenance, repair, and construction of the normal bulkhead common to single-family residences. These are not exemptions from the regulations, however; they are exemptions from a Shoreline Substantial Development Permit.
- Require consistency with WDFW design standards such as the Integrated Streambank Protection Guidelines (WDFW 2002).
- Give preference to those types of shoreline modifications that have a lesser impact on ecological functions. Policies should promote "soft" over "hard" shoreline modification measures where appropriate. Preference should also be given to existing structures or those that can be constructed entirely above the ordinary high water mark, and use vegetation and other natural materials (i.e., LWD) as the primary basis for protection.
- Incentives should be included in the SMP that would encourage modification of existing armoring, where feasible, to improve habitat while still maintaining any necessary site use and protection.

8.3.2. Piers and Docks

- Provide clear replacement and repair definitions and standards. "Repair" activities should be defined to include a replacement threshold so that applicants and staff will know when "replacement" requirements need to be met.
- Assess dimensional and other standards for new piers and replacement/modified piers contained in the existing SMP and update as needed to provide clarity.
- Consider standards that address materials such as grated decking for dock and pier replacements/modifications that may be proposed in the future along the shoreline.
- Be consistent with Corps of Engineers design standards, and recognize special local issues or circumstances.
- Require consistency with WDFW design standards such as the Integrated Streambank Protection Guidelines (WDFW 2002).

8.3.3. Fill

- Restoration fills, (typically referred to as nourishment) using site-specific suitable sediment types, should be encouraged, including improvements to shoreline habitats, natural materials to anchor LWD placements, and as needed to implement shoreline restoration. Recommend not requiring a Shoreline Conditional Use Permit for restoration-related fills that are consistent with the on-site geomorphology.
- Fills waterward of the ordinary high water mark to create developable land should be prohibited and should only be allowed landward of ordinary high water mark if not inconsistent with the requirement to protect shoreline ecological functions and ecosystem-wide processes.

8.3.4. Dredging

- Except for purposes of shoreline restoration, flood hazard reduction, the maintenance of existing legal moorage, and navigation, consider prohibiting these modifications.

8.3.5. Shoreline Habitat and Natural Systems Enhancement

- The SMP should include incentives to encourage restoration projects, particularly in areas identified as having lower function. For example, allow modification of impervious surface coverage, density, height, or setback requirements when paired with significant restoration. Emphasize that certain fills, such as spawning gravels, material to anchor logs, or material to create variety in floodplain elevations, can be an important component of some restoration projects.

8.4. Shoreline Uses

- For all shoreline uses, recognize that the SMP is an element of the jurisdictions' GMA Comprehensive Plans and that the SMPs need to be consistent with these Comprehensive Plans.

8.4.1. Agriculture

- The jurisdictions in the Coalition allow some agricultural uses in certain areas, and there may be some agricultural activities in the shoreline jurisdiction. Ensure that appropriate provisions for agricultural uses continue while also protecting critical areas such as riparian buffers from new agricultural development.

8.4.2. Aquaculture

- Ensure appropriate provisions for aquaculture uses are provided.

8.4.3. Boating Facilities

- Regulations should be crafted that are consistent with the WAC, as well as accommodate any known plans for modifications of any of these facilities. They should be consistent with WDFW and Corps of Engineers design standards, and recognize

special local issues or circumstances. Incentives should be used where appropriate to encourage on-site restoration.

8.4.4. Commercial Development

- Recognize commercial uses and consider incentives to attract water-oriented uses in appropriate locations along the shoreline, while ensuring no net loss of shoreline ecological functions.

8.4.5. Forest Practices

- Provide general policies and regulations for forest practices according to the SMP Guidelines.

8.4.6. Industry

- Include provisions for industrial uses while ensuring no net loss of shoreline ecological functions.

8.4.7. Mining

- Provide general policies and regulations for mining according to the SMP Guidelines.

8.4.8. Recreational Development

- Policies and regulations related to recreation management should provide clear preferences for shoreline restoration consistent with public access needs and uses. Include provisions for existing and potential recreational uses, including boating, scuba diving, kayaking, swimming, and fishing.

8.4.9. Residential Development

- Recognize current and planned shoreline residential uses with adequate provision of services and utilities as appropriate to allow for shoreline recreation and ecological protection.
- Include a policy to continue education of waterfront homeowners about the use of fertilizers and chemicals and encourage natural lawn care and landscaping methods to reduce chemical output into surrounding shorelines.
- Encourage low impact development techniques that reduce impervious surface areas, increase use of eco-friendly stormwater detention/transmission, and decrease flood hazards.

8.4.10. Transportation and Parking

- Allow for maintenance and improvements to existing roads and parking areas and for necessary new roads and parking areas where other locations outside of the shoreline jurisdiction are not feasible.
- Opportunities for armoring reduction may be available by removal or relocating some roads currently in the shoreline jurisdiction.

8.4.11. Utilities

- Allow for utility maintenance and extension with criteria for location and vegetation restoration as appropriate.

8.5. Restoration Plan

A Restoration Plan will be prepared as part of the SMP update process, consistent with WAC 173-26-201(2)(f).

The Restoration Plan must incorporate the findings from this analysis report and address the following six subjects (WAC 173-26-201(2)(f)(i-vi)):

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

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

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

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

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

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

The Restoration Plan will

> *"…include goals, policies, and actions for restoration of impaired shoreline ecological functions. These master program provisions should be designed to achieve overall improvements in shoreline ecological functions over time, when compared to the status upon adoption of the master program."*

The Restoration Plan will mesh potential projects identified in this report with additional projects, regional or local efforts, and programs of each jurisdiction, watershed groups, and environmental organizations that contribute or could potentially contribute to improved ecological functions of the shoreline.

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