Final

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

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COMMUNITY, REGIONAL & ENVIRONMENTAL

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

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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.

1.3.2. Lewis County

While the SMPs adoption and amendment times vary between the jurisdictions in the Coalition, the environment designations in the adopted SMPs are similar. Their descriptions are as follows:

- **Natural Environment** – "…identifies those resource systems and features which are key to the maintenance of natural, physical, and biological processes." The SMP does not designate any areas within the Coalition SMP jurisdiction as Natural Environment and does not include regulations for the designation.
- **Conservancy Environment** – "…is intended to provide for multiple use activities, although the intensity of uses will limited because of extensive commercial forest areas, steep slopes, flooding, desirability for low-intensity recreational use and wildlife habitat values." This designation was assigned to areas that are intended to maintain their existing character.
- **Rural Environment** – "…are those areas predominantly for agriculture and low-density residential development and which are not anticipating immediate expansion." This designation was intended for those areas characterized by intensive agricultural and recreational uses and those areas having a high capacity to support agricultural practices and intensive recreational development.
- **Urban Environment** – "…are those areas of intensive residential, commercial, or industrial use, or which are anticipating such intensive development in the near future." The designation was intended for areas currently or planned for high intensity land use including residential, commercial, and industrial development.

Lewis County adopted its first SMP in 1974 and amended it in 1998. From 2003 to 2013, the county approved approximately 806 Shoreline Exemptions and 43 Shoreline Substantial Development Permits, Shoreline CUPs, and Shoreline Variances.

The county is subject to the provisions of the state's Growth Management Act (GMA), which seeks to manage future growth systematically. The county Comprehensive Plan is a statement of policies and goals that guides growth and development throughout the county. It was adopted in 1999 and amended most recently in 2010. All other development ordinances, including land use, subdivision, environmental, and shoreline regulations must be consistent with the Comprehensive Plan. In addition, the SMP has been formally adopted by the county commissioners as an element of the county Comprehensive Plan.

The county adopted critical areas regulations in 1996 with amendments in 1998, 2000, and 2008. In the county, Lewis County Code (LCC) Chapter 17.35 (the critical areas regulations through the 2000 amendments) is still in effect and applies only to agriculture lands. In LCC 17.35, the county specifies stream buffers ranging from 10 to 100 feet depending on the type of the stream, intensity of use, and whether it is in a rural or urban area, with Type 1 water bodies (i.e., shorelines of the state) having a 50- to 100-foot buffer. The regulations require wetland buffers between 50 and 100 feet based on wetland classification and the intensity of the proposed land use. These buffers can increase depending on the level of habitat functions.

Everywhere else in the county, LLC Chapter 17.35A (the critical areas regulations through the 2008 amendments) is still in effect and applies to all other land uses. Stream buffers are 75 to 150 feet depending on the type of stream, with streams that are shorelines of the state being 150 feet. Wetland buffers range from 25 to 300 feet, depending on the type of wetland. These buffers can increase depending on the level of habitat functions.

1.3.3. City of Centralia

The city of Centralia's SMP was originally adopted in 1977 and subsequent amendments were not formally adopted. The city adopted its Comprehensive Plan in 2007. The goals of the Comprehensive Plan are directed toward ensuring superior public service, a strong and diverse local economy, diverse housing types, extensive recreational opportunities that support interconnections to regional and statewide trails, and protection of the natural environment.

The city updated its critical areas regulations in 2009. In Section 16.20.080 of the Centralia Municipal Code (CenMC), stream buffers range from 35 to 175 feet depending on the type of the stream, with Type S (1) water bodies (i.e., shorelines of the state) having a 175-foot buffer. In CenMC Section 16.17.050, minimum wetland buffers range from 25 to 300 feet, depending on category, intensity of use, water quality, and habitat function.

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.

1.3.5. City of Morton

The city of Morton's SMPs were adopted in 1977 and it has not been amended.The city adopted its Comprehensive Plan in 1997 and amended it in 2005. The goals of the Comprehensive Plan are directed toward preserving existing community character, diversify the local economy and work force, provide for housing demand, and ensure that city services have the capacity for growth.

The city updated its critical areas regulations in 2006. In Section 6.040.6 of the Morton Critical Areas Ordinance (MCAO), riparian habit area buffers range from 150 to 250 feet depending on the type of the stream, with Types 1 and 2 water bodies (i.e., shorelines of the state) having a 250-foot buffer. In MCAO Section 6.035.4, minimum wetland buffers range

from 25 to 300 feet, depending on category, intensity of use, water quality, and habitat function.

1.3.6. City of Winlock

The city of Winlock's SMPs were adopted in 1977 and it has not been amended.The city adopted its Comprehensive Plan in 2005. The goals of the Comprehensive Plan are directed toward ensuring a strong local economy.

The city updated its critical areas regulations in 2008. In Section 4.010.120.B of the Winlock Critical Areas Ordinance (WCAO), riparian ecosystem area buffers range from 75 to 250 feet depending on the type of the stream and their characteristics, with Type S riparian areas (i.e., shorelines of the state) having a 250-foot buffer. In WCAO Section 4.010.120.E, minimum wetland buffers range from 25 to 300 feet, depending on category, intensity of use, hydrologic function, and habitat function.

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

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		

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.

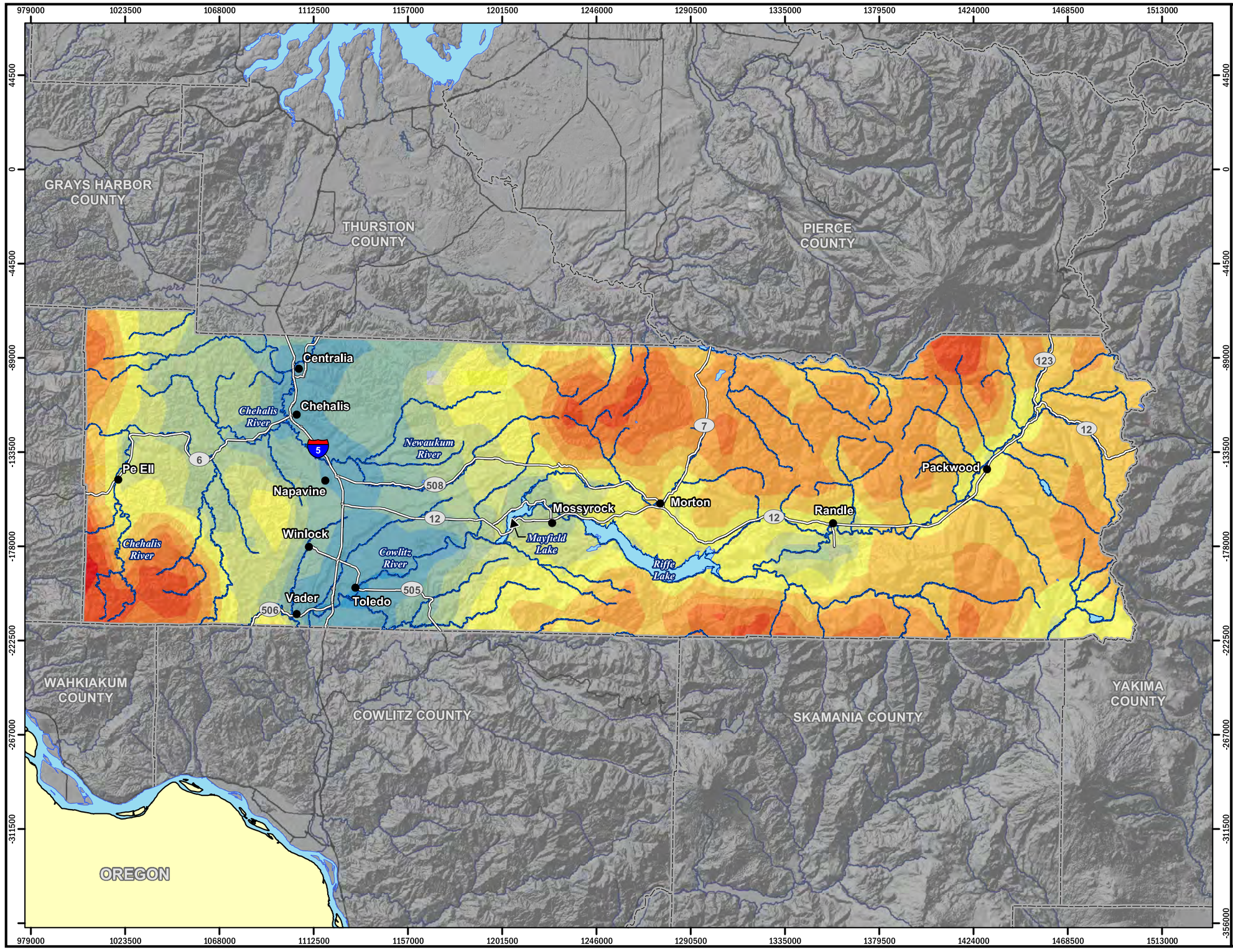
3.2.3. Geography and Hydrologic Processes

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

Figure 3.1.
Lewis County Precipitation Map



Legend

Annual precipitation

- 40-44
- 44-48
- 48-52
- 52-56
- 56-60
- 60-70
- 70-80
- 80-90
- 90-100
- 100-120
- 120-140
- City
- Highway
- River
- Lake
- County boundary

N

0 22,250 44,500 89,000

Feet

HERRERA

Coordinates: WA State Plane North
NAD83 (feet)

Produced By: GIS
Project: K:\Projects\12-05276-000\Project\precipitation_map.mxd (12/2/2012)

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

3.4.3.1. Lewis County

Lewis County covers 2,452 square miles and, roughly, three-fourths of the county is rugged, mountainous, and forested. Low rolling hills interspersed with rivers and tributaries including the Cowlitz, Chehalis, Deschutes, and Nisqually systems characterize the remainder. The major population centers of Chehalis and Centralia are located on the floodplains of the Chehalis River and its tributaries, including the Skookumchuck and Newaukum Rivers.

Over three-quarters of the land in the county are committed to federal, state, and private resource land uses. This includes 38 percent in federal and state ownership, primarily for timber and recreational uses. The county contains portions of the Snoqualmie and Gifford Pinchot National Forests and Mt. Rainier National Park. Approximately one-third of the county is designated as national forest. Another 37 percent is privately owned resource lands and is primarily large tracts of property devoted to mineral, agricultural and forestry uses.

Only 1 percent of the land lies within urban areas, with much of that committed to right-of-ways and public uses, or constrained by critical areas. An additional 1 percent of the land

is classified as a rural Local Areas of More Intensive Rural Development (LAMIRDS), which includes small towns in unincorporated areas, crossroads, and commercial and subdivision enclaves. Additional designations, such as Master Planned Resorts, are urban designations within rural area. Nearly 23 percent of the land is considered remote rural, much of which is characterized by steep slopes, wetlands and hydric soils. As a result, over 95 percent of the county is agricultural, resource land, open space, or remote rural areas and less than 5 percent is available for urban or more intense rural development.

The county adopted its current Comprehensive Plan on June 1999 and made amendments to it through December 2012. The county's Comprehensive Plan is a product of the statewide GMA requirements in Chapter 36.70A RCW. The purpose of the plan is to identify a vision for the county and to allocate and provide for growth consistent with the 14 goals of growth management articulated in RCW 36.70A.020 of the GMA.

The Land Use Element provides a broad, general direction for land use policy in the county in accordance with RCW 36.70A.070. It represents the county's policy plan for growth over the next 20 years. The Land Use Element implements many of the goals and objectives in the other plan elements through suggested land use designations and other action recommendations that support the GMA goals. It is based on a vision of the county that concentrates growth in urban areas and rural LAMIRDs, but recognizes the need for economic diversity in the county. Natural resource industries are encouraged, as are protections to private property rights.

The Land Use Element specifically considers the general distribution and location of land uses, the appropriate intensity and density of land uses given development trends; provides policy guidance for commercial and industrial land uses; addresses pre-existing, non-conforming uses; and, establishes land division policies for creating new lots in the unincorporated areas of the county. Based on the policy framework in the Plan, the county's development regulations and permitting processes are used to direct growth in order to insure consistency with the provisions of this element.

The county's Comprehensive Plan includes a Rural Element within its Land Use Element. The Rural Element identifies the major issues pertaining to rural development, the projected dispersal of rural population growth, and rural development goals and guidelines.

The county's land use designations consist of the following:

1. Urban Growth Areas (UGAs):

   Three types of Urban Growth designations are possible in the county: City UGAs, Fully Contained Communities, and Non-Municipal UGAs.

   - City UGAs:

     The majority of the UGAs in the county are planned for eventual incorporation into the cities of Centralia, Chehalis, Morton, Mossyrock, Napavine, Pe Ell, Toledo, Vader, and Winlock. Each municipality in the Coalition plans for its community's needs over the next 20 years based on the Lewis Countywide Planning Policies.

- Fully Contained Communities:

  The county has preliminarily designated one fully contained community, Birchfield, as a planned community UGA pursuant to RCW 36.70A.350.

- Non-Municipal UGAs:

  The county has designated two Major Industrial Development areas that are not associated with the UGAs of the incorporated cities and towns, the Cardinal Float Glass Facility and the Industrial Park at TransAlta.

  The county may adopt economic development urban growth areas (EDUGAs). These areas would be designated through a subarea planning process as directed by the implementation section of the Comprehensive Plan. Development within the EDUGAs could include a broad range of industrial, retail/commercial, and regional tourist-oriented uses. Large-scale sector planned developments would be encouraged to create well-designed complexes, buffer surrounding rural and resource lands, and ensure concurrent phasing of urban infrastructure improvements.

2. Rural Areas Designations:

   Less than 5 percent of the county land area is in urban or more intense rural uses. The county has a tradition of rural and resource based economic activity that has included logging, agriculture, and mining. As a result, much of the economic activity has been centered in small communities outside the incorporated cities of the county.

   Rural Areas Designations promotes a variety of densities and uses, including development, redevelopment, and changes of use. The county achieves the variety of densities and uses through land use designations in the rural areas. Rural land use designations include:

   - Limited Areas of More Intensive Rural Development (LAMIRDs):

     The GMA allows rural elements to include LAMIRDs. The county uses GMA LAMIRD criteria in addressing the variety of uses and densities in rural areas. There are three types defined by GMA and Lewis County has five categories of LAMIRD that reflect these three types.

     - Small Town:

       Small Towns are defined as a specific land use designation and small-town scale activities are confined to the designated small town areas. Small Towns have existing infrastructure which may include fire protection, water systems, school facilities, and other public buildings and services which serve not only the small town but also provide basic needs and services for the surrounding community.

     - Crossroad Commercial:

       The Crossroad Commercial designation serves the retail and commercial needs of local residents. Crossroad Commercial uses may also serve the needs of the traveling public. Crossroad Commercial areas are defined as a specific land use

designation and activities are typically smaller than in small towns and limited to the crossroad commercial district as mapped. Given the size of the county, crossroad commercial areas are essential to serve the rural public areas and support the ability to live and work in rural areas. Designated Crossroad Commercial areas include:

- Boistfort
- Cinebar
- Curtis
- Dorn's Corner
- Ethel
- Forest
- Galvin
- Leonard Road & U.S. Route 12
- Mary's Corner
- State Route 6 & Highway 603
- Stinky Corner

- Freeway Commercial:

  Historically the intersection areas along Interstate 5 have provided a convenient location for vehicle service and service to the traveling public, as well as hubs that have provided locations for numerous small businesses. The intersections, designated as Freeway Commercial areas, continue to provide a convenient location for commercial and small industrial activities in the county.

  The Freeway Commercial designation includes areas already impacted by and convenient to major transportation facilities. This designation serves the neighboring community and the retail, commercial, and emergency needs of the traveling public. Uses in this designation includes commercial, retail, and industrial. Uses in Freeway Commercial are larger and of greater intensity than in Crossroad and are limited to the existing developed area as initially designated and mapped during the Comprehensive Plan process.

  The Freeway Commercial areas identified below provide a logical and reasonable location for additional tourist and commercial services and rural small businesses:

  - Interstate 5 and U.S. Route 12
  - Interstate 5 and State Route 506
  - Interstate 5 and Jackson Highway South

- Rural Residential Center & Shoreline Residential:

This designation is intended for residential areas in the rural parts of the county; those already in existence, already platted, or near shorelines.

Rural Residential Centers are comprised of existing rural residential areas or existing platted areas where lots have been developed. Rural Residential Centers are not urban or likely to develop into urban areas during the 20-year Comprehensive Plan planning period and have logical outer boundaries separating developed and undeveloped areas.

The Shoreline Residential designation serves residential areas near significant shorelines where development occurred prior to the county's adoption of its first GMA Comprehensive Plan. These existing developments serve recreational and retirement populations and include small residential lots platted along shorelines to take advantage of recreation and view amenities. Shoreline Residential Areas have adequate school, water, and other public services to permit continued enjoyment of the shorelines without causing sprawl or impact to resource lands.

Rural Residential Centers and Shoreline Residential areas include:

- Brockway
- Curtis Hill
- Harmony
- High Valley Park
- Mayfield Park
- Lake Mayfield Estates
- Mayfield Village
- Mt. View Drive Addition
- Newaukum Hill
- Paradise Estates
- Timberline Village
- Valley Meadows

- Rural Area Industrial:

  The Rural Area Industrial designation allows industrial uses in the rural area, which are primarily dependent on natural resources. Existing designated areas include:

  - Curtis Railyard:

    The Curtis Railyard is an historic log and mill site located westerly of Interstate 5. Use of the site predates the county's adoption of its first GMA Comprehensive Plan. The Railyard has an existing rail siding and water supply from the Boistfort Water District. The Curtis Railyard serves a need for large rail-oriented or resource parcels that do not require municipal

sewer. The site has been changed from a UGA to a rural industrial area of more intensive use to avoid creating a demand for sewer in the area.

- Ed Carlson Memorial Field:

  Ed Carlson Memorial Field is a county-owned airport. Use of the site predates the GMA. The general aviation facility is outside city UGAs.

- Additional Sites:

  The county identified the additional areas, which are mapped and limited to existing lots:

  - Klein Bicycle
  - Williams Industrial
  - Ramsey Industrial Park
  - Taylor Drilling
  - Baer industrial site
  - Morton log yard industrial site
  - PLS log yard industrial site
  - Industrial Park at TransAlta (IPAT)
  - PSE Natural Gas Storage site
  - Larman Road Industrial Site/Airport

- Rural Development Districts:

  Lands outside the LAMIRDs are designated as Rural Development Districts (RDDs), which are intended to be predominately residential but which allow non-residential uses at a scale consistent with rural character. In RDD designations, existing lots of record, regardless of size, are legal lots for uses as set forth in the county's development regulations.

  The RDD designation allows a range of rural residential uses, which are all part of the county heritage: the many farms throughout the county, smaller homes, recreational homes, retirement communities, shoreline communities, and the family compounds. In addition to rural residential use, many of the large parcels in the county feature a wide variety of uses, including agricultural lands, which have been and can be used for other forms of rural development. A variety of rural densities is achieved through a hierarchy of RDD designations that emphasize the use of existing facilities and developed areas and that are designed to protect the rural character of the county.

  RDD development regulations provide mechanisms for encouraging clustered development and protecting large parcels from unnecessary division. RDD development regulations identify allowed uses, including resource uses and accessory uses, but limit large-scale commercial, industrial, or non-residential activities not related to resource uses.

- RDD-5:

  RDD-5 allows for a density of one residential unit per five acres where there is adequate access, and the ability to achieve septic approval and water supply at this scale, including intensity as established in the county's development regulations. This designation regulates areas which are not only characterized by parcelization and good transportation, but those which can be served by rural facilities and services and do not give rise to need for urban facilities and services. RDD-5 designations are located in areas that show a pattern of large lot residential development, and are typically near population centers such as the UGAs and small towns.

- RDD-10:

  RDD-10 allows for a density of one residential unit per 10 acres. The focus of RDD-10 is to assure that the permitted activities are consistent with the traditional practices and intensities and are suited to meet the needs of those who choose to live and work in rural areas. The RDD-10 designation is compatible with overall rural character, recognizes limitations on the availability of rural area services, and avoids the need for urban levels of service that cannot and will not be provided outside UGAs, except to meet recognized health emergencies as authorized by law.

- RDD-20:

  RDD-20 allows for a density of one residential unit per 20 acres or larger where significant development limitations, such as critical areas and remote distance from infrastructure, warrant a much lower density. RDD-20 designations are areas known to have potentially significant limitations due to soils, steep slopes, lack of access, or local water availability issues.

- Tourist Service Area:

  The Tourist Service Area designation allows for small-scale stand-alone resorts in rural the county, primarily in conjunction with recreation areas adjacent to Riffe Lake and owned by Tacoma Power. Commercial recreational facilities designed to serve the tourist population are considered appropriate uses within this non-residential designation. There is an inconsistency between the county Comprehensive Plan designation of "Tourist Service Area" and the county zoning designation of the same name. The county is working to address this inconsistency.

  Development regulations identify specific size, character, and facility criteria to determine how development will be approved in these areas. For example, tourist development with a low intensity of use, such as the Cispus Learning Center in Cispus Valley, would be of a rural type and size approvable through a special use permit process, under the standards of LCC Chapter 17.115. Larger destination resorts would pass through Master Planned Resort review according to LCC Chapter 17.20.

  The lake areas also provide a recreational resource for the central county area, and resort and recreation opportunities are encouraged where adequate public

facilities can be provided cost effectively and significant environmental consequences avoided. Three areas have been identified through hydro licensing processes as appropriate areas for park and recreational activity, with the size and nature of the proposed project determining the review and permitting criteria:

  - West End of Riffe Lake
  - East End of Riffe Lake
  - East End of Riffe Lake – 108 Bridge Area

- Master Planned Resorts:

  Master Planned Resorts are facilities designed to attract significant groups of people, may be located in the county to encourage use of more than one of the natural features to enable year-round as well as seasonal activities. Because of topography, environmental, public facility, and transportation issues, the best location for large resort facilities may be not in direct proximity with a significant natural feature, but a location where amenities can be readily accessed. As such, major planned resorts may be located in proximity to national parks and other major recreational areas. No such places have been identified yet in the county.

To supplement the county Comprehensive Plan, the South Lewis County Subarea Plan was developed for a 106-square mile subarea surrounding Interstate 5 in the southern portion of the county. The subarea includes the cities of Toledo, Vader, Winlock, associated UGAs, designated LAMIRDs, and unincorporated areas. The subarea plan provides specific land use, transportation, and economic development goals and policies for the subarea. Preferred areas for industrial development are identified and include the eastern portion of the city of Winlock's UGA.

A new Economic Development UGA was recommended at the intersection of Interstate 5 and State Route 505, which includes Lacamas Creek and its associated wetlands. Economic Development UGAs guide the location of light industry, tourist services, and retail services. Economic Development UGAs are recommended in the plan, however they are not officially designated because the current Lewis County Comprehensive Plan does not provide a basis for designating Economic Development UGAs. Comprehensive Plan policies would have to be adopted to allow designation of Economic Development UGAs identified through a subarea planning process. Currently economic development is limited to designated LAMIRDs.

3.4.3.2. City of Centralia

The city of Centralia adopted its current Comprehensive Plan on October 9, 2007. The Land Use Element of the city's Comprehensive Plan serves as the guide for the distribution of land uses. The plan covers the geographic area of the city and surrounding UGAs. Together, the UGA and the incorporated city make up the city's Urban Growth Boundary (UGB). Urban densities are encouraged inside of the UGB because public sewer and water systems and other city utilities can efficiently service this area.

The primary purpose of the city's UGB is to define the area where public expenditures already have been made for service facilities or will be in the future and to guide development to that area to use public investments more efficiently. This area was drawn based primarily on

the location and amount of potentially developable land to which sewer and water services are already provided or can be provided.

The city has planned for approximately 9 percent of the land within the UGA for commercial uses. The city's roots are based in its industrial foundation. Most of the land with an industrial land use classification is located west along the Interstate 5 corridor and outside of the city limits but within the UGA. Industrial uses are identified on 17.4 percent of the land within the UGA and approximately 83 percent of that industrial land is vacant. Heavy industrial users are planned for 70 percent of the land and 79 percent of that land is vacant. Lighter industrial users are planned for 30 percent of the land set aside of which 86 percent is vacant. To allow for greater diversity and flexibility of land uses the Comprehensive Plan allows for retail or commercial uses in the industrial land use designations. The city's land use designations include:

1. Residential:

   Residential land use consists of single-family and multi-family dwellings, including manufactured housing, foster care facilities, group quarters, and cooperative housing. Other land uses found within the residential designation include private schools, churches, planned residential development, planned unit developments, necessary utility facilities, and undeveloped land.

   - Very Low Density Residential (VLDR) (0.5- to 2-acre parcels):

     These are areas where the predominant character is large lot estates. Community water systems are sometimes available, but public sewer is not typically available. Streets are paved, but curb, gutter, and sidewalk will usually not be in place. These areas include land that may have the presence of critical areas or 100-year floodplain.

   - Low Density Residential (LDR) (one to four dwelling units per acre):

     These are areas in the city, which are well suited for large suburban lots. Developments will have full urban services, including public water and sewer, underground utilities, and paved streets periodically with curb, gutter, and sidewalk. These areas include land that may have the presence of critical areas or 100-year floodplain.

   - Medium Density Residential (MDR) (five to eight dwelling units per acre):

     These are areas with mostly single-family detached units, but with some attached dwelling units. These areas will usually have somewhat smaller single-family lots, and/or a slightly higher percentage of attached units than are found in the LDR areas. Developments will have full urban services. These areas include land that may have the presence of critical areas or 100-year floodplain.

   - Med-High Density Residential (M-HDR) (9 to 15 dwelling units per acre):

     These are areas with a mix of single-family units, duplexes, town-homes, planned developments, twin homes, and multi-family units. Developments have full urban services. These areas include land that may have the presence of critical areas or 100-year floodplain.

- High Density Residential (HDR) (16 dwelling units per acre):

  These areas are a mix of residential dwellings but consist of mainly multi-family buildings. Developments will have full urban services. These areas include land that may have the presence of critical areas or 100-year floodplain.

2. Commercial:

   Commercial land uses support the daily retail and service needs of the city and provide a basis for local employment. The commercial land use categories include land used for retail, wholesale trade, offices, hotels, motels, restaurants, service outlets, and similar uses.

   - Commercial General:

     The Commercial General designation includes commercial uses such as institutions, offices, and retail shops to service the residential and business community within both the city and the surrounding areas. It is intended to provide areas, which require large structures and direct vehicular access. This designation also includes business uses which are conducive to freeway locations such as motels, hotels, restaurants, etc., which serve the traveling public. This designation excludes residential uses. These areas include land that may have the presence of critical areas or 100-year floodplain.

   - Mixed-Use:

     The Mixed-Use designation allows for retail, office, and residential uses together in the same area. The mixed-use categories are split into two different land uses designations. New residential developments within a mixed-use area must have a component of a retail or office development. These areas include land that may have the presence of critical areas or 100-year floodplain.

   - Limited Business District:

     The Limited Business District designation includes commercial uses that provide convenience goods, such as small retail establishments, pharmacies, and personal services, such as dry cleaners, retail stores, with limited hours of operation. These areas are limited in size. This designation would allow medium-density residential uses that usually exist. These areas include land that may have the presence of critical areas or 100-year floodplain.

   - Commercial Central Business District (CBD):

     The Commercial CBD designation provides for a limited area in size and includes retail, commercial, office, and other related business uses essential to downtown functions. This designation would permit the provision of all basic services and amenities necessary to keep the downtown vital in the community. This designation would include dense development permitting taller structures with limited setback requirements, limited parking, parking garages or public parking lots, pedestrian facilities, etc. These areas include land that may have the presence of critical areas or 100-year floodplain.

3. Industrial:

   The proximity to Interstate 5, rail service, and regional markets make the city a desirable location for industrial uses. The Land Use Element proposes two categories of designated industrial land to accommodate industrial land uses. These categories include land used for manufacturing, processing, warehousing, storage and related uses. Heavy industrial uses are intended to be restricted to areas where impact to surrounding areas is minimized.

   - Light Industrial:

     The Light Industrial designation includes industrial uses involving assembly, manufacturing, processing, warehousing, and limited retail sales of bulk or large-scale products. This designation would include uses, which, in general, would not generate nuisance characteristics. Accessory non-industrial uses that support the primary activity and are compatible would be permitted such as administrative, sales, and service uses. This designation would prohibit residential uses except for on-site security units. These areas include land that may have the presence of critical areas or 100-year floodplain.

   - Heavy Industrial:

     The Heavy Industrial designation includes industrial uses involving assembly, manufacturing, processing, warehousing, distribution center, and other related uses such as concrete and asphalt batch plants. This designation would prohibit residential uses except for on-site security units. These areas include land that may have the presence of critical areas or 100-year floodplain.

4. Medical/Health Care:

   The Medical/Health Care designation provides for a limited area in size and includes commercial uses and activities that are usually health care in nature and that cater to the needs of the health care users and workers. These areas include land that may have the presence of critical areas or 100-year floodplain.

5. Public Facilities:

   The Public Facilities designation includes public or quasi-public facilities such as educational facilities, parks and recreation facilities and related uses, libraries, fairgrounds, government offices, such as municipal, state, county, and federal offices, and other facilities, and public safety facilities such as police and fire stations. These areas include land that may have the presence of critical areas or 100-year floodplain.

6. Parks and Open Space:

   The Parks and Open Space designation represents public or quasi-public and/or privately owned land that is a developed or undeveloped. This would include developed or undeveloped parks, natural open spaces, trail systems, land that has environmental sensitivities, and cemeteries. These areas include land that may have the presence of critical areas or 100-year floodplain.

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).

3.4.3.4. City of Morton

The city of Morton adopted its current Comprehensive Plan on June 23, 1997, and amended it on December 2005. Land uses within the city are allocated between residential, commercial, industrial, and essential public facility uses. The city's land use designations include:

1. R1 - Residential Single Family:

   Residential constitutes 71 percent of the total land area in the city and this district is the largest in the city. The amount of land designated for single-family development is approximately 800 acres. Sewer and water does not serve much of this district, so achieving urban densities of four to eight units per acre in the near future will be unlikely.

2. RM - Residential Multi-Family:

   The Residential Multi-Family land use designation is to be used primarily for multi-family and attached housing. The Residential Multi-Family District in intended to be located close to downtown business services to help achieve the intended average densities of 8 to 10 units per acre.

3. I – Industrial:

   The economy of an area generally relies on industrial lands used for manufacturing, processing, storage, and other industrial uses on major transportation corridors to provide its greatest employment opportunities. The city contains approximately 177 acres of land designated Industrial.

4. C – 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 city's economic health. In the city, approximately 233 acres are designated Commercial, which is 17 percent of the city's land area.

5. CS – Community Services:

   The Community Services designation is used for lands dedicated to providing public utility services, parks and recreation opportunities, and other public institutional land uses.

Land uses within the city's UGA consist of residential, commercial, and industrial uses. The PUD designation is a city special zoning district that acts as an overlay in the northwest portion of the UGA to accommodate master-planned development with a variety of housing types and densities on large, undeveloped parcels.

3.4.3.5. City of Winlock

The city of Winlock adopted its current Comprehensive Plan on September 12, 2005. The city is located at the confluence of two creeks in a narrow valley. The BNSF traverses the valley floor from south to north and divides the city into two sections. There are about four blocks of homes and businesses on the valley floor while the rest of the city is built on a higher plateau.

Much of the platted town is undeveloped due to steep slopes. Up above on the flats, is where most of the new residential growth is occurring. On the north and south sides of city, the valley widens into broad plains. East of city to Interstate 5, the land is level with few

topographical limitations on development. To the west, the land is more rolling, eventually becoming quite hilly. The city's land use designations include:

1. Residential:

   Residential uses of land occupy the majority (63 percent) of all land uses within the 2005 city UGA. There are 586 acres of residentially designated lands, of which 118 acres are vacant or only partially developed. There are 244 acres with environmental constraints, primarily steep slopes, floodplains, and aquifer sensitivity. The overall residential density within the UGA is roughly one dwelling unit per gross acre and is typical of older rural communities experiencing limited growth.

   In the Comprehensive Plan, the city used three categories of residential land use designations:

   - High Density Residential: Between 12 and 35 units per acre and includes apartments and other multi-family dwellings, as well as some manufactured housing.
   - Medium Density Residential: Between 4 and 12 units per acre and includes apartments and other multi-family dwellings, as well as some manufactured housing.
   - Low Density Residential: Less than four units per acre and includes conventional single-family residences, large-lot or estate housing, and manufactured housing. The city recognizes the need to alter minimum density requirements in order to comply with current GMA regulations.

2. Commercial:

   The city's downtown commercial area serves the needs of businesses and residents in a broad area surrounding the city. Commercial uses consist of retail and wholesale trades, professional businesses, restaurants, service outlets, and repair facilities. There are approximately 184 acres of commercially designated land within the city and the UGA boundary. Nearly 107 acres, or 58 percent of commercially designated land, is located in the 2005 Urban Growth Boundary alteration. In additional to freeway-oriented commercial land in the UGA, there are a number of vacant buildings in the downtown core that could accommodate commercial uses with major rehabilitation.

3. Industrial:

   The city's primary industrial employers include Shakertown, a manufacturer of wood products, and Metal Industries, a manufacturer of aluminum windows and doors. In addition, the New American Corporation is located in the city. Shakertown and Winlock Veneer are both located along the railroad tracks and Kerron Avenue within the northern portion of the city limits.

   These employment centers border residential properties and both industrial and residential uses have long established histories in the city. Residents and industry representatives in this area expressed their desire to maintain the current mix of light industry and single-family residential uses.

4. Other:

   There are several uses, which do not fit neatly within the above categories, yet they are important features within any community. The county records indicate 208 acres with this category and include such uses as transportation and utilities.

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

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

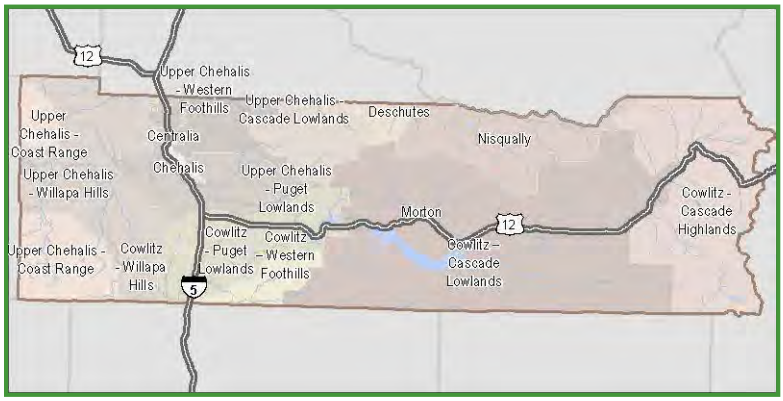
floodplain, which is the minimum extent of FFA within the shoreline jurisdiction; areas outside of the FEMA 100-year floodplain may in the future be classified as a FFA per WAC-365-190-110.

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.

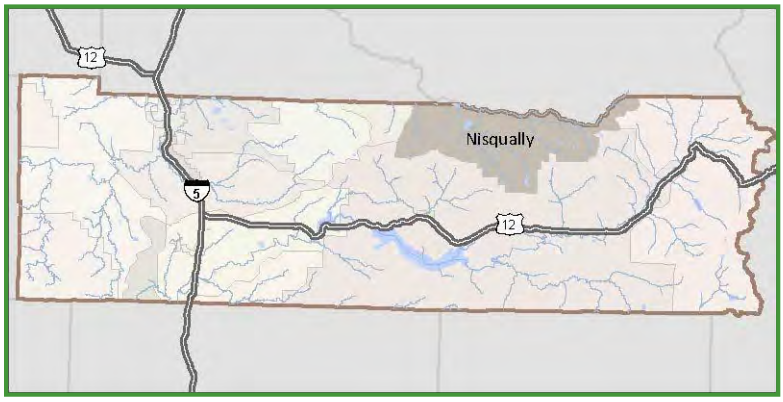
For the tables showing geologic hazards within each management area, entries in the left-hand column represent the proportion of the entire management area that is mapped as a given geologic hazard. Entries are provided only for those geologic hazards that have the potential to affect shorelines through 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.

4.1. Nisqually



The Nisqually watershed (WRIA 11) is approximately 761 square miles in area, of which approximately 180 square miles lie within the county. The Nisqually management area includes the Little Nisqually River as well as the Nisqually River and its southern tributary streams from the upstream end of Alder Lake to near its source at the Nisqually Glacier on Mt. Rainier. Land cover is more than 70 percent forest, with most of the remaining 30 percent consisting of recently disturbed land. Seventy percent of the Nisqually management area is in public ownership, and most of the privately held land is owned by timber companies. Table 4.2 summarizes the physical characteristics of the Nisqually management area. Shoreline jurisdiction in the Nisqually management area includes 6,700 acres along 18 stream reaches and 5 lakes (Table 4.3).

4.1.1. Physical and Biological Characterization

This section discusses characteristic aspects of physical and biological conditions in this management area. Refer to Sections 3.2.3.2 and 3.2.3.3 for an overview of the physical processes that influence shorelines in the terrain and land cover typical of this management area.

Hydrology in the Nisqually management area is dominated by fall and winter rains, rain-on-snow events, and glacial melt. Runoff from the upper Nisqually basin peaks twice a year, once in November due to autumn rainstorms, and once in late spring due to melting of snow and ice. Stream flow in the upper reaches of the Nisqually River is dominated by the runoff peaks from the upper basin. Further, down toward Alder Lake, the influence of tributary streams increases. Tributary flows are dependent on precipitation, and decline with the approach of

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
Nisqually	18 / 5 100 / 16	41% Private 23% Other Government 20% State 10% Municipal 7% Federal 0.5% County	69% Forest/Woodland 15% Recently Disturbed/Modified 11% Open Water 2% Nonvascular & Sparse Vascular Rock Vegetation 1% Developed/Human Use 1% Shrubland/Grassland 0.3% Agriculture	0.7 miles Leveed 77.7 acres Temperature	**Habitat Conservation Areas / Priority Habitat and Species** Coastal Resident Cutthroat, Rainbow Trout Bald Eagle, Elk, Harlequin Duck, Mule and Black-tailed Deer, Woodpecker, Waterfowl Concentrations Wetlands **Geologic Hazards** 21% Severe to Very Severe Erosion Hazard 8% Moderate to High Seismic/Liquefaction Hazard 92% Rainier Blast Zone 45% Mudflow/Lahar Hazard 26% Channel Migration Zone
Deschutes	1 / 0 5 / 0	100% Private	91% Forest/Woodland 9% Recently Disturbed/Modified 0.3% Developed/Human Use	-	**Habitat Conservation Areas / Priority Habitat and Species** Coastal Resident Cutthroat **Geologic Hazards** 55% Severe to Very Severe Erosion Hazard 31% Moderate to High Seismic/Liquefaction Hazard
Upper Chehalis – Coast Range	4 / 0 59 / 0	100% Private	74% Forest/Woodland 26% Recently Disturbed/Modified 0.2% Agriculture	0.1 acres Temperature	**Habitat Conservation Areas / Priority Habitat and Species** Chinook Salmon, Coastal Resident Cutthroat, Coho Salmon, Steelhead Trout Elk, Roosevelt Elk **Geologic Hazards** 45% Severe to Very Severe Erosion Hazard 0.1% Moderate to High Seismic/Liquefaction Hazard 86% Landslide Hazard
Upper Chehalis – Willapa Hills	19 / 3 120 / 8	97% Private 3% State 0.2% Federal 0.1% County	45% Forest/Woodland 38% Agriculture 8% Recently Disturbed/Modified 8% Shrubland/Grassland 0.6% Developed/Human Use	0.4 miles Leveed 43.3 acres Temperature 13.7 acres Dissolved Oxygen	**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, Wild Turkey **Geologic Hazards** 2% Severe to Very Severe Erosion Hazard 72% Moderate to High Seismic Hazard 9% Landslide Hazard
Upper Chehalis – Puget Lowland	19 / 2 84 / 1	99% Private 0.5% Municipal 0.3% County	68% Agriculture 21% Forest/Woodland 6% Shrubland/Grassland 4% Recently Disturbed/Modified 1% Developed/Human Use 0.3% Open Water	2.0 miles Leveed 22.2 acres Total Phosphorus 22.2 acres Fecal Coliform 13.7 acres Dissolved Oxygen 11.7 acres Turbidity 3.8 acres PCB 2.1 acres Temperature 0.1 acres Dioxin	**Habitat Conservation Areas / Priority Habitat and Species** Chinook Salmon, Coastal Resident Cutthroat, Coho Salmon, Largemouth Bass, Steelhead Trout Bald Eagle, Cavity-nesting Ducks, Elk, Oak Woodland, Roosevelt Elk, Waterfowl Concentrations Wetlands **Geologic Hazards** 1% Severe to Very Severe Erosion Hazard 92% Moderate to High Seismic/Liquefaction Hazard 7% Landslide Hazard

Table 4.1 (continued). 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
Upper Chehalis – Western Foothills	7 / 7 27 / 13	99% Private 0.5% Municipal 0.3% County	36% Agriculture 23% Shrubland/Grassland 22% Forest/Woodland 11% Recently Disturbed/Modified 6% Open Water 1% Developed/Human Use 0.1% Nonvascular & Sparse Vascular Rock Vegetation	0.2 miles Leveed	**Habitat Conservation Areas / Priority Habitat and Species** Chinook Salmon, Coastal Resident Cutthroat, Coho Salmon, Steelhead Trout Elk, Harlequin Duck, Waterfowl Concentrations **Geologic Hazards** 3% Severe to Very Severe Erosion Hazard 75% Moderate to High Seismic/Liquefaction Hazard 5% Landslide Hazard
Upper Chehalis – Cascade Lowlands	3 / 1 24 / 1	96% Private 3% Other Government 1% Municipal	68% Forest/Woodland 30% Recently Disturbed/Modified 1% Open Water 0.3% Shrubland/Grassland 0.2% Agriculture 0.2% Developed/Human Use 0.1% Nonvascular & Sparse Vascular Rock Vegetation		**Habitat Conservation Areas / Priority Habitat and Species** Chinook Salmon, Coastal Resident Cutthroat, Coho Salmon, Rainbow Trout, Steelhead Trout Harlequin Duck **Geologic Hazards** 78% Severe to Very Severe Erosion Hazard 26% Moderate to High Seismic/Liquefaction Hazard 100% Landslide Hazard
Cowlitz – Willapa Hills	4 / 0 6 / 0	100% Private	59% Forest/Woodland 34% Agriculture 4% Recently Disturbed/Modified 1% Developed/Human Use 0.3% Shrubland/Grassland		**Habitat Conservation Areas / Priority Habitat and Species** Chinook Salmon, Coastal Resident Cutthroat, Coho Salmon, Steelhead Trout Roosevelt Elk **Geologic Hazards** 1% Severe to Very Severe Erosion Hazard 42% Moderate to High Seismic/Liquefaction Hazard
Cowlitz – Puget Lowland	19 / 2 88 / 32	67% Private 30% Municipal 3% State 0.3% County 0.1% Federal	63% Forest/Woodland 12% Agriculture 10% Open Water 7% Shrubland/Grassland 3% Recently Disturbed/Modified 2% Nonvascular & Sparse Vascular Rock Vegetation 1% Developed/Human Use 0.2% Semi-Desert	5.0 miles Leveed 216.7 acres PCB 8.1 acres 4,4'-DDE	**Habitat Conservation Areas / Priority Habitat and Species** Chinook Salmon, Chum Salmon, Coastal Resident Cutthroat, Coho Salmon, Rainbow Trout, Steelhead Trout Bald Eagle, Cavity-nesting Ducks, Elk, Harlequin Duck, Mule and Black-tailed Deer, Oak Woodland, Roosevelt Elk, Waterfowl Concentrations, Wetlands, Wild Turkey **Geologic Hazards** 12% Severe to Very Severe Erosion Hazard 30% Moderate to High Seismic/Liquefaction Hazard

Table 4.1 (continued). 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
Cowlitz – Western Foothills	3 / 0 35 / 0	100% Private	52% Forest/Woodland 8% Open Water 4% Agriculture 3% Shrubland/Grassland 2% Nonvascular & Sparse Vascular Rock Vegetation 2% Recently Disturbed/Modified 0.1% Developed/Human Use	0.1 miles Leveed	**Habitat Conservation Areas / Priority Habitat and Species** Coastal Resident Cutthroat, Coho Salmon, Steelhead Trout Bald Eagle, Cavity-nesting Ducks, Elk, Harlequin Duck, Mule and Black-tailed Deer, Pileated Woodpecker, Waterfowl Concentrations, Western Toad **Geologic Hazards** 22% Severe to Very Severe Erosion Hazard 29% Moderate to High Seismic/Liquefaction Hazard
Cowlitz – Cascade Lowlands	55 / 5 309 / 90	45% Private 39% Municipal 13% Other Government 2% Federal 1% State 0.1% County	63% Forest/Woodland 13% Agriculture 9% Open Water 7% Recently Disturbed/Modified 5% Nonvascular & Sparse Vascular Rock Vegetation 2% Shrubland/Grassland 0.7% Developed/Human Use	10.1 miles Leveed 215.1 acres Temperature	**Habitat Conservation Areas / Priority Habitat and Species** Chinook Salmon, Chum Salmon, Coastal Resident Cutthroat, Coho Salmon, Rainbow Trout, Steelhead Trout Bald Eagle, Cavity-nesting Ducks, Elk, Harlequin Duck, Mule and Black-tailed Deer, Pileated Woodpecker, Waterfowl Concentrations, Western Toad, Wood Duck **Geologic Hazards** 10% Severe to Very Severe Erosion Hazard 15% Moderate to High Seismic/Liquefaction Hazard 35% Rainier Blast Zone 34% Mudflow/Lahar Hazard 21% Channel Migration Zone 0.4% Landslide Hazard
Cowlitz – Cascade Highlands	21 / 6 137 / 19	95% Other Government 2% Federal 2% Private 1% State	85% Forest/Woodland 12% Open Water 2% Recently Disturbed/Modified 1% Shrubland/Grassland 0.5% Nonvascular & Sparse Vascular Rock Vegetation 0.2% Developed/Human Use	7.5 acres Temperature	**Habitat Conservation Areas / Priority Habitat and Species** Coho Salmon, Rainbow Trout, Steelhead Trout Elk, Mountain Goat, Mule and Black-tailed Deer **Geologic Hazards** 0.1% Severe to Very Severe Erosion Hazard 28% Moderate to High Seismic/Liquefaction Hazard 49% Rainier Blast Zone 12% Mudflow/Lahar Hazard 0.5% Channel Migration Zone
Centralia	6 / 0 9 / 1	74% Private 13% State 11% Municipal 2.4% County 0.1% Federal	35% Agriculture 27% Forest/Woodland 16% Developed/Human Use 13% Recently Disturbed/Modified 6% Shrubland/Grassland 2% Open Water 0.2% Aquatic Vegetation	1.0 miles Leveed 16.2 acres Turbidity 12.9 acres Dioxin	**Habitat Conservation Areas / Priority Habitat and Species** Chinook Salmon, Coastal Resident Cutthroat, Coho Salmon, Largemouth Bass, Steelhead Trout Harlequin Duck, Oak Woodland, Roosevelt Elk, Waterfowl Concentrations **Geologic Hazards** 1% Severe to Very Severe Erosion Hazard 78% Moderate to High Seismic/Liquefaction Hazard **Critical Aquifer and Wetland Management**

Table 4.1 (continued). 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
Morton	3 / 0 3 / 0	89% Private 10% Municipal 0.1% State	40% Forest/Woodland 31% Agriculture 16% Developed/Human Use 9% Recently Disturbed/Modified 1% Nonvascular & Sparse Vascular Rock Vegetation 0.4% Shrubland/Grassland 0.2% Open Water		**Habitat Conservation Areas / Priority Habitat and Species** Chinook Salmon, Coho Salmon, Rainbow Trout, Steelhead Trout Elk, Mule and Black-tailed Deer **Geologic Hazards** 4% Severe to Very Severe Erosion Hazard 92% Moderate to High Seismic/Liquefaction Hazard 0.2% Landslide Hazard
Winlock	3 / 0 2 / 0	89% Private 10% Municipal 0.6% County	48% Forest/Woodland 33% Developed/Human Use 16% Agriculture 2% Recently Disturbed/Modified		**Habitat Conservation Areas / Priority Habitat and Species** Chinook Salmon, Coastal Resident Cutthroat, Coho Salmon, Steelhead Trout Roosevelt Elk **Geologic Hazards** 15% Severe to Very Severe Erosion Hazard 51% Moderate to High Seismic/Liquefaction Hazard

Table 4.2. Nisqually Management Area Characteristics.	
Physiography [a]	Westerly trending ridges and valleys with reservoirs and medium gradient rivers and streams; U-shaped, glaciated valleys in the east
Elevation (feet) [b]	2,000-6,000
Lithology [a]	Oligocene-Eocene andesitic, basaltic, and rhyolitic lava flows and breccia
Mean Annual Precipitation (inches) [b]	69-113
Natural Vegetation [a]	Western hemlock, western red cedar, Douglas fir
Land Use / Land Cover [a]	Douglas fir/western hemlock/western red cedar/vine maple/red alder forests are widespread. Forestry and recreation are important land uses and pastureland occurs in lower valleys

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

Table 4.3. Nisqually Management Area Shoreline Reaches (Map Series 2).

Reach Number [a]	Primary Water Body	Shoreline Area (acres)	Map Reference (Township-Range)
01-01	Little Nisqually River	425.4	T14N-R04E, T15N-R04E
01-02	East Creek	441.4	T14N-R04E, T15N-R05E
01-03	Nisqually River	255.0	T15N-R05E
01-04	Nisqually River	382.4	T15N-R05E, T15N-R06E
01-05	Nisqually River	447.1	T15N-R06E, T15N-R07E
01-06	Nisqually River	680.2	T14N-R07E, T15N-R07E
01-08	Nisqually River	329.8	T14N-R07E, T15N-R08E
01-09	Mineral Creek	214.8	T14N-R05E, T15N-R05E
01-10	Roundtop Creek	265.3	T14N-R05E
01-11	Mineral Creek	88.5	T14N-R05E
01-12	Mineral Creek	601.6	T13N-R05E, T14N-R06E
01-13	North Fork Mineral Creek	803.0	T13N-R06E, T14N-R06E
01-14	Reese Creek	31.6	T15N-R06E
01-15	Big Creek	420.4	T14N-R06E, T15N-R07E
01-16	Catt Creek	393.2	T14N-R06E, T15N-R06E
01-17	Berry Creek	297.4	T14N-R07E, T14N-R08E
01-18	Paradise River	64.5	T15N-R08E
01-19	Unnamed Wetland	24.9	T15N-R04E
01-20	Mineral Lake	361.1	T14N-R05E
01-21	Unnamed Lake	39.2	T14N-R07E
01-22	Granite Lake	49.6	T14N-R07E
01-23	Cora Lake	50.8	T14N-R07E
01-24	Unnamed Lake	32.7	T14N-R04E

[a] Reach 01-07 was skipped in the numbering sequence during initial delineation of reaches. The Nisqually Management Area contains 23 reaches. The reaches were not renumbering during the characterization to avoid inadvertent discrepancies.

summer. Low flow in the Nisqually River occurs in late summer, and is largely supported by groundwater base flow and glacial melt, which fluctuates daily as temperatures rise and fall (GeoEngineers 2007). Peak flows are typically on the order of 10 times larger than average daily flows. The Nisqually River also experiences episodic glacial outburst floods and lahars.

Sediment yield to channels in the Nisqually management area originates predominantly from Mount Rainier and is dominated by glacial sources and debris flows. Sediment produced by glaciers is stored near the headwaters of the Nisqually River and its tributaries, and is delivered to the channel network by mass wasting and/or stream action. Alluvial and glacial terraces are also significant sources of sediment for the mainstem Nisqually River. Unglaciated tributaries also provide sediment from mass wasting events associated with winter storms (GeoEngineers 2007).

The Nisqually River is a sediment-rich braided river, in which channel-forming sediment moves episodically downgrade until it reaches the local base level at Alder Lake. As a consequence of its high sediment load, the river is prone to migration of the active channel within an unvegetated active corridor, to expansion of the active corridor through bank erosion without corresponding opposite-bank deposition, and to occasional avulsion, in which the active corridor switches to a new location, or reoccupies an old one. Riparian vegetation, LWD, and channel morphology of tributaries to the Nisqually are typical of streams in steep forested landscapes, as discussed in Section 3.2.3.2.

Table 4.4 summarizes mapped geologic hazard critical areas for this management area and lists the shoreline reaches in which land subject to each hazard is found.

Table 4.4. Nisqually Management Area Geologic Hazards (Map Series 11 – 14, 28).

Hazard Type	Percentage of Management Area	Reaches Affected
Erosion Hazard [a]	21%	01, 02, 04, 06, 09, 10, 12-14, 16, 20, 24
Seismic/Liquefaction [b]	8%	06, 08, 13, 17-18
Rainier Blast Zone	92%	02-06, 08-23
Mudflow/Lahar	45%	02-06, 08, 09
Channel Migration	26%	03-06
Landslide Hazard	0%	–

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

Eleven reaches have documented presence of priority fish species including Coastal resident cutthroat trout and rainbow trout. Dense forested areas, many of which are managed by DNR, surround many of the tributaries of the Nisqually River. These forested areas typically contain elk and deer priority habitat, while priority areas such as bald eagle roosts, harlequin duck breeding areas, waterfowl concentrations, and wetlands are located near the Nisqually River mainstem. Bald eagles have been documented in 7 of the 23 reaches, mainly in areas associated with the mainstem where foraging opportunities are likely present. Wetlands associated with Mineral Creek occur downstream of the North Fork Mineral Creek confluence, and near the North Fork headwaters where it originates in state forestlands.

There are 23 reaches in this management area; 6 reaches are considered polluted, all because of temperature impairments. One reach (Mineral Lake) is a water of concern due to total phosphorus concentrations.

4.1.2. Shoreline Use Patterns

4.1.2.1. Existing Shoreline Land Use and Designations

The Comprehensive Land Use designations from the Lewis County Comprehensive Plan in the shoreline management area are provided in Table 4.5a. Land use designations reflect the community's goals and they will be used in the process of determining the environment designations for the county's shoreline jurisdiction.

Table 4.5a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in Lewis County for the Nisqually Shoreline Management Area.

Description	Typical Uses	Percentage of Management Area
RRD 5	Residential Development, one dwelling per 5 acres	1.0%
RRD 10	Residential Development, one dwelling per 10 acres	1.5%
RRD 20	Residential Development, one dwelling per 20 acres	14.6%
Cities, UGAs and LAMIRDS	Cities, rural residential, commercial, and industrial development	1.0%
Forest Resource Lands and Parks	Forested lands, forestry operations, state-owned conservation areas, and parks	80.6%
Mineral Resource Lands	Mining and undeveloped resource lands	1.3%

The current land use patterns that are found in the shoreline management area are provided in Table 4.5b. Existing land use patterns will be used in the process of determining the environment designations for the county'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 county was not available for this report.

The zoning designations from the Lewis County Code (Title 17 Land Use and Development Regulations) that are found in the shoreline management area are provided in Table 4.5c. 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 county's shoreline jurisdiction.

4.1.2.2. Existing Public Access

The Nisqually shoreline management area has over 116 miles of shoreline. The shoreline management area contains limited public access in Mount Rainier National Park along south bank of the Nisqually River near the Paradise Road entry area. There is a camping area on the south bank of Alder Lake and there is trail access to creek shorelines within the Snoqualmie National Forest. There are no identified county, Tacoma Power, or Lewis County PUD facilities providing public access in the Nisqually shoreline management area.

Table 4.5b. Current Land Use Patterns in Lewis County for the Nisqually Shoreline Management Area.	
Current Land Use Patterns	**Percentage of Management Area**
Unknown	5.1%
Agriculture	0.3%
Cultural/Recreational	0.7%
Forest	27.9%
Industrial	0.4%
Mining Activities	0.2%
Multi-Family Residential	3.1%
Open Space	0.1%
Railroad	0.6%
Right-of-Way	0.6%
Single-Family Residential	1.6%
Timber	1.2%
Vacant/Undeveloped	58.1%
Water	0.1%

Table 4.5c. Current Zoning Designations in Lewis County for the Nisqually (WRIA 11) Shoreline Management Area.			
Description	**Symbol**	**Typical Uses**	**Percentage of Management Area**
Forest Resource Lands	Forest	Commercial forestry operation	75.5%
Forest Resource Lands Local Importance	FRL-LI	Commercial forestry operations, agricultural production	1.9%
Mine	Mine	Mining industries, undeveloped resource land	1.2%
Rural Development District, one DU/10 acres	RDD-10	Residential development compatible with rural character, one dwelling unit per 10 acres	1.5%
Rural Development District, one DU/20 acres	RDD-20	Development limitations warrant lower density, one dwelling unit per 20 acres	14.6%
Rural Development District, one DU/5 acres	RDD-5	Residential development near population centers such as UGAs and small towns, one dwelling unit per 5 acres	1.0%
Rural Residential Center	RRC-R2	Rural residential development with density greater than one unit per 2 acres	0.7%
Small Towns Industrial	STI	Mills, forest products and agricultural industries	0.1%
Small Towns Mixed Use/Commercial	STMU	Commercial uses, retail uses, gateway communities	0.3%
Wilderness	Wilderness	Federal or state forestlands	3.2%

On Big Creek:

- Big Creek Campground is a U.S. Forest Service campground in the Gifford Pinchot National Forest. It is a single-loop campground located close to the west entrance of Mt. Rainier National Park with 29 campground camping sites and 27 RV sites. Some sites overlook Big Creek.

There are two boat launches on Mineral Lake:

- North from the town of Mineral on west side of lake there is a year-round, ADA accessible, concrete boat launch with restroom facilities.
- West of the town of Mineral on the south side of the lake, there is a year-round, non-ADA accessible boat launch

4.1.3. Shoreline Modifications

Table 4.6 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 this management area.

Table 4.6. Nisqually Management Area Shoreline Modifications (Map Series 19 to 20).

Reach Number	Sum of Dike and Levee Length (feet) [a]	Other Shoreline Modifications [b]
01-02	413	–
01-06	1,186	Moderate armoring present
01-10	106	–
01-11	1,408	–
01-12	430	Road adjacent to stream
01-13	96	–
01-20	–	Development along south and west shoreline

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

4.1.4. Reach Functional Assessment

The Nisqually management area has an average score of 26.8 (out of 36 possible points) for processes and functions of all reaches and across all assessment criteria (see Table 2.5). For the reaches in this management area, the total function scores (sum of the scores for all 12 assessment criteria) range between 21 and 33, indicating a moderate to high level of unimpaired processes and functional value. In general, shoreline processes and functions in the Nisqually River Basin have been adversely impacted through a variety of land use practices. In the upper part of the Nisqually watershed, which includes the Nisqually management area, commercial timber activities have increased sediment loads, reduced large woody debris input and recruitment potential, and altered precipitation run-off patterns (Kerwin 2000).

The range of scores in this management area is comparable to management areas with similar land use patterns, physical processes, and associated impairments. In general, the low scoring reaches and high scoring reaches also tend to exhibit comparable conditions, such as level of development or land use patterns, with similarly scored reaches throughout the county, even if the basis of the scores (i.e., causes of impairment) are different.

In this management area, the lowest scoring reaches (01-01 and 01-06) were characterized in part by agricultural use (East Creek) and development that has reduced forest cover compared to historical conditions, and by significant armoring (Nisqually River). Some undeveloped stream reaches have impaired water quality due to high temperatures. Reaches that are located in relatively high elevation forestlands typically provide limited functions for water and sediment transport due to relatively small watershed area, naturally steep terrain, timber harvest, associated roads, and potential for increased fine sediments in the streams. However, some reaches such as those affected by erosion hazards (Table 4.4) could contain important sources of sediment supply based on the potential for naturally occurring erosion or landslides. These events are key processes to maintain channel structure and, over the long term, adequate spawning gravels for priority fish species. Reaches in this management area also had reduced function scores due to limited presence or complete absence of wetlands. The presence and condition of wetlands are an important factor in several shoreline functions and are therefore a consideration in several of the assessment criteria. In this management area, and in similar forested areas throughout the county, a low score does not necessarily indicate impairment due to anthropogenic causes. It may indicate a limited functional value due to natural conditions (e.g., presence of steep slopes, or limited wetlands or backwater features) that also influence the score.

The highest scored reaches in the management area were 01-03 along the Nisqually River and the those associated with remote undeveloped lakes in the management area. Lakes tend to be scored higher than streams in the forested areas of the county, likely because different criteria are used for lake environments to address a different set of functions from streams. Mineral Lake (total score of 24) scored relatively low compared to other lakes in this management area, primarily due to few documented priority species and habitats, high phosphorous concerns, and development related impairments in the shoreline jurisdiction along the south and west shorelines.

4.1.5. Restoration Opportunities

Removal of invasive non-native plant species is a restoration opportunity on the mainstem Nisqually River. Pierce County's Noxious Weed Control Board is currently sponsoring a Japanese Knotweed eradication program in the upper Nisqually River basin located in the Nisqually management area.

A restoration priority should include decommissioning forest roads, particularly on geologically sensitive slopes. Decommissioning problematic forest roads would greatly enhance tributary stream habitat and fluvial processes (CBPHWG 2008).

Removing or setting back levees (Table 4.6) could also benefit this management area by increasing side channel habitat, floodplain connectivity, and riparian habitat quality. Replacement of fish blocking culverts would help restore accessible habitat.

4.2. Deschutes

The Deschutes watershed (WRIA 13) is approximately 761 square miles in area, of which approximately 180 square miles lie within the county. The Deschutes River has the only jurisdictional shoreline in the Deschutes management area. Intact and recently disturbed forest and woodland are the dominant land cover types. Less than 2 percent of the land is in public ownership. Table 4.7 summarizes the physical characteristics of the Deschutes management area. Shoreline jurisdiction in includes 237 acres along one stream reach. Table 4.8 lists the reaches in this management area.

Table 4.7. Deschutes Management Area Characteristics.

Physiography [a]	Westerly trending ridges and valleys with reservoirs and medium gradient rivers and streams. U-shaped, glaciated valleys in the east.
Elevation (feet) [b]	1,100-3,800
Lithology [a]	Oligocene-Eocene andesitic, basaltic, and rhyolitic lava flows and breccia.
Mean Annual Precipitation (inches) [b]	55-101
Natural Vegetation [a]	Western hemlock, western red cedar, Douglas fir
Land Use / Land Cover [a]	Douglas fir/western hemlock/western red cedar/vine maple/red alder forests are widespread. Forestry and recreation are important land uses and pastureland occurs in lower valleys.

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

Table 4.8. Deschutes Management Area Shoreline Reaches (Map Series 2).

Reach Number	Primary Water Body	Shoreline Area (acres)	Map Reference (Township-Range)
02-01	Deschutes River	236.8	T14N-R03E, T15N-R03E

4.2.1. Physical and Biological Characterization

This section discusses characteristic aspects of physical and biological conditions in this management area. Refer to Section 3.2.3.2 for an overview of the physical processes that influence shorelines in the terrain and land cover typical of this management area.

Runoff to the Deschutes River is driven by precipitation from winter storms. Precipitation in the upper watershed (i.e., the part within Lewis County) reaches 90 inches per year in the

headwaters. Precipitation occurs as rain below 1,500 feet, as snow above 2,500 feet, and as a mixture in between (Pacific Groundwater Group 1995). During summer months, precipitation is minimal, and stream flow is driven by groundwater. Streamflow in the Deschutes River and its tributaries follows the temporal distribution of precipitation, with peaks in the winter and lower (base) flows in the summer.

Sediment yield and sediment transport processes in the Deschutes are typical of those in steep forested basins in Western Washington, as described in Section 3.2.3.2.

Riparian areas consist of moderately dense conifer and deciduous tree cover. The Deschutes River in Lewis County is moderately steep, with cascades in places. Pools are scarce, but tend to be deep, and are interspersed with a high proportion of riffle and rapids sections.

Table 4.9 summarizes known geologic hazard critical areas for this management area as whole and lists the shoreline reaches in which land subject to each hazard is found.

Table 4.9. Deschutes Management Area Geologic Hazards (Map Series 11 - 14, 28).

Hazard Type	Percentage of Total Area	Reaches Affected [3]
Erosion Hazard [a]	55%	01
Seismic/Liquefaction [b]	31%	01
Rainier Blast Zone	0%	-
Mudflow/Lahar	0%	-
Channel Migration	0%	-
Landslide Hazard	0%	-

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

Coastal resident cutthroat trout are present in the Deschutes River. Other PHS species and habitats are not mapped in the management area. However, the general character of the watershed in this upper extent is much like the adjacent Nisqually River system, and the habitats are well connected by forestlands without any major road barriers. In this relatively steep terrain, there are few mapped wetlands and the Deschutes River is relatively confined.

There is only one reach in this management area. This reach does not have any known (reported) water quality impairments, or known or suspected threats to water quality.

4.2.2. Shoreline Use Patterns

4.2.2.1. Existing Shoreline Land Use and Designations

The Comprehensive Land Use designations from the Lewis County Comprehensive Plan in the shoreline management area are provided in Table 4.10a. Land use designations reflect the community's goals and they will be used in the process of determining the environment designations for the county's shoreline jurisdiction.

The current land use patterns that are found in the shoreline management area are provided in Table 4.10b. Existing land use patterns will be used in the process of determining the

environment designations for the county'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 county was not available for this report.

Table 4.10a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in Lewis County for the Deschutes (WRIA 13) Shoreline Management Area.

Description	Typical Uses	Percentage of Management Area
Forest Resource Lands and Parks	Forested lands, forestry operations, state-owned conservation areas, and parks	100.0%

Table 4.10b. Current Land Use Patterns in Lewis County for the Deschutes (WRIA 13) Shoreline Management Area.

Current Land Use Patterns	Percentage of Management Area
Forest	100.0%

The zoning designations from the Lewis County Code (Title 17 Land Use and Development Regulations) that are found in the shoreline management area are provided in Table 4.10c. 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 county's shoreline jurisdiction.

Table 4.10c. Current Zoning Designations in Lewis County for the Deschutes (WRIA 13) Shoreline Management Area.

Description	Symbol	Typical Uses	Percentage of Management Area
Forest Resource Lands	Forest	Commercial forestry operation	100.0%

4.2.2.2. Existing Public Access

The Deschutes shoreline management area has 105 miles of shoreline; however, it is primarily private forestland with no existing formal, public access.

4.2.3. Shoreline Modifications

No dikes or levees for reaches are recorded in the available data, nor were 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 this management area.

4.2.4. Reach Functional Assessment

The reach in this management area has a total functional score of 26 reflecting a moderately high functional value. The reduced score for this reach that contains relatively intact ecological conditions overall reflects the steep slopes, narrow adopted floodway or the 2010 flood channel study area, and natural lack of significant wetlands, as described previously for

the Nisqually management area. Forest roads in the shoreline jurisdiction and in relatively close proximity to the stream may be a source of heightened supply of fine sediments.

4.2.5. Restoration Opportunities

The small amount of development in the management area, and the presence of a natural fish barrier outside the management area, limits the restoration opportunities. Despite the lack of development, historic logging activity in the northwestern portion of the Deschutes management area presents an opportunity to decommission logging roads, especially on steep and geologically sensitive slopes. Conservation could also be used to protect permanently forestlands in the Deschutes management area.

4.3. Upper Chehalis

The following discussion of WRIA 23 ecosystem processes and shoreline functions is broken down in to five distinct management areas: Coast Range, Willapa Hills, Puget Lowlands, Western Foothills, and Cascades Lowlands.

4.3.1. Upper Chehalis – Coast Range

The Upper Chehalis – Coast Range management area encompasses 150 square miles of steeply sloped mountains with high gradient, cascading streams and rivers. Major water bodies include the Chehalis River, South Fork Chehalis River, Crim Creek, and Stillman Creek. Less than 1 percent of the land is developed; the remainder is intact or recently disturbed forest. Approximately 10 percent is managed by WDNR; the remainder is in private ownership. Table 4.11 summarizes the physical characteristics of the Upper Chehalis – Coast Range management area. Shoreline jurisdiction includes 2,881 acres along four stream reaches. Table 4.12 lists the reaches in this management area.

4.3.1.1. Physical and Biological Characterization

The following section discusses documented aspects of physical and biological conditions in this management area. Refer to Section 3.2.3.2 for an overview of the physical processes that influence shorelines in the terrain and land cover typical of this management area.

Streamflow in the Chehalis basin follows the yearly variation of precipitation, with high precipitation and stream flow occurring between December and March and low precipitation and stream flow in August (Reckendorf et al. 2012).

Sediment yield to the streams in the Upper Chehalis management area is episodic. The December 2007 storm, for example, resulted in large sediment inputs into the Chehalis and South Fork Chehalis Rivers, due to widespread landsliding (Watershed GeoDynamics 2012).

Table 4.11. Upper Chehalis – Coast Range Management Area Characteristics.	
Physiography [a]	Steeply sloped mountains; high gradient, cascading streams and rivers with stable summer flow
Elevation (feet) [b]	440-3,100
Lithology [a]	Tertiary basaltic flows, pillow lavas, tuffaceous basalt, breccia, porphyritic basalt, basaltic sandstone/siltstone/conglomerate, concretionary marine siltstone, tuffaceous mudstone/siltstone/sandstone
Mean Annual Precipitation (inches) [b]	61-125
Natural Vegetation [a]	Western hemlock, western red cedar, Douglas fir
Land Use / Land Cover [a]	Douglas fir/western hemlock/red alder/western red cedar forests; forestry, rural residential development, recreation
[a] Level IV Ecoregion characteristics from Pater et al. (1998) [b] Management area characteristics (see Table 2.1 for specific data sources)	

Table 4.12. Upper Chehalis – Coast Range Management Area Shoreline Reaches (Map Series 2).

Reach Number	Primary Waterbody Name	Shoreline Area (acres)	Map Reference (Township-Range)
3A-01	Chehalis River	1,584.0	T11N-R05W, T12N-R05W
3A-02	Crim Creek	323.4	T12N-R05W
3A-03	Stillman Creek	556.4	T11N-R04W, T12N-R04W
3A-04	South Fork Chehalis River	417.2	T11N-R03W, T11N-R04W

Current levels of LWD in the Chehalis River are low, in part due to a history of LWD removal, timber harvest, and the use of splash dams. There is a limited supply of large trees available for contributing to stream ecosystems processes (Watershed GeoDynamics 2012). However, episodic events such as the landslides of 2007 can supply LWD to channels, especially if LWD is not cleared from floodplains before streams have a chance to engage it.

Areas of channel incision have been documented in the mainstem Chehalis River upstream of Pe Ell (Smith and Wenger 2001). The mainstem Chehalis River has severe impacts from channel incision, sedimentation, riparian loss or conversion, water quality problems, and reduction in stream flow, and many of these problems are translated to the mainstem Chehalis River from tributaries. As much as 25 percent of sediment loading in the lower watershed is originating from streams in the county (Smith and Wenger 2001; Smith 2005). This is supported by the fact that approximately 28 percent of the Chehalis River watershed is within Lewis County. As such, land use and forest practices are important elements in managing downstream sediment loads in the Chehalis River and tributaries.

Table 4.13 summarizes known geologic hazard critical areas for this management area as whole and lists the shoreline reaches in which land subject to each hazard is found.

Table 4.13. Upper Chehalis – Coast Range Management Area Geologic Hazards (Map Series 11 – 14, 28).		
Hazard Type	**Percentage of Total Area**	**Reaches Affected**
Erosion Hazard [a]	45%	01-04
Seismic/Liquefaction [b]	<1%	04
Rainier Blast Zone	0%	-
Mudflow/Lahar	0%	-
Channel Migration	Not mapped, but occurs in this management area.	-
Landslide Hazard	86%	01-03
[a] Severe or Very Severe Erosion Hazard [b] Moderate to High Liquefactions Susceptibility		

Priority fish presence in the management area includes all four Washington coast salmon and trout species that are known to occur in the county. Chinook are generally confined to the Chehalis River (reach 3A-01), where spawning habitat for Chinook is also documented. Side channel and off-channel habitat is limited due to natural channel confinement, examples include Crim, Thrash, and Cinnabar Creeks (Smith and Wenger).The steep, high elevation forested landscape limit the presence of priority habitats such as wetlands and others commonly associated with lower valleys, and wetlands have not been mapped in the management area.

There are four reaches in this management area. One reach, Stillman Creek, is listed as impaired due to temperature problems and a second reach, Chehalis River, is polluted due to fecal coliform bacteria.

4.3.1.2. Shoreline Use Patterns

Existing Shoreline Land Use and Designations

The Comprehensive Land Use designations from the Lewis County Comprehensive Plan in the shoreline management area are provided in Table 4.14a. Land use designations reflect the community's goals and they will be used in the process of determining the environment designations for the county's shoreline jurisdiction.

Table 4.14a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in Lewis County for the Upper Chehalis – Coast Range Shoreline Management Area.		
Description	**Typical Uses**	**Percentage of Management Area**
Forest Resource Lands	Commercial forestry operations, state-owned conservation land	100.0%

The current land use patterns that are found in the shoreline management area are provided in Table 4.14b. Existing land use patterns will be used in the process of determining the environment designations for the county'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 county was not available for this report.

Table 4.14b. Current Land Use Patterns in Lewis County for the Upper Chehalis - Coast Range Shoreline Management Area.

Current Land Use Patterns	Percentage of Management Area
Forest	99.8%
Vacant/Undeveloped	0.2%

The zoning designations from the Lewis County Code (Title 17 Land Use and Development Regulations) that are found in the shoreline management area are provided in Table 4.14c. 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 county's shoreline jurisdiction.

Table 4.14c. Current Zoning Designations in Lewis County for the Upper Chehalis - Coast Range Shoreline Management Area.

Description	Symbol	Typical Uses	Percentage of Management Area
Forest Resource Lands	Forest	Commercial forestry operation	100.0%

Existing and Potential Public Access

The Upper Chehalis – Coast Range shoreline management area has no public access within its 59-mile shoreline jurisdiction, which is primarily private forestland.

4.3.1.3. Shoreline Modifications

No dikes or levees for reaches are recorded in the available data, nor were 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 this management area.

4.3.1.4. Reach Functional Assessment

The reaches in this management area have scores of either 24 (three reaches) or 25 (one reach), indicating a moderate to high level of functional value and relatively low impairments, which are primarily associated with forest practices and land use and not related to other types of development. For example, high levels of fine sediments in runoff may impact salmon egg survival and population success in this management area. Although much of the upper Chehalis basin is forestland used for timber production, key systems for forest management are in place to protect priority habitat and species. These include the Washington Forests and Fish Rules (Forest practice rules) and several Habitat Conservation Plans (HCPs) approved by NMFS for forest landowners, such as DNR and private timber companies. Removal of large areas of forest adjacent to shorelines may have a widespread effect on stream temperatures.

4.3.1.5. Restoration Opportunities

The Limiting Factors Technical Advisory Group identified restoration actions for subbasins in the Chehalis River watershed overall (Smith and Wenger 2001). The actions were generally broad in nature and included:

- Reconnecting habitats
- Increasing LWD
- Removing riprap
- Reducing sediment loads
- Rehabilitating old roads
- Restoring riparian vegetation and excluding livestock to reduce bank erosion
- Revegetating open riparian areas with native plants
- Interplanting conifers in forests dominated by deciduous species to accelerate succession, and increase LWD recruitment
- Reducing delivery of livestock waste or other pollutants into the stream
- Restoring wetlands and off channel habitat

Smith and Wenger (2001) found floodplain connectivity problems and a lack of off-channel habitat in Roger Creek, Mack Creek, and lower to middle George Creek. Channel incision in these impacted streams decreases the amount of off-channel habitat available to salmonids. Appropriate LWD placement in incised channels can help reconnect mainstem creek systems with side channels, increasing off-channel habitat. Reconstructing channels to a more sinuous form (where appropriate), could also help reconnect floodplains with side channels.

4.3.2. Upper Chehalis – Willapa Hills

The Upper Chehalis – Willapa Hills management area encompasses 265 square miles of low drainage density (meaning streams are relatively few and far between) rolling hills and mountains, with medium gradient, sinuous streams and rivers. Major water bodies include the Chehalis River, South Fork Chehalis River, Bunker Creek, Elk Creek, Lake Creek, Lincoln Creek, and Stillman Creek. Less than 1 percent of the land is developed, and approximately ten percent is agricultural or grassland; the remainder is intact or recently disturbed forest. Approximately 16 percent is Washington state public land; the remainder is in private ownership. Table 4.15 summarizes the physical characteristics of the Upper Chehalis – Willapa Hills management area. Shoreline jurisdiction includes 8,325 acres along 19 stream reaches and three lakes. Table 4.16 lists the reaches in this management area.

Table 4.15. Physical Characteristics of the Upper Chehalis – Willapa Hills Management Area.	
Physiography [a]	Low, rolling hills and mountains with medium gradient, sinuous streams and rivers. Low drainage density.
Elevation (feet) [b]	125-1,600
Lithology [a]	Miocene sandstone, siltstone, shale.
Mean Annual Precipitation (inches) [b]	50-90
Natural Vegetation [a]	Western hemlock, western red cedar, Douglas fir.
Land Use / Land Cover [a]	Douglas fir/western hemlock/red alder/western red cedar forests. Forestry, some rural residential development, pastureland.
[a] Level IV Ecoregion characteristics from Pater et al. (1998) [b] Management area characteristics (see Table 2.1 for specific data sources)	

Table 4.16. Upper Chehalis – Willapa Hills Management Area Shoreline Reaches (Map Series 2).			
Reach Number	**Primary Waterbody Name**	**Shoreline Area (acres)**	**Map Reference (Township-Range)**
3B-01	Garrard Creek South Fork	138.6	T15N-R05W
3B-02	Independence Creek	288.7	T15N-R04W
3B-03	Lincoln Creek	987.7	T14N-R04W, T15N-R05W
3B-04	Deep Creek	76.5	T14N-R03W, T14N-R04W
3B-05	Bunker Creek	544.2	T13N-R04W, T14N-R04W
3B-06	Chehalis River	65.1	T13N-R03W, T13N-R04W
3B-07	Chehalis River	1933.4	T13N-R04W, T13N-R05W
3B-08	Elk Creek	420.4	T13N-R05W
3B-09	Chehalis River[1]	381.3	T13N-R05W
3B-10	Stowe Creek[1]	39.9	T12N-R05W, T13N-R05W
3B-11	Rock Creek	191.8	T12N-R05W, T13N-R05W
3B-12	Chehalis River	91.8	T12N-R05W, T13N-R05W
3B-13	Chehalis River South Fork	238.8	T13N-R03W, T13N-R04W
3B-14	Lake Creek	622.3	T12N-R03W, T13N-R03W
3B-15	Chehalis River South Fork	646.5	T12N-R04W, T13N-R04W
3B-16	Lost Creek	94.5	T12N-R04W
3B-17	Stillman Creek	127.7	T12N-R04W
3B-18	Halfway Creek	287.5	T12N-R04W
3B-19	Chehalis River South Fork	866.0	T11N-R03W, T12N-R04W
3B-20	Miller Swamp	104.0	T13N-R04W
3B-21	Unnamed Lake	117.4	T12N-R03W
3B-22	Unnamed Lake	60.4	T12N-R03W
Sections of the right bank of the Chehalis River and Stowe Creek that lie within the city of Pe Ell are not included in Lewis County jurisdictional shoreline.			

4.3.2.1. Physical and Biological Characterization

The following section discusses unique aspects of physical and biological conditions in this management area. Refer to Section 3.2.3.2 for an overview of the physical processes that influence shorelines in the terrain and land cover typical of this management area.

Physical processes in this management area are similar to those in the Upper Chehalis – Coast Range management area (Section 4.3.1). The primary differences is are a greater proportion of reaches in this management area traverse flat alluvial valleys, and that the sediments derived from adjacent hillslopes tend to break down rapidly during transport, leading to a greater proportion of fine sediment in the bed and banks of streams.

Similar to the Upper Chehalis – Coast Range management area, streams in the Willapa Hills region have experienced accelerated erosion and incision. Erosion was found to be common from the confluence of Elk Creek to the South Fork Chehalis River (Smith and Wenger 2001). Channel-migration related bank erosion has also been found along portions of the Chehalis and South Fork Chehalis Rivers (Reckendorf et al. 2012).

Table 4.17 summarizes known geologic hazard critical areas for this management area as whole and lists the shoreline reaches in which land subject to each hazard is found.

Table 4.17. Upper Chehalis – Willapa Hills Management Area Geologic Hazards (Map Series 11 – 14, 28).

Hazard Type	Percentage of Total Area	Reaches Affected
Erosion Hazard [a]	2%	01-02, 14, 16, 18, 19, 21-22
Seismic/Liquefaction [b]	72%	01-20
Rainier Blast Zone	0%	-
Mudflow/Lahar	0%	-
Channel Migration [c]	Not mapped, but occurs in this management area.	07, 09, 11, 13, 15-17, 19
Landslide Hazard	9%	01, 12, 15-19

[a] Severe or Very Severe Erosion Hazard
[b] Moderate to High Liquefactions Susceptibility
[c] CMZ maps not available; affected reaches based on Reckendorf et al. (2012), Figure 12.

There are at least six priority species and habitats in this management area. This management area contains habitat for all for Washington coast salmon and trout that occur in the county, Many reaches (17 out of 22 total) contain known spawning and rearing areas for coho and steelhead. Accelerate erosion and sedimentation, lack of riparian cover, and warm water temperatures are primary limiting factors for salmon and steelhead. The lakes in this management area, as with many of the small lakes in the county, are vegetated with emergent vegetation and floating-leaved aquatic plants and they likely function as headwater wetlands closely associated with the nearby streams. Coho have been documented in one of the Lake Creek headwater lakes but access may be difficult or rare as presence has not been documented in the other. The only other reaches in the management area without documented fish presence are Miller Swamp and Stowe Creek, a small tributary that enters the Chehalis River at Pe Ell. Cavity nesting duck habitat is present in approximately

1,500 acres in the relatively wide floodplains around Miller Swamp. Smaller patches of waterfowl habitat are present along Lincoln Creek. Bald eagle management zones for protection of nest sites extend into reaches along Halfway Creek and the South Fork Chehalis River downstream from Lost Creek.

There are 22 reaches in this management area. There are 29 listings for polluted conditions affecting 14 of the reaches; many of the reaches are listed as polluted due to more than one pollutant. Pollution due to fecal coliform bacteria affects 12 reaches, temperature affects 8 reaches, and dissolved oxygen affects 4 reaches.

4.3.2.2. Shoreline Use Patterns

Existing Shoreline Land Use and Designations

The Comprehensive Land Use designations from the Lewis County Comprehensive Plan in the shoreline management area are provided in Table 4.18a. Land use designations reflect the community's goals and they will be used in the process of determining the environment designations for the county's shoreline jurisdiction.

Table 4.18a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in Lewis County for the Upper Chehalis – Willapa Hills Shoreline Management Area.

Description	Typical Uses	Percentage of Management Area
RRD 5	Residential Development, one dwelling per 5 acres	4.4%
RRD 10	Residential Development, one dwelling per 10 acres	7.6%
RRD 20	Residential Development, one dwelling per 20 acres	18.0%
Cities, UGAs and LAMIRDS	Cities, rural residential, commercial, and industrial development	1.1%
Agricultural Resource Lands	Commercial production of aquaculture, horticulture, grain, dairy, and other crops	54.6%
Forest Resource Lands and Parks	Forested lands, forestry operations, state-owned conservation areas, and parks	14.0%
Mineral Resource Lands	Mining and undeveloped resource lands	0.3%

The current land use patterns that are found in the shoreline management area are provided in Table 4.18b. Existing land use patterns will be used in the process of determining the environment designations for the county'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 county was not available for this report.

The zoning designations from the Lewis County Code (Title 17 Land Use and Development Regulations) that are found in the shoreline management area are provided in Table 4.18c. 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 county's shoreline jurisdiction.

Table 4.18b. Current Land Use Patterns in Lewis County for the Upper Chehalis - WIllapa Hills Shoreline Management Area.	
Current Land Use Patterns	**Percentage of Management Area**
Unknown	4.2%
Agriculture	44.1%
Cultural/Recreational	1.7%
Forest	25.3%
Industrial	0.7%
Multi-Family Residential	2.2%
Open Space	0.5%
Railroad	0.6%
Right-of-Way	3.4%
Service/Government	0.1%
Single-Family Residential	10.2%
Timber	2.2%
Vacant/Undeveloped	4.8%

Table 4.18c. Current Zoning Designations in Lewis County for the Upper Chehalis - WIllapa Hills Shoreline Management Area.			
Description	**Symbol**	**Typical Uses**	**Percentage of Management Area**
Agricultural Resource Lands	ARL	Commercial production of aquaculture, horticulture, grain, dairy, and other crops	54.8%
City	CC	City or UGA	0.1%
Forest Resource Lands	Forest	Commercial forestry operation	13.3%
Forest Resource Lands Local Importance	FRL-LI	Commercial forestry operations, agricultural production	0.1%
Mine	Mine	Mining industries, undeveloped resource land	0.3%
Park	Park	Park or open space	0.5%
Rural Area Industrial	RAI	Residential development near population centers such as UGAs and small towns, one dwelling unit per 5 acres	0.8%
Rural Development District 10	RDD-10	Residential development compatible with rural character, one dwelling unit per 10 acres	7.6%
Rural Development District 20	RDD-20	Development limitations warrant lower density, one dwelling unit per 20 acres	18.0%
Rural Development District 5	RDD-5	Rural residential development with density greater than one unit per 1 acre	4.4%
Small Towns - Mixed Use/Commercial	STMU	Commercial uses, retail uses, gateway communities	0.1%

Existing and Potential Public Access

The Upper Chehalis – Willapa Hills shoreline management area has 128 miles of shoreline jurisdiction, which includes stream and lakes. There are two primary public access points to the Chehalis River and its tributaries in the shoreline management area:

- Rainbow Falls State Park is a 139-acre camping park with 3,400 feet of shoreline on the Chehalis River. Situated in stands of old-growth forest, the park features a waterfall and a small fuchsia garden. The park is open year round for camping and day use.
- The Willapa Hills Trail is a 56-mile long trail system being developed between the city of Chehalis and the city of South Bend. On the way to Adna, it crosses two century-old trestles that span the Newaukum and Chehalis Rivers. The trestles at Spooner Road and Dryad, taken out during the 2007 catastrophic flood, are scheduled to be replaced with FEMA funds by 2014. The state, county, and local groups have been working on funding further improvements.

In addition, on the South Fork of the Chehalis River, the Boistfort Tennis Courts located at Boistfort Elementary school provide water-enjoyment access to the river.

4.3.2.3. Shoreline Modifications

Table 4.19 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 this management area.

Table 4.19. Upper Chehalis – Willapa Hills Management Area Shoreline Modifications (Map Series 19 to 20).

Reach Number	Sum of Dike and Levee Length (feet) [a]	Other Shoreline Modifications [b]
3B-04	255	Short segment of armoring near upstream extent of reach
3B-08	125	
3B-11	650	Limited armoring along McCormick Creek Road
3B-17	322	
3B-19	696	

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

In 1993, numerous sites of riprap were documented along the mainstem Chehalis River between the South Fork Chehalis confluence and Pe Ell, while low levels of riprap were noted in the tributaries in this area. Hope Creek had a single site of riprap, while Elk Creek had 13 sites, which impacted 125 linear stream feet; however, no channelization was noted in that subbasin, or in Rock Creek where riprap was also documented (Wampler et al. 1993, cited in Smith and Wenger 2001).

4.3.2.4. Reach Functional Assessment

Reaches in this management area have an average score of 25.0, ranging between 21 and 35. This indicates moderately low functional value to high functional value (or moderately high levels to low levels of impairment). The reaches scoring lowest (score of 21) were stream reaches including South Fork Chehalis, Stillman Creek, and Lost Creek. These reaches scored low primarily due vegetation alterations from timber harvest and agricultural land use, which limit forest cover and reduce recruitable LWD that is important to channel forming processes and channel structure. Lack of LWD was noted during the review of aerial images in many of the stream reaches in this management area. The impaired reaches were also scored low due to water quality concerns including high fecal coliform, high water temperatures, and low dissolved oxygen. Other reaches in the management area share similar impairments to those present in these reaches to varying degrees. Reaches with the highest scores (Miller Swamp and unnamed lakes) are high quality wetland environments with good hydrologic connectivity and low levels of disturbance. These undeveloped areas also directly and indirectly provide key habitat conditions for several priority species.

4.3.2.5. Restoration Opportunities

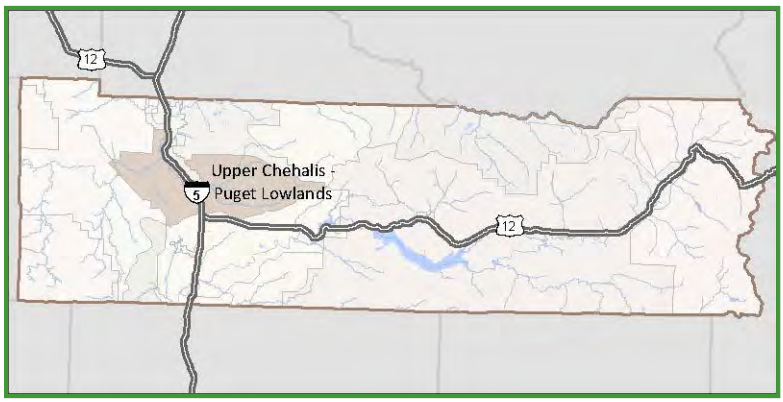
In 2001, Herrera Environmental Consultants performed assessments of barrier culverts on Jones Creek (Herrera 2001a), Lucas Creek (Herrera 2001b), Scammon Creek (Herrera 2001c), Stearns Creek tributaries (Herrera 2001d, 2001e), and Wildcat Creek (Herrera 2001f). The Lewis County Conservation District performed an assessment of barrier culverts in the management area, including surveys on Bunker Creek, Stearns Creek, Van Ornum, Creek, Mill Creek, Coal Creek, and several unnamed creeks; over 75 percent of the culverts assessed in 2003 were documented as fish passage barriers (Verd 2003). The Lewis County Conservation District performed a separate assessment of barrier culverts on Lincoln and Scammon Creeks (Verd 2004a), Independence Creek (Verd 2004b), and Scatter and Prairie Creeks (Verd 2004c). Anchor (2012) also documented numerous barrier culverts in the Upper Chehalis – Willapa Hills management area.

Although not all of the streams and culverts identified in these studies are within the shoreline jurisdiction, these assessments identified numerous fish passage improvement opportunities (projects) in the Upper Chehalis – Willapa Hills management area due to barrier culverts located throughout the area. Implementation of these project opportunities, including those in the shoreline jurisdiction would open salmonid access to additional habitat area, which is likely to result in increased fish survival and production for those species that use streams in the shoreline jurisdiction. Several projects are planned to address barrier culverts in the Upper Chehalis – Willapa Hills management area, sponsored by Lewis County Public Works, WDNR, and the Lewis County Conservation District.

In addition to barrier culverts, landslides from forest roads are one of the greatest problems, in areas with moderate to steep slopes. These landslides lead to erosion and sedimentation of tributary streams (CBPHWG 2008). Sidecast forest roads (i.e., roads that include sidecast material within the road prism) in particular are susceptible to landslides. Additional restoration opportunities include decommissioning forest roads, particularly on geologically sensitive slopes. Abandoning and decommissioning forest roads can greatly enhance tributary stream habitat and fluvial processes (CBPHWG 2008).

Smith and Wenger (2001) recommended that protection of existing lateral (floodplain and riparian) habitat and restoration of potential lateral habitat should be a priority for Elk Creek. Other creeks that may benefit from riparian and floodplain restoration include Lincoln Creek and Bunker Creek (G. Fornes, WDFW, June 19, 2013, personal communication).

4.3.3. Upper Chehalis – Puget Lowlands



The Upper Chehalis – Puget Lowlands management area encompasses 152 square miles of rolling terraces and floodplains with meandering streams and oxbow lakes. Major water bodies include the Chehalis River, Berwick Creek, Kearney Creek, Lucas Creek, the Newaukum River, Salzer Creek, and Stearns Creek. Land cover is 43 percent forest and woodland, 24 percent recently disturbed, 30 percent agricultural, and 2 percent developed (this tally does not include the cities of Centralia or Chehalis). Less than 2 percent of the land is public; the remaining 98.5 percent is in private ownership. Table 4.20 summarizes the physical characteristics of the Upper Chehalis – Puget Lowlands management area. Shoreline jurisdiction includes 11,673 acres along 19 stream reaches and 2 lakes. Table 4.21 lists the reaches in this management area.

Table 4.20. Physical Characteristics of the Upper Chehalis – Puget Lowlands Management Area.

Physiography [a]	Rolling terraces and floodplains with meandering streams and oxbow lakes
Elevation (feet) [b]	120-1,450
Lithology [a]	Holocene alluvial deposits; Pleistocene alpine glacial outwash material
Mean Annual Precipitation (inches) [b]	45-60
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)

4.3.3.1. Physical and Biological Characterization

Refer to Section 3.2.3.1 for an overview of the physical processes that influence shorelines in the terrain and land cover typical of this management area.

Table 4.22 summarizes known geologic hazard critical areas for this management area as whole and lists the shoreline reaches in which land subject to each hazard is found.

Table 4.21. Upper Chehalis – Puget Lowlands Management Area Shoreline Reaches (Map Series 2).

Reach Number	Primary Waterbody Name	Shoreline Area (acres)	Map Reference (Township-Range)
3C-01	Chehalis River	958.4	T14N-R03W, T15N-R03W
3C-02	Chehalis River	633.1	T14N-R02W, T14N-R03W
3C-03	Chehalis River	1,550.4	T13N-R03W, T14N-R03W
3C-04	Chehalis River	1,022.3	T13N-R02W, T14N-R03W
3C-05	Chehalis River	2,560.8	T13N-R03W
3C-06	Chehalis River	510.5	T13N-R03W
3C-07	Stearns Creek	315.7	T13N-R02W, T13N-R03W
3C-08	Chehalis River	501.2	T13N-R03W, T13N-R04W
3C-09	Newaukum River[1]	720.2	T13N-R02W, T14N-R02W
3C-10	Berwick Creek	165.3	T13N-R02W
3C-11	Newaukum River[1]	422.1	T13N-R01W, T13N-R02W
3C-12	Newaukum River	95.3	T13N-R01W
3C-13	Newaukum River South Fork	1,057.0	T13N-R01E, T13N-R01W
3C-14	Newaukum River South Fork	86.2	T13N-R01E
3C-15	Kearney Creek	108.1	T13N-R01E, T13N-R02E
3C-16	Newaukum River Middle Fork	241.7	T13N-R01W
3C-17	Newaukum River North Fork	290.1	T13N-R01W
3C-18	Newaukum River North Fork	141.7	T13N-R01W, T14N-R01W
3C-19	Lucas Creek	233.6	T13N-R01E, T14N-R01W
3C-20	Unnamed Lake	2.5	T14N-R02W
3C-21	Carlisle Lake	57.9	T13N-R01E

1. Reaches 3C-09 and 3C-11 are separated by a short section of the Newaukum River that passes through the city of Napavine and is not Lewis County jurisdictional shoreline.

Table 4.22. Upper Chehalis – Puget Lowlands Management Area Geologic Hazards (Map Series 11 – 14, 28).

Hazard Type	Percentage of Total Area	Reaches Affected
Erosion Hazard [a]	1%	01-04, 06-08, 13-15, 19
Seismic/Liquefaction [b]	92%	01-21
Rainier Blast Zone	0%	-
Mudflow/Lahar	0%	-
Channel Migration [c]	Not mapped, but occurs in this management area.	13
Landslide Hazard	7%	11-12, 14, 16, 17-19

[a] Severe or Very Severe Erosion Hazard
[b] Moderate to High Liquefactions Susceptibility
[c] CMZ maps not available; affected reach from Olson and Cramer (2009), Figure 1.

This management area supports all four priority salmon and trout species that are present in the watershed, as well as largemouth bass in the reach downstream from Centralia near Lincoln Creek. The management area supports cavity nesting ducks and waterfowl concentrations throughout many of the reaches. Oak woodlands, which often coincide with cavity nesting duck habitat are mapped along the mainstem Chehalis River and lower Newaukum River. Bald eagle nest and communal roost buffers are also present in six reaches in the same areas.Carlisle Lake is a human-made millpond located in Onalaska. It no longer receives mill effluent. Carlisle Lake has no surface inlets, and drains to the South Fork Newaukum River (Ecology 2013b). Steelhead has been documented in the reach.

There are 21 reaches in this management area. There are 55 listings for polluted conditions affecting 13 of the reaches, and many of the reaches are listed as polluted due to more than one pollutant. Pollution due to fecal coliform bacteria affects 10 reaches, and dissolved oxygen problems affect 8 reaches, temperature impacts 7 reaches, and turbidity 4 reaches. There is one listing each for dioxin, PCBs, and total phosphorus as well as two impaired waters listings due to invasive species. This management area also has a number of listings for threatened water quality conditions; however, all of these listings are in reaches that are already listed as polluted for a different water quality parameter.

4.3.3.2. Shoreline Use Patterns

Existing Shoreline Land Use and Designations

The Comprehensive Land Use designations from the Lewis County Comprehensive Plan in the shoreline management area are provided in Table 4.23a. Land use designations reflect the community's goals and they will be used in the process of determining the environment designations for the county's shoreline jurisdiction.

Table 4.23a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in Lewis County for the Upper Chehalis – Puget Lowlands Shoreline Management Area.

Description	Typical Uses	Percentage of Management Area
RRD 5	Residential Development, one dwelling per 5 acres	4.4%
RRD 10	Residential Development, one dwelling per 10 acres	7.6%
RRD 20	Residential Development, one dwelling per 20 acres	18.0%
Cities, UGAs and LAMIRDS	Cities, rural residential, commercial, and industrial development	1.1%
Agricultural Resource Lands	Commercial production of aquaculture, horticulture, grain, dairy, and other crops	54.6%
Forest Resource Lands and Parks	Forested lands, forestry operations, state-owned conservation areas, and parks	14.0%
Mineral Resource Lands	Mining and undeveloped resource lands	0.3%

The current land use patterns that are found in the shoreline management area are provided in Table 4.23b. Existing land use patterns will be used in the process of determining the

environment designations for the county'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 county was not available for this report.

Table 4.23b. Current Land Use Patterns in Lewis County for the Upper Chehalis – Puget Lowlands Shoreline Management Area.

Current Land Use Patterns	Percentage of Management Area
Agriculture	60.2%
Commercial	0.1%
Cultural/Recreational	0.9%
Forest	6.6%
Multi-Family Residential	2.0%
Open Space	1.2%
Railroad	0.7%
Right-of-Way	1.9%
Service/Government	3.0%
Single-Family Residential	12.1%
Timber	2.2%
Water	0.1%
Vacant/Undeveloped	4.0%
Other	5.0%

The zoning designations from the Lewis County Code (Title 17 Land Use and Development Regulations) that are found in the shoreline management area are provided in Table 4.23c. 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 county's shoreline jurisdiction.

Existing and Potential Public Access

The Upper Chehalis – Puget Lowlands shoreline management area has 84 miles of shoreline. There is one primary public access point to the Chehalis River and its tributaries in the shoreline management area:

- Newaukum Valley Golf Course provides water-enjoyment use through visual access to the Newaukum River adjacent to the course

In addition, the Chehalis River Basin Land Trust owns land next to the South Fork of the Newaukum River and an easement along the Chehalis River:

- **South Fork Newaukum River** - 1.3 acres at the junction of the South Fork Newaukum River and Kearney Creek, streams with high water quality and good fish habitat
- **Galvin Conservation Easement** - An easement on 57 acres and 2.5 miles along the Chehalis River consists of mature native forest including the largest grove of mature cottonwoods remaining in the Chehalis basin. The area provides habitat for

anadromous and resident fish and supports bald eagles, pileated woodpeckers, beavers, river otters, and a variety of native flora and fauna. The site provides a habitat corridor with open water, riparian zone, wetlands, and upland features. Mature black cottonwood trees are present.

Table 4.23c. Current Zoning Designations in Lewis County for the Upper Chehalis - Puget Lowlands Shoreline Management Area.

Description	Symbol	Typical Uses	Percentage of Management Area
Agricultural Resource Lands	ARL	Commercial production of aquaculture, horticulture, grain, dairy, and other crops	57.2%
Forest Resource Lands	Forest	Commercial forestry operation	0.2%
Forest Resource Lands Local Importance	FRL-LI	Commercial forestry operations, agricultural production	0.2%
Rural Development District 5	RDD-5	Residential development near population centers such as UGAs and small towns, one dwelling unit per 5 acres	10.7%
Rural Development District 10	RDD-10	Residential development compatible with rural character, one dwelling unit per 10 acres	14.3%
Rural Development District 20	RDD-20	Development limitations warrant lower density, one dwelling unit per 20 acres	17.0%
Small Towns - Mixed Use/Commercial	STMU	Commercial uses, retail uses, gateway communities	0.4%

4.3.3.3. Shoreline Modifications

Table 4.24 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 this management area.

4.3.3.4. Reach Functional Assessment

Reaches in this management area have an average score of 25.5 and scores range between 21 and 32. Impairments are mostly associated with agriculture, the dominant land use, and rural residential development. The reach that scored lowest (reach 3C-20) has a low score in part because of the small size of the reach (2.5 acres) and surrounding development within the management area. The reach is a small segment of a considerably larger wetland complex that is mostly located in the Chehalis management area. This reach scored low due to the highway and railroad that dominate the reach and associated lack of vegetation and functioning habitat, as well as a 303(d) listing. Dioxin levels in fish tissue exceeded National Toxic Rule criterion in a 5-fish composite of cutthroat trout fillets.

The highest-ranking reaches were along a segment of Kearney Creek (score of 32), and M.F. Newaukum River. These areas are relatively undeveloped with good coverage by forest and wetlands. They are also known spawning areas for priority salmon species.

Throughout the management area, mass wasting, lack of riparian cover, and poor water quality are primary limiting factors for salmon. Based on modeling, the mainstem between Newaukum River and the Skookumchuck River exhibited 168 percent change between existing and historical shade due to tree canopy loss (Smith and Wenger 2001). That segment of stream, which includes several reaches in this management area, was ranked highest for most degraded stream with regard to altered shade from vegetation. Water quality limiting factors are related primarily to warm water temperatures and low dissolved oxygen. In addition to degraded vegetation cover, stream channel alterations and poor in-stream habitat complexity were noted in several of the reaches.

Table 4.24. Upper Chehalis – Puget Lowlands Management Area Shoreline Modifications (Map Series 19 to 20).

Reach Number	Sum of Dike and Levee Length (feet) [a]	Other Shoreline Modifications [b]
3C-01	291	
3C-02	72	
3C-03	449	
3C-07	87	
3C-09	5,407	Moderate armoring at intervals throughout reach
3C-10		Armoring at intervals
3C-11	101	
3C-12	241	
3C-13	2,549	
3C-14	540	Straightening and possible armoring along Pigeon Springs Road
3C-18	505	
3C-19	514	

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

4.3.3.5. Restoration Opportunities

There are numerous fish passage improvement opportunities (projects) in the Upper Chehalis – Puget Lowlands management area because of fish passage barriers located throughout the management area. Implementation of these project opportunities would open salmonid access to additional habitat area, which is likely to result in increased fish survival and production. Several projects have been proposed to address barrier culverts in this management area by Lewis County Public Works and Lewis County Conservation District.

The Lewis County Conservation District has proposed to create a new channel on the lower reach of Wisner Creek near its confluence with Mill Creek. Historic logging activities destroyed the natural stream channel, causing the creek flow to become dispersed in a flat area dominated by non-native reed canarygrass. Creation of a new channel will restore the lost channel and will open salmonid access to approximately 1.2 linear miles of tributary stream habitat (PRISM 2013). The new channel would be approximately 500 feet long and would be revegetated using native plant species (such as cedar and cottonwood, etc.).

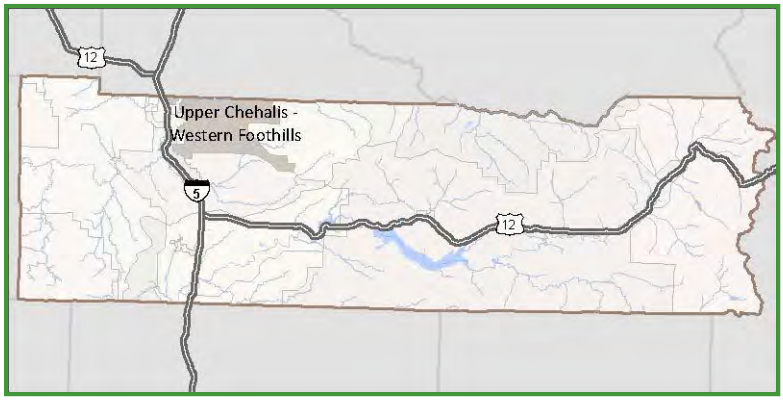
Smith and Wenger (2001) also recommended water quality improvement activities in this management area:

- Reduce water withdrawals from both surface and ground sources
- Restore riparian vegetation in tributaries (prioritize tributaries with warm water problems) and along the mainstem Chehalis River, particularly between Porter and Newaukum Creeks
- Reduce fine sediment transport by addressing excess fine sediment inputs at their sources (sites are prioritized in the mainstem Streambed/Sediment section of the Smith and Wenger report). Activities that promote the maintenance and increase of instream LWD would also help address this problem, particularly in high priority tributaries; upper Chehalis, and Newaukum River.
- Address low dissolved oxygen levels associated with high nutrient concentrations by reducing livestock and urban waste inputs
- Increase activities that lead to natural recharges in the aquifers. Both flow and water quality are highly dependent on adequate summer flows. These flows are supplied by groundwater. Loss of wetlands, artificial diversion of floodwaters through ditching, and groundwater withdrawals all contribute to a loss of water quality and summer flows in the Chehalis Basin.

The Chehalis Basin Flood Authority has been working to identify and prioritize salmon enhancement projects, and to estimate benefits and costs. Eighty-nine programs or projects were identified to address fish passage, riparian conditions, floodplain conditions, or a combination of multiple limiting factors (Montgomery et al. 2012). Not all of the projects identified were in this management area. However, several priority projects, ranking in the top 35, involving riparian restoration and LWD enhancements were on the Newaukum River in this management area (Anchor QEA 2012).

Fish tissue sampling to monitor dioxin levels, and evaluation of pollutant sources and possible corrective actions, is a restoration opportunity in reach 3C-20. This activity would also apply to the rest of the waterbody located in the Chehalis management area, an unnamed lake and wetland (reach CH-06) associated with Dillenbaugh Creek.

4.3.4. Upper Chehalis – Western Foothills



The Upper Chehalis – Western Foothills management area encompasses 82 square miles of low, rolling to steeply sloping hills with medium to high gradient streams. Jurisdictional water bodies include the Skookumchuck River, Hanaford Creek, the Newaukum River, Salzer Creek, and Plummer Lake. Land cover is 45 percent forest

and woodland, 43 percent recently disturbed, 11 percent agricultural and grassland, and 1 percent developed. Less than 1 percent of the land is public; the remaining 99.8 percent is in private ownership. Table 4.25 summarizes the physical characteristics of the Upper Chehalis – Western Foothills management area. Shoreline jurisdiction includes 4,969 acres along eight stream reaches and six lakes. Table 4.26 lists the reaches in this management area.

Table 4.25. Physical Characteristics of the Upper Chehalis – Western Foothills Management Area.

Physiography [a]	Low, rolling to steeply sloping hills with medium to high gradient streams
Elevation (feet) [b]	170-1,475
Lithology [a]	Pleistocene alpine glacial deposits; Tertiary sandstone and siltstone; Eocene andesite
Mean Annual Precipitation (inches) [b]	47-60
Natural Vegetation [a]	Western hemlock, western red cedar; some Douglas fir, bigleaf maple
Land Use / Land Cover [a]	Douglas fir and western hemlock forests; forestry, rural residential development, hay farming, pastureland

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

Table 4.26. Upper Chehalis – Western Foothills Management Area Shoreline Reaches (Map Series 2).

Reach Number	Primary Waterbody Name	Shoreline Area (acres)	Map Reference (Township-Range)
3D-01	Unnamed Creek	40.3	T15N-R02W
3D-02	Skookumchuck River	213.2	T15N-R02W
3D-03	Hanaford Creek	438.2	T15N-R02W
3D-04	Hanaford Creek	258.9	T14N-R01E, T15N-R01W
3D-05	Hanaford Creek	1,485.2	T15N-R01W, T15N-R02W
3D-06	South Hanaford Creek	820.6	T14N-R01W, T15N-R02W
3D-07	Salzer Creek	837.7	T14N-R01W, T14N-R02W
3D-08	Newaukum River North Fork	256.7	T14N-R01W
3D-09	Pond Number Three	56.4	T15N-R01W
3D-10	Unnamed Lake	141.2	T15N-R01W
3D-11	Unnamed Lake	153.3	T14N-R01W, T15N-R01W
3D-12	Unnamed Lake	98.4	T14N-R01W
3D-13	Pond Number Seven	76.9	T14N-R01W
3D-14	Plummer Lake	91.9	T14N-R02W

4.3.4.1. Physical and Biological Characterization

Refer to Section 3.2.3.2 for an overview of the physical processes that influence shorelines in the terrain and land cover types found in this management area.

Table 4.27 summarizes known geologic hazard critical areas for this management area as whole and lists the shoreline reaches in which land subject to each hazard is found.

Table 4.27. Upper Chehalis - Western Foothills Management Area Geologic Hazards (Map Series 11 - 14, 28).

Hazard Type	Percentage of Total Area	Reaches Affected
Erosion Hazard [a]	3%	01-08, 11-14
Seismic/Liquefaction [b]	75%	01-09, 13-14
Rainier Blast Zone	0%	-
Mudflow/Lahar	0%	-
Channel Migration	Not mapped, but occurs in this management area.	-
Landslide Hazard	5%	08

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

This management area supports all four priority salmon and trout species that are present in the watershed. Several reaches, including the Skookumchuck River, Hanaford Creek, Salzer Creek, and Newaukum River support known spawning and rearing populations of these fish. Extensive wetlands are present throughout the stream valleys in this management area. Cavity nesting duck habitat is mapped in the lower reaches of the Skookumchuck and Hanaford Rivers, and around the larger lakes that have forested riparian areas along their western edges. Waterfowl concentrations are also common.

There are 14 reaches in this management area. There are five listings for polluted conditions affecting two of the reaches. Pollution due to fecal coliform bacteria and dissolved oxygen affects two reaches, while temperature problems affect one reach. This management area also has two listings for threatened water quality conditions; however, these listings are in reaches that are already listed as polluted for a different water quality parameter.

4.3.4.2. Shoreline Use Patterns

Existing Shoreline Land Use and Designations

The Comprehensive Land Use designations from the Lewis County Comprehensive Plan in the shoreline management area are provided in Table 4.28a below. Land use designations reflect the community's goals and they will be used in the process of determining the environment designations for the county's shoreline jurisdiction.

The current land use patterns that are found in the shoreline management area are provided in Table 4.28b. Existing land use patterns will be used in the process of determining the environment designations for the county'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 county was not available for this report.

Table 4.28a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in Lewis County for the Upper Chehalis – Western Foothills Shoreline Management Area.		
Description	**Typical Uses**	**Percentage of Management Area**
RRD 5	Residential Development, one dwelling per 5 acres	2.4%
RRD 10	Residential Development, one dwelling per 10 acres	7.0%
RRD 20	Residential Development, one dwelling per 20 acres	43.0%
Cities, UGAs and LAMIRDS	Cities, rural residential, commercial, and industrial development	15.1%
Agricultural Resource Lands	Commercial production of aquaculture, horticulture, grain, dairy, and other crops	12.8%
Forest Resource Lands and Parks	Forested lands, forestry operations, state-owned conservation areas, and parks	8.5%
Mineral Resource Lands	Mining and undeveloped resource lands	11.2%

Table 4.28b. Current Land Use Patterns in Lewis County for the Upper Chehalis – Western Foothills Shoreline Management Area.	
Current Land Use Patterns	**Percentage of Management Area**
Agriculture	49.2%
Cultural/Recreational	0.3%
Forest	13.1%
Mining Activities	3.4%
Multi-Family Residential	1.2%
Open Space	1.1%
Railroad	1.0%
Right-of-Way	1.5%
Single-Family Residential	8.4%
Timber	2.2%
Utilities	0.9%
Water	0.7%
Vacant/Undeveloped	16.5%
Other	0.5%

The zoning designations from the Lewis County Code (Title 17 Land Use and Development Regulations) that are found in the shoreline management area are provided in Table 4.28c. 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 county's shoreline jurisdiction.

Table 4.28c. Current Zoning Designations in Lewis County for the Upper Chehalis – Western Foothills Shoreline Management Area.			
Description	**Symbol**	**Typical Uses**	**Percentage of Management Area**
Agricultural Resource Lands	ARL	Commercial production of aquaculture, horticulture, grain, dairy, and other crops	12.8%
Forest Resource Lands	Forest	Commercial forestry operation	8.1%
Mine	Mine	Mining industries, undeveloped resource land	11.2%
Park	Park	Park or open space	0.3%
Rural Area Industrial	RAI	General purpose industrial, transportation, and forest resource activities in rural areas	5.5%
Rural Development District 5	RDD-5	Residential development near population centers such as UGAs and small towns, one dwelling unit per 5 acres	2.4%
Rural Development District 10	RDD-10	Residential development compatible with rural character, one dwelling unit per 10 acres	7.0%
Rural Development District 20	RDD-20	Development limitations warrant lower density, one dwelling unit per 20 acres	43.1%
Urban Growth Area County	UGA - County	County Urban Growth Area	9.6%

Existing and Potential Public Access

The Upper Chehalis – Western Foothills shoreline management area has almost 40 miles of stream and lake shoreline jurisdiction. There is one primary public access point to the Skookumchuck River in the shoreline management area:

- Schaeffer County Park, a 17—acre park north of the city of Centralia, provides swimming and fishing on the Skookumchuck River as well as playgrounds, covered shelter, a picnic area, and hiking trails.

4.3.4.3. Shoreline Modifications

Table 4.29 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 this management area.

4.3.4.4. Reach Functional Assessment

The reaches in this management area have scores ranging from 20 to 30 showing relatively low functional values ranging to high functional value. The average score across all reaches and assessment criteria was 25.8. The reaches with the highest scores (3D-03 and 3D-04) are segments of Hanaford Creek containing relatively high levels of vegetation cover, wetlands, and habitat connectivity. The lowest scored reach (3D-10) is a pond associated with the Centralia power plant. That reach scored low generally due to limited vegetation, roads, and lack of adequate habitat connectivity or priority habitat features and species.

Table 4.29. Upper Chehalis – Western Foothills Management Area Shoreline Modifications (Map Series 19 to 20).		
Reach Number	**Sum of Dike and Levee Length (feet) [a]**	**Other Shoreline Modifications [b]**
3D-01		Ditch wetland
3D-02	558	Altered channel
3D-03	438	
3D-05		Stream channel altered
3D-06		Channel and riparian vegetation altered
3D-07	93	
[a] Data Source: Lewis County Dikes and Levees shapefile [b] Aerial Photography: Google Earth, May 2013		

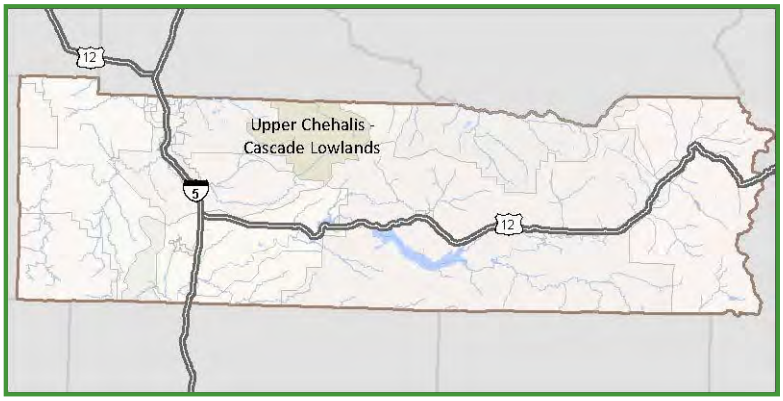
4.3.4.5. Restoration Opportunities

Restoration opportunities in the Upper Chehalis – Western Foothills management area should focus on removing fish barriers. Anchor (2012) documented culvert barriers on Salzer Creek, Coal Creek, and several unnamed tributaries to these systems. The Lewis County Conservation District also performed a culvert barrier assessment on Hanaford Creek; over half of the culverts were rated impassable (barrier culverts) (Verd 2002b).

A good example is a project led by the Lewis County Conservation District to replace a barrier culvert located under a puncheon on an unnamed tributary stream to Coal Creek with a 40-foot long bridge. Correction of this salmonid passage barrier will improve access to approximately 1.6 linear miles of tributary stream habitat.

Another restoration opportunity includes floodplain restoration on Salzer Creek. Reconnecting Salzer Creek with an old Chehalis River oxbow (Lower Mile Oxbow) would likely improve salmonid habitat access while providing improved flood control.

4.3.5. Upper Chehalis – Cascade Lowlands



The Upper Chehalis – Cascade Lowlands management area encompasses 102 square miles of westerly trending ridges and valleys with medium gradient rivers and streams. Jurisdictional water bodies include the Skookumchuck River, the North and South Fork Newaukum River, and Newaukum Lake. Land cover is 55 percent forest and woodland, 45 percent recently disturbed, with less than 1 percent agricultural, grassland, or developed. Approximately 1 percent of the land is public; the remaining 99 percent is in private ownership. Table 4.30 summarizes the physical characteristics of the Upper Chehalis –

Cascade Lowlands management area. Shoreline jurisdiction includes 1,176 acres along three stream reaches and one lake. Table 4.31 lists the reaches in this management area.

Table 4.30. Physical Characteristics of the Upper Chehalis – Cascade Lowlands Management Area.

Physiography [a]	Westerly trending ridges and valleys with reservoirs and medium gradient rivers and streams. U-shaped, glaciated valleys in the east.
Elevation (feet) [b]	420-3,750
Lithology [a]	Oligocene-Eocene andesitic, basaltic, and rhyolitic lava flows and breccia.
Mean Annual Precipitation (inches) [b]	53-101
Natural Vegetation [a]	Western hemlock, western red cedar, Douglas fir.
Land Use / Land Cover [a]	Douglas fir/western hemlock/western red cedar/vine maple/red alder forests are widespread. Forestry and recreation are important land uses and pastureland occurs in lower valleys.

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

Table 4.31. Upper Chehalis – Cascade Lowlands Management Area Shoreline Reaches (Map Series 2).

Reach Number	Primary Waterbody Name	Shoreline Area (acres)	Map Reference (Township-Range)
3E-01	Skookumchuck River	436	T14N-R02E, T15N-R02E
3E-02	Newaukum River North Fork	369	T14N-R01E
3E-03	Newaukum River South Fork	330	T13N-R01E, T14N-R02E
3E-04	Newaukum Lake	40	T14N-R03E

4.3.5.1. Physical and Biological Characterization

Refer to Section 3.2.3.2 for an overview of the physical processes that influence shorelines in the terrain and land cover types found in this management area.

Table 4.32 summarizes known geologic hazard critical areas for this management area as whole and lists the shoreline reaches in which land subject to each hazard is found.

Table 4.32. Upper Chehalis – Cascade Lowlands Management Area Geologic Hazards (Map Series 11 – 14, 28).

Hazard Type	Percentage of Total Area	Reaches Affected
Erosion Hazard [a]	78%	01-03
Seismic/Liquefaction [b]	26%	02-03
Rainier Blast Zone	0%	-
Mudflow/Lahar	0%	-
Channel Migration	Not mapped, but occurs in this management area.	-
Landslide Hazard	100%	01-03

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

Shorelines in this management area exhibit some similar characteristics to the Coast Range in that they are within a steep, relatively high elevation forested landscape. This management area includes spawning habitat for Chinook, coho, and steelhead. Mapped wetlands are relatively rare and mainly associated with the Newaukum Lake, although small unmapped patches are likely present, particularly in the form of groundwater seeps. Harlequin duck habitat is mapped in the Skookumchuck and N.F. Newaukum drainages.

This management area includes four reaches. None of these reaches has any known water quality impairments, or known or suspected threats to water quality.

4.3.5.2. Shoreline Use Patterns

Existing Shoreline Land Use and Designations

The Comprehensive Land Use designations from the Lewis County Comprehensive Plan in the shoreline management area are provided in Table 4.33a. Land use designations reflect the community's goals and they will be used in the process of determining the environment designations for the county's shoreline jurisdiction.

Table 4.33a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in Lewis County for the Upper Chehalis – Cascade Lowlands Shoreline Management Area.

Description	Typical Uses	Percentage of Management Area
RRD 10	Residential Development, one dwelling per 10 acres	91.4%
Forest Resource Lands and Parks	Forested lands, forestry operations, state-owned conservation areas, and parks	8.6%

The current land use patterns that are found in the shoreline management area are provided in Table 4.33b. Existing land use patterns will be used in the process of determining the environment designations for the county'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 county was not available for this report.

Table 4.33b. Current Land Use Patterns in Lewis County for the Upper Chehalis – Cascade Lowlands Shoreline Management Area.

Current Land Use Patterns	Percentage of Management Area
Single-Family Residential	0.2%
Multi-Family Residential	0.1%
Right-of-Way	0.0%
Agriculture	0.0%
Forest	97.8%
Timber	0.7%
Vacant/Undeveloped	1.2%

The zoning designations from the Lewis County Code (Title 17 Land Use and Development Regulations) that are found in the shoreline management area are provided in Table 4.33c. 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 county's shoreline jurisdiction.

Table 4.33c. Current Zoning Designations in Lewis County for the Upper Chehalis – Cascade Lowlands Shoreline Management Area.

Description	Symbol	Typical Uses	Percentage of Management Area
RRD 10	RDD-10	Residential development compatible with rural character, one dwelling unit per 10 acres	91.4%
Forest Resource Lands	Forest	Commercial forestry operation	8.6%

Existing Public Access

The Upper Chehalis – Cascade Lowlands shoreline management area has 24 miles of stream and lake shoreline jurisdiction; however, it is primarily private forestland with no existing public access.

4.3.5.3. Shoreline Modifications

No dikes or levees for reaches are recorded in the available data, nor were 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 this management area.

4.3.5.4. Reach Functional Assessment

Stream reaches in this management area have scores of 24 (two reaches) and 25 (one reach). Newaukum Lake has a score of 31. These reaches share similar qualities as those in the Nisqually and Chehalis Coast management areas, moderately steep slopes, high level of forest cover, and similar forestry land use patterns. Function scores across all 12 assessment criteria generally reflect the natural conditions of each reach, with some impairments likely resulting from timber harvest and forest roads throughout the landscape. Lower scores for the stream reaches reflect the steep slopes, narrow adopted floodways or the 2010 flood channel study area, and lack of significant wetlands or backwaters that are important to the movement of water and sediment, water quality, and riparian vegetation and habitat structure.

4.3.5.5. Restoration Opportunities

Abandoning and decommissioning forest roads built before forest practices regulations became established would help reduce the risk of landslides, and other sources of fine and associated sedimentation. A Landslide Hazard Zonation project completed for the upper portions of the North Fork and South Fork Newaukum River watersheds will help targeting forest roads in need abandonment or decommissioning (LCCD 2012).

4.4. Cowlitz (WRIA 26)

The Cowlitz River drains an area of approximately 2,480 square miles of the western slopes of the Cascade Range from Mount Rainier south to Mount Adams and Mount St. Helens. Formed by the confluence of the Clear Fork and the Ohanapecosh River, the main Cowlitz flows generally southwest for about 133 miles to join the Columbia River at river mile (RM) 68 approximately 3.5 miles southeast of Longview, Washington (WDF 1951). The following discussion of WRIA 26 ecosystem processes and shoreline functions is broken down in to five distinct management areas: Willapa Hills, Puget Lowlands, Western Foothills, Cascade Lowlands, and Cascade Highlands.

4.4.1. Cowlitz – Willapa Hills

The Cowlitz – Willapa Hills management area is a relatively small area west of Winlock. The terrain is similar to that of the Chehalis – Willapa Hills management area. Land cover is 60 percent forest and woodland, 32 percent recently disturbed, and 8 percent agricultural, grassland, or developed. Table 4.34 summarizes the physical characteristics of the Cowlitz – WIllapa Hills management area. Shoreline jurisdiction includes 308 acres along three streams: Stillwater Creek, its tributary Brim Creek, and a small section of Campbell Creek. Table 4.35 lists the reaches in this management area.

Table 4.34. Physical Characteristics of the Cowlitz – Willapa Hills Management Area.

Physiography [a]	Low, rolling hills and mountains with medium gradient, sinuous streams and rivers; low drainage density
Elevation (feet) [b]	200-1,400
Lithology [a]	Miocene sandstone, siltstone, shale
Mean Annual Precipitation (inches) [b]	53-71
Natural Vegetation [a]	Western hemlock, western red cedar, Douglas fir
Land Use / Land Cover [a]	Douglas fir/western hemlock/red alder/western red cedar forests; forestry, some rural residential development, pastureland

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

Table 4.35. Cowlitz – Willapa Hills Management Area Shoreline Reaches (Map Series 2).			
Reach Number	**Primary Waterbody Name**	**Shoreline Area (acres)**	**Map Reference (Township-Range)**
4A-01	Brim Creek	66.2	T11N-R03W
4A-02	Stillwater Creek	232.4	T11N-R03W
4A-03	Campbell Creek	2.7	T11N-R03W
4A-04	Stillwater Creek	6.6	T11N-R03W

4.4.1.1. Physical and Biological Characterization

This section discusses characteristic aspects of physical and biological conditions in this management area. Refer to Section 3.2.3.2 for an overview of the physical processes that influence shorelines in the terrain and land cover typical of this management area.

Runoff is predominantly from rainfall. Widespread immature forest stands and high forest road densities increase the risk of high peak flows.

Sediment yield and sediment transport processes in the Willapa Hills tributaries of the Cowlitz are typical of those in steep forested basins in Western Washington, as described in Section 3.2.3.2. Road densities are high, and sediment yields are likely to remain high until they are updated to meet forest practices standards.

Most of the small tributaries to the Cowlitz River have low quantities of stable LWD due to historic removal and the legacy of splash damming.

Table 4.36 summarizes known geologic hazard critical areas for this management area as whole and lists the shoreline reaches in which land subject to each hazard is found.

Table 4.36. Cowlitz – Willapa Hills Management Area Geologic Hazards (Map Series 11 – 14, 28).		
Hazard Type	**Percentage of Total Area**	**Reaches Affected**
Erosion Hazard [a]	1%	01
Seismic/Liquefaction [b]	42%	01-03
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		

All of the reaches in this management area contain known spawning coho salmon habitat or juvenile steelhead rearing habitat or both. Chinook and cutthroat trout presence and presumed presence have been documented in these reaches. Wetlands may be limited (approximately 3 acres are mapped) but are present. Other priority habitats typically

associated with aquatic environments and shorelines are not mapped within the management area.

None of the four reaches in this management area has any known water quality impairments, or known or suspected threats to water quality.

4.4.1.2. Shoreline Use Patterns

Existing Shoreline Land Use and Designations

The Comprehensive Land Use designations from the Lewis County Comprehensive Plan in the shoreline management area are provided in Table 4.37a. Land use designations reflect the community's goals and they will be used in the process of determining the environment designations for the county's shoreline jurisdiction.

Table 4.37a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in Lewis County for the Cowlitz - Willapa Hills Shoreline Management Area.

Description	Typical Uses	Percentage of Management Area
RRD 5	Residential Development, one dwelling per 5 acres	14.8%
RRD 10	Residential Development, one dwelling per 10 acres	44.7%
Forest Resource Lands and Parks	Forested lands, forestry operations, state-owned conservation areas, and parks	40.5%

The current land use patterns that are found in the shoreline management area are provided in Table 4.37b. Existing land use patterns will be used in the process of determining the environment designations for the county'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 county was not available for this report.

Table 4.37b. Current Land Use Patterns in Lewis County for the Upper Cowlitz - Willapa Hills Shoreline Management Area.

Current Land Use Patterns	Percentage of Management Area
Single-Family Residential	3.5%
Multi-Family Residential	0.6%
Right-of-Way	0.6%
Forest	90.8%
Timber	0.9%
Vacant/Undeveloped	3.6%

The zoning designations from the Lewis County Code (Title 17 Land Use and Development Regulations) that are found in the shoreline management area are provided in Table 4.37c. 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 county's shoreline jurisdiction.

Table 4.37c. Current Zoning Designations in Lewis County for the Cowlitz – Willapa Hills Shoreline Management Area.			
Description	**Symbol**	**Typical Uses**	**Percentage of Management Area**
RRD 5	RDD-5	Residential development near population centers such as UGAs and small towns, one dwelling unit per 5 acres	14.8%
RRD 20	RDD-20	Development limitations warrant lower density, one dwelling unit per 20 acres	44.7%
Forest Resource Lands	Forest	Commercial forestry operation	40.5%

Existing Public Access

The Cowlitz – Willapa Hills shoreline management area has 6.4 miles of shoreline jurisdiction; however, it is primarily private forestland with no existing public access.

4.4.1.3. Shoreline Modifications

No dikes or levees for reaches are recorded in the available data, nor were 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 this management area.

4.4.1.4. Reach Functional Assessment

All four reaches in this management area have a score of 22. This is due to the similar land use and development patterns between the reaches, and relatively small sizes of two of the reaches (2.7 and 6.6 acres), as well their close proximity to one another and similar ecological characteristics. The similarities resulted in identical results for functions across all 12 criteria. Primary impairments are related to residential development and agriculture, which have resulted in reduced forest cover along the shoreline. Limited wetlands and narrow adopted floodway or the 2010 flood channel study area, in combination with the limited potential for recruitment and transport of LWD result in moderate degradation of habitat complexity from development and impacted forest vegetation.

4.4.1.5. Restoration Opportunities

Restoration opportunities in the Cowlitz - Willapa Hills management area should focus on rehabilitating riparian areas, and the floodplain along the mainstem Stillwater Creek (LCFRB 2010A). Improved management and restoration of commercial forestlands in the management area should also be a priority to improve the hydrologic functioning, and habitat value of tributary streams.

Stillwater Creek may benefit from riparian vegetation enhancement or restoration (Wade 2000).

4.4.2. Cowlitz – Puget Lowlands

The Cowlitz – Puget Lowlands management area encompasses 192 square miles of rolling terraces and floodplains with meandering streams and oxbow lakes. Streams in this management area are the Cowlitz River (including Mayfield reservoir downstream to the county boundary) and lower segments of tributary streams including the Tilton River and Cinebar Creek, Mill Creek, Salmon Creek, and Klickitat Creek. Other major streams are Olequa Creek (and the lower portion of its tributary, Stillwater Creek) and the entire length of Lacamas Creek. Land cover is 45 percent forest and woodland, 17 percent recently disturbed, 35 percent agricultural or grassland, and 2 percent developed (this tally does not include the city of Winlock). Approximately 6 percent of the land is public; the remaining 94 percent is in private ownership. Table 4.38 summarizes the physical characteristics of the Cowlitz – Puget Lowlands management area. Shoreline jurisdiction includes 9,000 acres along 19 stream reaches and two lakes. Table 4.39 lists the reaches in this management area.

Table 4.38. Physical Characteristics of the Cowlitz – Puget Lowlands Management Area.

Physiography [a]	Rolling terraces and floodplains with meandering streams and oxbow lakes
Elevation (feet) [b]	80-1,100
Lithology [a]	Holocene alluvial deposits; Pleistocene alpine glacial outwash material
Mean Annual Precipitation (inches) [b]	47-59
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)

4.4.2.1. Physical and Biological Characterization

This section discusses characteristic aspects of physical and biological conditions in this management area. Refer to Section 3.2.3.1 for an overview of the physical processes that influence shorelines in the terrain and land cover typical of this management area.

Runoff is generated by rainfall, rain-on-snow events, and spring snowmelt. Flow in the Cowlitz River is regulated by a series of dams, the most influential of which is the Mossyrock Dam that impounds Riffe Lake. Dam operations have reduced flood peaks and average spring

flows, while increasing average summer base flow, as well as fall and winter flows. In the lowland areas, developed land has increased imperviousness, which leads to higher runoff.

Table 4.39. Cowlitz – Puget Lowlands Management Area Shoreline Reaches (Map Series 2).

Reach Number	Primary Waterbody Name	Shoreline Area (acres)	Map Reference (Township-Range)
4B-01	Olequa Creek Wetland	30.3	T12N-R02W
4B-02	Unnamed tributary to Olequa Creek	31.1	T12N-R02W
4B-03	King Creek	8.5	T12N-R02W
4B-04	Olequa Creek	376.0	T11N-R02W, T12N-R02W
4B-05	Stillwater Creek	194.3	T11N-R02W, T11N-R03W
4B-06	Lacamas Creek	81.5	T12N-R01E, T12N-R01W
4B-07	Lacamas Creek	672.2	T12N-R01W, T12N-R02W
4B-08	Lacamas Creek	357.4	T11N-R02W, T12N-R02W
4B-09	Cowlitz River	796.7	T11N-R01W
4B-10	Cowlitz River	1,384.2	T11N-R01E
4B-11	Cowlitz River	773.4	T12N-R01E, T12N-R01W
4B-12	Cowlitz River	196.4	T12N-R01E, T12N-R02E
4B-13	Cowlitz River	2,270.4	T12N-R02E, T13N-R02E
4B-14	Salmon Creek	259.0	T11N-R01W
4B-15	Mill Creek	484.5	T12N-R01E, T13N-R02E
4B-16	Tilton River	192.2	T13N-R02E
4B-17	Cinebar Creek	187.6	T13N-R02E, T13N-R03E
4B-18	Tilton River	282.7	T13N-R02E, T13N-R03E
4B-19	Klickitat Creek	117.6	T12N-R02E
4B-20	Unnamed Lake	103.2	T12N-R01W, T12N-R02W
4B-21	Unnamed Lake	200.2	T12N-R01E

Sediment transport capacity in the reach immediately downstream of Mayfield dam exceeds the supply of sediment from upstream, leading to a locally reduced proportion of gravel in the stream. Reaches in this management area have low quantities of stable LWD due to historic removal, the legacy of splash damming, and a lack of large trees in riparian areas. Banks are generally stable, which may contribute to the lack of LWD. Floodplain habitats have been channelized and incised throughout portions of Olequa Creek (Wade 2000).

Table 4.40 summarizes known geologic hazard critical areas for this management area as whole and lists the shoreline reaches in which land subject to each hazard is found.

Priority fish species, including Chinook, coho, chum, and steelhead, are present in 19 of the 21 reaches in this management area. Rainbow trout and coastal resident cutthroat trout are

also present in three reaches. The streams in this management area are known Chinook and coho spawning areas, and juvenile steelhead rearing areas. The upper reaches of Olequa Creek above Winlock, provides important spawning and rearing habitat for steelhead, coho, and likely cutthroat trout (Wade 2000). Side channels along the Cowlitz mainstem provide functioning spawning and rearing habitat for fall Chinook and steelhead that is rare in the lower Cowlitz mainstem, and these may need protection or enhancement (Wade 2000). Wetlands are common in the Cowlitz River and Lacamas Creek floodplains. Among other priority habitat areas typically associated with terrestrial, upland environments, this management area contains several areas of known waterfowl, harlequin duck, and oak woodland habitats. Bald eagle nest sites or communal roosts are present in six reaches along the Cowlitz River and Mayfield reservoir.

Table 4.40. Cowlitz – Puget Lowlands Management Area Geologic Hazards (Map Series 11 – 14, 28).

Hazard Type	Percentage of Total Area	Reaches Affected
Erosion Hazard [a]	12%	01
Seismic/Liquefaction [b]	30%	01-03
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

There are 21 reaches in this management area. There are nine listings for polluted conditions affecting four of the reaches; many of the reaches are listed as polluted due to more than one pollutant. Priority pollutants (e.g., DDE, PCBs, and mercury) account for seven of these listings and invasive species account for the remaining two. This management area also has two listings for threatened water quality conditions. One of these listings is for a reach that is already listed as polluted for a different water quality parameter while the other is listed for fecal coliform bacteria.

4.4.2.2. Shoreline Use Patterns

Existing Shoreline Land Use and Designations

The Comprehensive Land Use designations from the Lewis County Comprehensive Plan in the shoreline management area are provided in Table 4.41a. Land use designations reflect the community's goals and they will be used in the process of determining the environment designations for the county's shoreline jurisdiction.

The current land use patterns that are found in the shoreline management area are provided in Table 4.42b. Existing land use patterns will be used in the process of determining the environment designations for the county'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 county was not available for this report.

Table 4.41a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in Lewis County for the Cowlitz – Puget Lowlands Shoreline Management Area.		
Description	**Typical Uses**	**Percentage of Management Area**
RRD 5	Residential Development, one dwelling per 5 acres	15.7%
RRD 10	Residential Development, one dwelling per 10 acres	33.4%
RRD 20	Residential Development, one dwelling per 20 acres	22.9%
Cities, UGAs and LAMIRDS	Cities, rural residential, commercial, and industrial development	1.8%
Agricultural Resource Lands	Commercial production of aquaculture, horticulture, grain, dairy, and other crops	16.3%
Forest Resource Lands and Parks	Forested lands, forestry operations, state-owned conservation areas, and parks	7.1%
Mineral Resource Lands	Mining and undeveloped resource lands	2.8%

Table 4.42b. Current Land Use Patterns in Lewis County for the Cowlitz – Puget Lowlands Shoreline Management Area.	
Current Land Use Patterns	**Percentage of Management Area**
Single-Family Residential	5.7%
Multi-Family Residential	4.2%
Commercial	0.1%
Utilities	13.0%
Right-of-Way	1.5%
Service/Government	0.1%
Cultural/Recreational	1.5%
Open Space	0.3%
Agriculture	13.2%
Fishing Activities	0.3%
Forest	17.6%
Timber	2.6%
Water	10.7%
Vacant/Undeveloped	16.0%
Unknown	13.2%

The zoning designations from the Lewis County Code (Title 17 Land Use and Development Regulations) that are found in the shoreline management area are provided in Table 4.42c. 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 county's shoreline jurisdiction.

Table 4.42c. Current Zoning Designations in Lewis County for the Cowlitz - Puget Lowlands Shoreline Management Area.			
Description	**Symbol**	**Typical Uses**	**Percentage of Management Area**
Agricultural Resource Lands	ARL	Commercial production of aquaculture, horticulture, grain, dairy, and other crops	13.3%
Forest Resource Lands	Forest	Commercial forestry operation	4.9%
Freeway Commercial	FC	Commercial development located near major transportation routes serving the local population and the traveling public	0.1%
Lake	Lake	Lake	18.3%
Mine	Mine	Mining industries, undeveloped resource land	2.3%
Park	Park	Park or open space	0.9%
Rural Development District 10	RDD-10	Residential development compatible with rural character, one dwelling unit per 10 acres	27.2%
Rural Development District 20	RDD-20	Development limitations warrant lower density, one dwelling unit per 20 acres	18.7%
Rural Development District 5	RDD-5	Residential development near population centers such as UGAs and small towns, one dwelling unit per 5 acres	12.9%
Rural Residential Center	RRC-R10000	Rural residential development	0.2%
Rural Residential Center - R.5	RRC-R.5	Rural residential development with density greater than one unit per 0.5 acre	0.3%
Rural Residential Center - R1	RRC-R1	Rural residential development with density greater than one unit per 1 acre	0.1%
Urban Growth Area	UGA	City Urban Growth Area	0.8%

Existing Public Access

The Upper Chehalis – Puget Lowlands shoreline management area has 119 miles of shoreline jurisdiction. There are a number of public access points in the shoreline management area. The Mayfield Lake area provides a recreational resource for the central county area, and resort and recreation opportunities are encouraged where adequate public facilities can be provided cost effectively and significant environmental consequences avoided.

On the Cowlitz River:

- South Lewis County Park covers 43 acres adjacent to the Cowlitz River in Toledo with access to the Cowlitz River and a 19-acres lake. A lake supporting wetland vegetation, wildlife, and birds has formed in an old gravel pit on the property. Amenities include camping, swimming, fishing, boating, and playground and picnic area.
- Cowlitz Trout Hatchery Unit is a 280-acre unit of WDFW's Cowlitz Wildlife Area and is located adjacent to the WDFW Cowlitz Trout Hatchery near Winlock. It is managed for black-tailed deer and riparian forest habitats. This unit has several large fields that are mowed and maintained as forage fields. Additionally, three fields totaling 9 acres were planted with 3,700 trees and shrubs representative of a mixed deciduous forest. This

area is along a riparian corridor that provides seasonal inundation to the surrounding floodplain that, when finished, will create a palustrine wetland environment.

- There are four boat launches on the Cowlitz River below Mayfield Lake:
    - **Blue Creek** – Next to the Cowlitz Trout Hatchery Unit there is a year-round, ADA-accessible, concrete boat launch for motorized boats with restroom facilities operated and maintained by Tacoma Power.
    - **Interstate 5** – On the north bank of the Cowlitz River at the Interstate 5 Bridge, a year-round, ADA accessible, concrete boat launch for motorized boats with restroom facilities is accessible from State Route 506.
    - **Massey Bar** – From Buckley Road, there is a year-round, ADA-accessible, concrete boat launch for motorized boats with restroom facilities. There is also bank fishing.
    - **Winters** - On the south bank of where Interstate 5 crosses the Cowlitz River accessible from Mandy Road, there is a year-round, non-ADA accessible boat launch for non-motorized boats.

On Mayfield Lake:

- Ike Kinswa State Park is located on the northern shoreline of Mayfield Lake. It consists of 454 acres of forest with 46,000 feet of shoreline on Mayfield Lake. The Cowlitz Indians originally inhabited the area around Ike Kinswa State Park. Their burial ground is located in the region. Many graves were relocated when the Mayfield Dam backed water up into the canyon. The area was originally named Mayfield Lake State Park, but the name was changed in 1971 to honor Ike Kinswa, a Cowlitz Indian who represented his people.

  This State Park is open all year and offers a boat launch, campground and day-use facility. The park provides fishing, recreational boating, and swimming. There are 2 boat ramps and 52 unsheltered picnic tables. A few small trails meander around the park for a total of 1.5 miles.
- Mayfield Buffer Unit is a unit of WDFW's Cowlitz Wildlife Area that was created as mitigation for the Cowlitz River hydroelectric projects. Tacoma Power purchased a 60- to 300-foot buffer along the entire shoreline of Mayfield Lake. The upland is mainly residential development with access to the buffer primarily by water. The buffer areas are accessed by boat almost exclusively. There are some areas where the lands can be access from shore but parking would be very limited.
- Mayfield Lake County Park is located on the south bank of the lake. It has 8,400 feet of beach front, a boat launch, picnic shelters, camping sites, and a beach on the lake. The park includes 54 individual camping sites and showering facilities for campers. Twenty-three acres of the park are designated as wildlife mitigation lands, which will remain in recreational use but will not be further developed.
- Two privately run recreational facilities on Mayfield Lake provide a variety of visitor services:
    - Harmony Lakeside RV Park

    - Lake Mayfield Resort and Marina
- In addition, Mayfield Lake Youth Camp is located on the south shore of the lake.

On Olequa Creek:

- McMurphy Park is located on Annonen Road on a bend of Olequa Creek. It has picnic sites and access to the creek. The park is owned by the city of Vader. The city is in the process of extending utilities to the park.

4.4.2.3. Shoreline Modifications

Table 4.43 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 this management area.

Table 4.43. Cowlitz – Puget Lowlands Management Area Shoreline Modifications (Map Series 19 to 20).

Reach Number	Sum of Dike and Levee Length (feet) [a]	Other Shoreline Modifications [b]
4B-07	208	
4B-09	4,710	development, significant armoring
4B-10	13,014	
4B-11	5,428	
4B-12	-	Salmon Hatchery Dam
4B-13	-	Mayfield Dam
4B-14	2,793	
4B-15	170	

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

4.4.2.4. Reach Functional Assessment

Reaches in this management area are rated between 20 and 35 for overall functions. The average score for all reaches combined is 26.2, indicating a moderate to high functional value overall with a few reaches scored moderately low. The reach with the lowest score is Mayfield Lake, a reservoir on the mainstem of Cowlitz River. Although most of the shoreline is well vegetated, there are areas of development, overwater structures, and other shoreline modification such as the Highway 12 bridge crossing. Probably the most significant feature characterizing this reach and affecting ecological functions is the Mayfield Dam. Altered processes that, in turn, affect functions in this reach are impaired water, sediment, and LWD transport. Functions are impaired by these altered conditions that reduce habitat complexity and suitability for salmon. Fish access is also limited by the Mayfield Dam and Barrier dam in reach 4B-12 immediately downstream. The highest scored reaches are wetlands, a headwater wetland of Olequa Creek (4B-20) and a relatively intact unnamed wetland (4B-21). These reaches are suitable for protection.

Much of the forested riparian area in the Tilton watershed has a reduced potential for LWD recruitment in the lower reaches compared to historical conditions. Lack of LWD was noted in

the Cowlitz River, Salmon Creek, and Tilton River during the functions assessment, and was one factor contributing to impaired functions and moderate functional scores (for example, a reach function score of 25 associated with the Tilton River). Historical channel cleaning and timber harvest have resulted in fewer log jams, and riparian forests composed of relatively young conifers or deciduous trees with poor large wood structure (Wade 2000). The mainstem Tilton River has limited spawning capacity due to lack of spawning gravel. Elevated peak flows and lack of LWD result in the transport of spawning gravels out of the river.

4.4.2.5. Restoration Opportunities

Restoring floodplain functioning on the mainstem Cowlitz River presents a major restoration opportunity (LCFRB 2010A). The recently completed Brim Bar Side channel Rehabilitation project (Habitat Work Schedule 2013) on RM 42.7 of the Cowlitz River is an excellent example of a floodplain restoration project. This project used engineered logjams to enhance flows from the mainstem Cowlitz River into a side channel which feeds into beaver ponds at the downstream end, improving holding, rearing, and refuge habitat for salmonids.

Restoring salmonid spawning habitat below Mayfield Dam is another restoration opportunity for the lower Cowlitz River. In 2002, Tacoma Power received a new 35-year license from the Federal Energy Regulatory Commission (FERC) to operate Mayfield Dam, Mossyrock Dam, and the Barrier Dam (LCFRB 2010A). As part of the FERC license, Tacoma Power must augment spawning gravel and LWD in the lower Cowlitz River among other provisions (LCFRB 2010A).

An additional restoration opportunity includes enhancement of existing habitat features on the lower Cowlitz River to mitigate the effects of hydro-regulation. An excellent example is the Otter Creek Side Channel Design project proposed by the Cowlitz Indian Tribe in cooperation the United States Forest Service, which intends to increase flow in an existing side channel while maintaining the side channel habitat characteristics.

Improper sizing and angling of culverts located under roads can create fish passage barriers, preventing salmonids from accessing spawning and rearing habitat. In the Cowlitz Puget Lowlands management area, several projects are in the planned to replace culverts that are fish passage barriers, including the following:

- The Washington State Department of Natural Resources has proposed replacing a barrier culvert located at the confluence of an unnamed creek and Curtis Creek, which ultimately discharges to Olequa Creek. A culvert with a 24-inch outfall drop poses a fish barrier. Replacement with a larger culvert that is 100 percent fish passable would provide salmonids access to 0.2 linear miles of spawning and rearing habitat (PRISM 2013).
- The Cowlitz Indian Tribe is sponsoring a project on Little Salmon Creek to replace an undersized barrier culvert. The existing culvert presents a complete salmonid passage barrier due to high water velocities passing through the culvert, and is regularly overwhelmed during high flow events, causing the creek to overtop and erode the road (PRISM 2013). The project would replace the culvert with a 40-foot long steel bridge, providing fish passage and restoring more natural hydrologic functioning to the creek at the project site.

Most of the lower Cowlitz mainstem (below RM 20) has been diked and channelized. It will be important to preserve or enhance off-channel, floodplain, and side channel habitat (Wade 2000). In the Cowlitz mainstem, from RM 20 to RM 49, efforts should be considered to preserve functioning side channels and restore others (Harza 2000). These areas provide critical rearing and spawning habitat for fall Chinook and steelhead.

Wade (2000) recommended focusing riparian restoration efforts in the more productive streams of the lower Cowlitz River subbasin, including Olequa Creek. Similarly, analysis conducted by WDFW and documented in the South Lewis County Habitat Analysis Report (Carleton and Jacobson 2009) resulted in recommendations to treat the Lacamas Creek corridor and adjacent lands as an important habitat focus area due to the frequency and diversity of important and relatively uncommon habitats. As a habitat focus area for the south county region, it is also important for limiting fragmentation and other impacts related to development. The analysis report (Carleton and Jacobson 2009) recommended designating the habitat focus area in a subarea plan and adopting the plan as part of the county comprehensive plan. It also recommended policy or regulatory changes affecting critical areas ordinances, Public Benefit Rating System, zoning, and annual transportation project planning and ranking. More specifically, it recommended the following ideas for implementation of a designated habitat focus area around Lacamas Creek:

- Provide additional points under the Public Benefit Rating System (PBRS) for lands in the Lacamas Creek habitat focus area to foster land conservation through favorable property tax rates.
- Encourage the use of cluster development on lands zoned R 1-5, R-10, and R-20 within the habitat focus area. Some density incentives, combined with permanent protection of large, contiguous habitat patches, would reward landowners for developing in a way that best protects wildlife habitat connectivity.
- Adopt policies in the comprehensive plan supporting the need to plan for wildlife habitat and connectivity, and to consider impacts on local biodiversity for rezone/land use change proposals.
- Change mitigation provisions of the county CAO to allow for and encourage, in appropriate circumstances, off-site mitigation for unavoidable fish and wildlife habitat impacts. The habitat focus area should be considered a priority location for off-site mitigation projects.
- Project location for hydrologic process and water quality impacts (i.e., wetland fills) should be guided by Ecology's restoration priorities. When consistent with Ecology's guidance, the habitat focus area can be considered a priority location for these projects, to gain additional resource benefits from the required mitigation.
- Given the importance of connectivity between the habitat focus area and the greater surrounding rural areas, individual land use/rezone proposals in outlying rural areas with comparatively high fish and wildlife conservation values could be limited, while development in or close to urban centers could be encouraged or offered incentives.
- Culvert and bridge maintenance or replacement projects within the Lacamas Creek habitat focus area could be prioritized for public funding under the Lewis County Department of Public Works annual transportation improvement program (TIP). Linking

road infrastructure development with the reopening and upgrading of fish and wildlife migration crossings would provide incentives for rural redevelopment that also improve connectivity for fish and wildlife movement.

- Enable trading of development rights (TDR) through a new county ordinance. Such an incentive-based program would allow willing landowners within the habitat focus area (and other areas throughout the county) to gain financial benefit for foregoing development, and providing the community with protection of wildlife habitat and working lands.
- Consider adding oak woodlands and remnant native prairie as habitats of local importance under the CAO. This action would require project review that would allow state agency biologists to assist landowners with ideas for managing these important habitat features.
- Consider expanding county riparian buffer requirements to match those required within Winlock or Vader. As a second option, consider requiring wider buffers within the habitat focus area.

4.4.3. Cowlitz – Western Foothills

The Cowlitz – Western Foothills management area encompasses 54 square miles of low, rolling to steeply sloping hills with medium to high gradient streams. It situated generally south of Mayfield reservoir on the Cowlitz River, east of the mainstem Cowlitz River, and west of the higher elevation Cascade lowlands. This management area includes three stream reaches. Two reaches are middle portions of Salmon Creek, upstream and downstream of the Cedar Creek confluence. The third is Cedar Creek. These streams eventually flow into the Cowlitz River downstream from Toledo. Land cover is 78 percent forest and woodland, 19 percent recently disturbed, 2 percent agricultural and grassland, and less than 1 percent developed land. Six percent of the land is public; the remaining 94 percent is in private ownership. Table 4.44 summarizes the physical characteristics of the Cowlitz – Western Foothills management area. Shoreline jurisdiction includes 1,197 acres along three stream reaches. Table 4.45 lists the reaches in this management area.

4.4.3.1. Physical and Biological Characterization

The Western Foothills portion of the Cowlitz basin is similar in character to the Western Foothills portion of the Chehalis basin (Section 4.3.4). Most of the management area is characterized by undeveloped but intensively managed forest lands. The forest zones are typical of those found in the southern Cascades. Climax species are western hemlock, Douglas fir, and western red cedar (WDW 1990). Refer to Section 3.2.3.2 for an overview of the physical processes that influence shorelines in the terrain and land cover types found in this management area.

Table 4.44. Physical Characteristics of the Cowlitz - Western Foothills Management Area.	
Physiography [a]	Low, rolling to steeply sloping hills with medium to high gradient streams
Elevation (feet) [b]	150-1,500
Lithology [a]	Pleistocene alpine glacial deposits; Tertiary sandstone and siltstone; Eocene andesite
Mean Annual Precipitation (inches) [b]	47-61
Natural Vegetation [a]	Western hemlock, western red cedar; some Douglas fir, bigleaf maple
Land Use / Land Cover [a]	Douglas fir and western hemlock forests; forestry, rural residential development, hay farming, pastureland
[a] Level IV Ecoregion characteristics from Pater et al. (1998) [b] Management area characteristics (see Table 2.1 for specific data sources)	

Table 4.45. Cowlitz - Western Foothills Management Area Shoreline Reaches (Map Series 2).			
Reach Number	**Primary Waterbody Name**	**Shoreline Area (acres)**	**Map Reference (Township-Range)**
4C-01	Salmon Creek	359.2	T11N-R01W
4C-02	Salmon Creek	398.6	T11N-R01E, T11N-R01W
4C-03	Cedar Creek	439.7	T11N-R01E, T11N-R01W

Table 4.46 summarizes known geologic hazard critical areas for this management area as whole and lists the shoreline reaches in which land subject to each hazard is found.

Table 4.46. Cowlitz - Western Foothills Management Area Geologic Hazards (Map Series 11 - 14, 28).		
Hazard Type	**Percentage of Total Area**	**Reaches Affected**
Erosion Hazard [a]	22%	01-05, 08-19, 21
Seismic/Liquefaction [b]	29%	01-05, 08-12, 14-15, 18, 21
Rainier Blast Zone	0%	-
Mudflow/Lahar	0%	-
Channel Migration	0%	-
Landslide Hazard	0%	-
[a] Severe or Very Severe Erosion Hazard [b] Moderate to High Liquefactions Susceptibility		

All three reaches in this management area have known occurrences of coho, steelhead, and coastal resident cutthroat trout. Coho and steelhead use streams throughout the management area for spawning. Although they are not contiguous or extensive compared to wetlands in the lower valley of the Cowlitz River mainstem, significant wetlands are present in Cedar

Creek and Salmon Creek above the Cedar Creek confluence. Riparian areas are generally well vegetated with forest. Gravel bars and LWD are present, particularly in the lower reach below Cedar Creek, but are likely limited compared to historical conditions.

None of the three reaches in this management area has any known (reported) water quality impairments, or known or suspected threats to water quality.

4.4.3.2. Shoreline Use Patterns

Existing Shoreline Land Use and Designations

The Comprehensive Land Use designations from the Lewis County Comprehensive Plan in the shoreline management area are provided in Table 4.47a. Land use designations reflect the community's goals and they will be used in the process of determining the environment designations for the county's shoreline jurisdiction.

Table 4.47a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in Lewis County for the Cowlitz – Western Foothills Shoreline Management Area.

Description	Typical Uses	Percentage of Management Area
RRD 20	Residential Development, one dwelling per 20 acres	2.6%
Forest Resource Lands and Parks	Forested lands, forestry operations, state-owned conservation areas, and parks	96.0%
Mineral Resource Lands	Mining and undeveloped resource lands	1.4%

The current land use patterns that are found in the shoreline management area are provided in Table 4.47b. Existing land use patterns will be used in the process of determining the environment designations for the county'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 county was not available for this report.

The zoning designations from the Lewis County Code (Title 17 Land Use and Development Regulations) that are found in the shoreline management area are provided in Table 4.47c.

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 county'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 county was not available for this report.

Table 4.47b. Current Land Use Patterns in Lewis County for the Cowlitz – Western Foothills Shoreline Management Area.

Current Land Use Patterns	Percentage of Management Area
Single-Family Residential	0.5%
Multi-Family Residential	1.9%
Right-of-Way	1.1%

Table 4.47b. Current Land Use Patterns in Lewis County for the Cowlitz - Western Foothills Shoreline Management Area.	
Current Land Use Patterns	**Percentage of Management Area**
Agriculture	11.5%
Forest	82.4%
Timber	1.1%
Vacant/Undeveloped	0.3%
Unknown	1.2%

Table 4.47c. Current Zoning Designations in Lewis County for the Cowlitz - Western Foothills Shoreline Management Area.			
Description	**Symbol**	**Typical Uses**	**Percentage of Management Area**
Rural Development District 20	RDD-20	One dwelling unit per 20 acres, development limitations warrant lower density	2.6%
Forest Resource Lands	Forest	Commercial forestry operation	96.0%
Mine	Mine	Mining industries, undeveloped resource land	1.4%

Existing Public Access

The Cowlitz - Foothills shoreline management area has 35 miles of shoreline jurisdiction; however, it is primarily private forestland with no existing public access.

4.4.3.3. Shoreline Modifications

Table 4.48 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 this management area.

Table 4.48. Cowlitz - Western Foothills Management Area Shoreline Modifications (Map Series 19 to 20).		
Reach Number	**Sum of Dike and Levee Length (feet) [a]**	**Other Shoreline Modifications [b]**
4C-01	193	-
4C-03	263	-
[a] Data Source: Lewis County Dikes and Levees shapefile [b] Aerial Photography: Google Earth, May 2013		

4.4.3.4. Reach Functional Assessment

All three stream reaches in this management area received a score of 26 for overall functions. The streams scored similarly across functions, with minor variations between vegetation functions (forest cover for maintaining water temperatures) and hyporheic functions (support of vegetation). The stream channel within this hilly forested landscape exhibits relatively

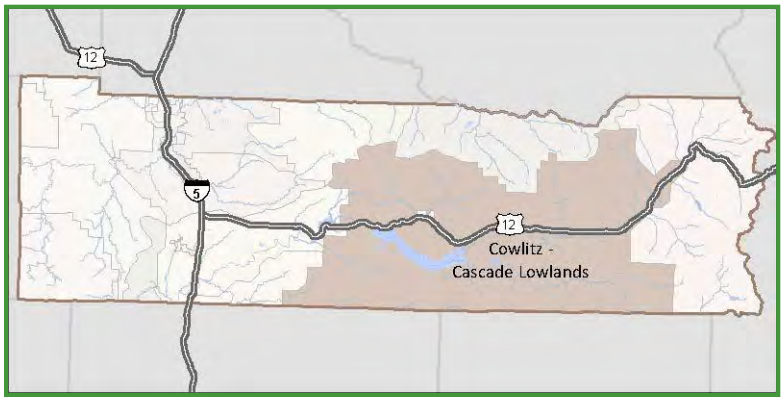
good channel complexity in terms of sinuosity and riparian vegetation throughout most areas, particularly where recent timber harvest is not evident. LWD is present and observable in aerial photographs, but may be limited to the lower reach below the Cedar Creek confluence. Due to a low level of development, timber harvest and associated roads may be the most significant cause of shoreline impacts throughout the management area. However, as described for forested management areas in the Chehalis basin, management areas containing a significant area of intensively managed forests in the Cowlitz watershed, including this one, are managed under existing systems (forest practice rules and HCPs); and those systems should help to protect and conserve priority species and functions associated with shorelines.

4.4.3.5. Restoration Opportunities

A restoration priority for the Cowlitz Western Foothills management area is the removal of barrier culverts that restrict salmonids' ability to access spawning and rearing habitats. Salmonid species that benefit in particular from culvert retrofits in smaller stream systems include coho, steelhead, and cutthroat trout. 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. Implementation of new forest practices outlined in the Department of Natural Resources' Habitat Conservation Plan, State Forest Practices Rules, and the Northwest Forest Plan will improve habitat conditions for a variety of salmonids (LCFRB 2010a).

Another restoration priority should focus on restoring riparian vegetation along Salmon Creek, which contains productive habitat for coho and winter steelhead (LCFRB 2010b). This should include multiple vegetation strata (ground cover, shrubs, and trees) to maximize ecological functions.

4.4.4. Cowlitz – Cascade Lowlands



The Cowlitz – Cascade Lowlands management area includes much of the eastern half of the county from the upstream extent of Mayfield Reservoir to the Cascade highlands located to the east. It encompasses 809 square miles of westerly trending ridges and valleys with medium gradient rivers and streams. This management area includes 60 reaches; 54 stream reaches and 6 lake reaches (including two in Riffe Lake). Primary subbasins within the management area are the Cowlitz River mainstem (including Riffe Lake) upstream to the Muddy Fork Cowlitz River, Tilton River, Cispus River, Winston Creek, and Skate Creek.

This management area also includes the lower reaches of higher elevation streams that are mostly located in Cascade highlands including Butter Creek, Coal Creek, Lake Creek, Johnson Creek, and Smith Creek. Land cover is 68 percent forest and woodland, 27 percent recently disturbed, 3 percent agricultural, grassland, or developed, and 2 percent open

water. Forty-eight percent of the land is public; the remaining 52 percent is in private ownership. Table 4.49 summarizes the physical characteristics of the Cowlitz – Cascade Lowlands management area. Shoreline jurisdiction includes 37,671 acres along 55 stream reaches (including the reservoirs on the Cowlitz River) and 5 lakes. Table 4.50 lists the reaches in this management area.

Table 4.49. Physical Characteristics of the Cowlitz - Cascade Lowlands Management Area.

Physiography [a]	Westerly trending ridges and valleys with reservoirs and medium gradient rivers and streams; U-shaped, glaciated valleys in the east
Elevation (feet) [b]	420-5,500
Lithology [a]	Oligocene-Eocene andesitic, basaltic, and rhyolitic lava flows and breccia[1] Quaternary alpine glacial and alluvial deposits in valleys[2]
Mean Annual Precipitation (inches) [b]	53-105
Natural Vegetation [a]	Western hemlock, western red cedar, Douglas fir
Land Use / Land Cover [a]	Douglas fir/western hemlock/western red cedar/vine maple/red alder forests are widespread; forestry and recreation are important land uses and pastureland occurs in lower valleys

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

4.4.4.1. Physical and Biological Characterization

This section discusses characteristic aspects of physical and biological conditions in this management area. Refer to Section 3.2.3.2 for an overview of the physical processes that influence shorelines in the terrain and land cover typical of this management area.

Runoff is generated by rainfall, rain-on-snow events, spring snowmelt, and glacial meltwater during the summer months. Forestry related impacts on upland vegetation structure have led to increased peak flows and decreased base flows in tributary basins.

Sediment yield is elevated above natural levels in many basins in this management area, and fine sediment loads are consequently high in many streams. 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

Table 4.50. Cowlitz – Cascade Lowlands Management Area Shoreline Reaches (Map Series 2).			
Reach Number	**Primary Waterbody Name**	**Shoreline Area (acres)**	**Map Reference (Township-Range)**
4D-01	Tilton River North Fork	541.5	T13N-R03E, T14N-R03E
4D-02	Tilton River	498.9	T13N-R03E, T13N-R04E
4D-03	Tilton River	289.9	T12N-R04E, T13N-R04E
4D-04	Johnson Creek	538.3	T12N-R04E, T12N-R05E
4D-05	Tilton River	31.0	T12N-R04E, T13N-R04E
4D-06	Connelly Creek	109.0	T13N-R04E
4D-07	Tilton River South Fork	189.6	T13N-R04E
4D-08	Tilton River East Fork	522.1	T13N-R04E, T13N-R06E
4D-09	Tilton River	52.9	T13N-R04E, T13N-R05E
4D-10	Tilton River	206.5	T13N-R05E
4D-11	Tilton River West Fork	320.0	T13N-R04E, T14N-R04E
4D-12	Winston Creek	171.1	T12N-R02E
4D-13	Winston Creek South Fork	680.0	T11N-R02E, T12N-R03E
4D-14	Salmon Creek	431.3	T11N-R01E, T11N-R02E
4D-15	Devils Creek	176.6	T11N-R02E, T11N-R03E
4D-16	Green River	328.9	T11N-R04E
4D-17	Green River	166.0	T10N-R05E, T11N-R05E
4D-18	Cowlitz River	507.6	T12N-R02E, T12N-R03E
4D-19	Cowlitz River	12,940.6	T11N-R04E, T12N-R05E
4D-20	Shelton Creek	55.8	T12N-R04E
4D-21	Landers Creek	124.4	T11N-R05E
4D-22	Rainey Creek	270.4	T12N-R05E, T12N-R06E
4D-23	Cowlitz River	201.5	T11N-R05E, T11N-R06E
4D-24	Goat Creek	197.3	T11N-R05E
4D-25	Lake Scanewa	586.7	T11N-R06E, T12N-R06E
4D-26	Cowlitz River	1,761.4	T12N-R06E, T12N-R07E
4D-27	Siler Creek	827.0	T12N-R07E
4D-28	Cowlitz River	1,785.3	T12N-R06E, T12N-R07E
4D-29	Kiona Creek	216.7	T12N-R06E, T13N-R06E
4D-30	Silver Creek	893.6	T12N-R07E, T14N-R07E
4D-31	Cowlitz River	2,216.7	T12N-R07E, T12N-R08E

Table 4.50 (continued). Cowlitz - Cascade Lowlands Management Area Shoreline Reaches.			
Reach Number	**Primary Waterbody Name**	**Shoreline Area (acres)**	**Map Reference (Township-Range)**
4D-32	Davis Creek	881.7	T12N-R08E
4D-33	Kilborn Creek	40.6	T12N-R08E
4D-34	Davis Creek	96.2	T12N-R08E, T13N-R08E
4D-35	Cowlitz River	1,155.5	T12N-R08E, T13N-R09E
4D-36	Cowlitz River	40.3	T13N-R09E
4D-37	Cowlitz River	1,971.8	T13N-R09E, T14N-R10E
4D-38	Hall Creek	355.7	T13N-R09E
4D-39	Butter Creek	49.6	T13N-R09E
4D-40	Cispus River	195.0	T11N-R06E
4D-41	Quartz Creek	278.5	T10N-R06E, T11N-R06E
4D-42	Cispus River	93.6	T11N-R06E
4D-43	Woods Creek	155.3	T11N-R06E, T11N-R07E
4D-44	Cispus River	415.6	T11N-R06E, T11N-R07E
4D-45	Greenhorn Creek	211.8	T11N-R07E
4D-46	Cispus River	105.2	T11N-R07E
4D-47	Cispus River	360.8	T11N-R07E, T11N-R08E
4D-48	Yellowjacket Creek	307.8	T11N-R08E
4D-49	Cispus River	288.2	T11N-R08E
4D-50	Cispus River	483.3	T10N-R09E, T11N-R09E
4D-51	Cispus River North Fork	576.0	T11N-R08E, T11N-R09E
4D-52	Willame Creek	368.0	T12N-R09E, T13N-R09E
4D-53	Skate Creek	647.9	T13N-R09E, T14N-R09E
4D-54	Smith Creek	34.9	T12N-R09E, T13N-R09E
4D-55	Johnson Creek	40.1	T13N-R09E
4D-56	Lake Creek	34.9	T13N-R09E
4D-57	Swofford Pond	314.8	T12N-R03E
4D-58	Unnamed Lake	62.9	T12N-R08E
4D-59	Bear Prairie	93.5	T14N-R08E
4D-60	Blue Lake	172.4	T11N-R09E

(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).

In this management area, hardwood species such as alder, cottonwood, maple, and willow dominate riparian corridors along larger streams and rivers. Upland climax species across the shoreline jurisdiction and landscape overall are western hemlock, Douglas fir, and western red cedar (WDW 1990). 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.

Most reaches in the Tilton watershed are sediment-transport reaches composed of large rock and bedrock; finer materials are transported downstream. As such, stream banks are inherently stable and resistant to erosion. Exceptions to this condition appear in the lower reach of the North Fork Tilton where it runs through easily erodible glacial till and in the mainstem Tilton downstream from the West Fork Tilton confluence.

Table 4.51 summarizes known geologic hazard critical areas for this management area as whole and lists the shoreline reaches in which land subject to each hazard is found.

Table 4.51. Cowlitz - Cascade Lowlands Management Area Geologic Hazards (Map Series 11 - 14, 28).

Hazard Type	Percentage of Total Area	Reaches Affected
Erosion Hazard [a]	10%	01-14, 16-26, 29-30, 32, 35-37, 40-41, 52-53
Seismic/Liquefaction [b]	15%	01-05, 07-13, 16-17, 19, 23, 32, 35-38, 40-42, 44-55, 57
Rainier Blast Zone	35%	26-39, 52-56, 58-59
Mudflow/Lahar	34%	19, 23-33, 35-42, 52-56, 58-59
Channel Migration	21%	26-33, 35-39, 46-47, 49, 52, 53, 55-56, 58
Landslide Hazard	<1%	06-08

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

All six priority fish species including the four federally listed salmon species are present in this management area. Multiple species are present in nearly all of the reaches with the exception of Shelton Creek (a small drainage entering Lake Riffe), and the isolated lakes which do not support priority fish species. Many reaches are used are used for spawning. Spawning Chinook and steelhead are documented throughout the management area. Wetlands are present in 51 of the 60 reaches. Wetlands are prominent in the wide valley of the meandering Cowlitz River mainstem upstream from Lake Scanewa, and adjacent to Davis Creek, a tributary of the Tilton River, near Morton. These same areas also contain priority habitat for cavity nesting ducks.

Natural barriers to anadromous fish passage occur on many tributaries within a mile or two of the confluence with the upper Cowlitz River. The low-gradient habitat within these tributary

channels provides a large proportion of the habitat within the subbasin. Channel alterations, combined with increased sediment inputs, have created low-flow passage problems and reduced habitat quality within these important reaches. LWD is generally lacking, resulting in limited pool habitat, cover, and habitat diversity in the mainstem and lower reaches of most tributaries. LWD recruitment potential is also low (Wade 2000).

There are 60 reaches in this management area. There are 23 listings for polluted conditions affecting 14 of the reaches. Pollution due to temperature is the cause of 21 of the listings. There are also two reaches that are listed due to invasive species, both on lakes (Riffe Lake and Swofford Pond). This management area also has 12 listings for threatened water quality conditions, with the exception of three reaches listed for dissolved oxygen and two for biological assessment, the remaining threats are also associated with elevated temperatures.

4.4.4.2. Shoreline Use Patterns

Existing Shoreline Land Use and Designations

The Comprehensive Land Use designations from the Lewis County Comprehensive Plan in the shoreline management area are provided in Table 4.52a. Land use designations reflect the community's goals and they will be used in the process of determining the environment designations for the county's shoreline jurisdiction.

Table 4.52a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in Lewis County for the Cowlitz – Cascade Lowlands Shoreline Management Area.

Description	Typical Uses	Percentage of Management Area
RRD 5	Residential Development, one dwelling per 5 acres	4.2%
RRD 10	Residential Development, one dwelling per 10 acres	5.6%
RRD 20	Residential Development, one dwelling per 20 acres	33.8%
Cities, UGAs and LAMIRDS	Cities, rural residential, commercial, and industrial development	2.2%
Agricultural Resource Lands	Commercial production of aquaculture, horticulture, grain, dairy, and other crops	11.9%
Forest Resource Lands and Parks	Forested lands, forestry operations, state-owned conservation areas, and parks	41.5%
Mineral Resource Lands	Mining and undeveloped resource lands	0.8%

The current land use patterns that are found in the shoreline management area are provided in Table 4.52b. Existing land use patterns will be used in the process of determining the environment designations for the county'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 county was not available for this report.

Table 4.52b. Current Land Use Patterns in Lewis County for the Cowlitz - Cascade Lowlands Shoreline Management Area.	
Current Land Use Patterns	**Percentage of Management Area**
Single-Family Residential	1.8%
Multi-Family Residential	3.5%
Industrial	0.1%
Utilities	28.6%
Right-of-Way	0.7%
Railroad	0.1%
Service/Government	1.6%
Cultural/Recreational	1.8%
Open Space	0.3%
Agriculture	11.4%
Forest	25.1%
Timber	1.3%
Water	1.3%
Vacant/Undeveloped	15.9%
Unknown	6.5%

The zoning designations from the Lewis County Code (Title 17 Land Use and Development Regulations) that are found in the shoreline management area are provided in Table 4.52c. 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 county's shoreline jurisdiction.

Existing Public Access

The Cowlitz - Cascade Lowlands management area has 399 miles of shoreline jurisdiction. There are a number of public access points in the shoreline management area. The Riffe Lake area provides a recreational resource for the central county area, and resort and recreation opportunities are encouraged where adequate public facilities can be provided cost effectively and significant environmental consequences avoided.

On Riffe Lake:

- Riffe Buffer Unit is a unit of WDFW's Cowlitz Wildlife Area and was started as mitigation for the Cowlitz River hydroelectric projects. Tacoma Public Utilities has purchased a 60- to 300-foot buffer along the entire shoreline of Riffe Reservoir. The upland is mainly in private timber ownership and access to the buffer is primarily by water. Large wood within the reservoir precludes water sport activities but the reservoir is known for its trout and landlocked coho fishery. The buffer zone is best accessed via boat though some locations may be accessible via logging road.

  Unlike the buffer on Mayfield Lake, Riffe Lake's buffers are predominately bordered by private commercial timberlands. The buffer zone provides diversity of forage and

Table 4.52c. Current Zoning Designations in Lewis County for the Cowlitz – Cascade Lowlands Shoreline Management Area.

Description	Symbol	Typical Uses	Percentage of Management Area
Agricultural Resource Lands	ARL	Commercial production of aquaculture, horticulture, grain, dairy, and other crops	8.24%
Forest Resource Lands	Forest	Commercial forestry operation	27.07%
Lake [a]	Lake	Lake	30.67%
Mine	Mine	Mining industries, undeveloped resource land	0.54%
Park	Park	Park or open space	0.61%
PTSA	PTSA	PTSA	0.60%
Rural Development District 10	RDD-10	Residential development compatible with rural character, one dwelling unit per 10 acres	3.88%
Rural Development District 20	RDD-20	Development limitations warrant lower density, one dwelling unit per 20 acres	23.40%
Rural Development District 5	RDD-5	Residential development near population centers such as UGAs and small towns, one dwelling unit per 5 acres	2.89%
Rural Residential Center	RRC-R10000	Rural residential development	0.02%
Rural Residential Center - R.5	RRC-R.5	Rural residential development with density greater than one unit per 0.5 acre	0.04%
Rural Residential Center - R1	RRC-R1	Rural residential development with density greater than one unit per 1 acre	0.66%
Rural Residential Center - R2	RRC-R2	Rural residential development with density greater than one unit per 2 acres	0.01%
Small Towns - Industrial	STI	Mills, forest products and agricultural industries	0.15%
Small Towns - Mixed Use/Commercial	STMU	Commercial uses, retail uses, gateway communities	0.59%
Small Towns - Residential	STR-4	Residential development, four dwelling units per acre	0.03%
Wilderness	Wilderness	Federal or state forestlands	0.60%

[a] While 'Lake" is not a Lewis County zoning designation, it is shown as such so that Riffe Lake and Mayfield Lake (reservoirs) are included in the land use calculations.

cover not found in the adjacent clearcuts making this area a vital habitat component for local wildlife. Fishing for landlocked coho (silvers) is a favorite pastime of those visiting this area as well as hang gliding and windsurfing. There is also a bass fishing competition on this lake annually.

- Kosmos Unit is a 750-acre unit of WDFW's Cowlitz Wildlife Area and is located on the east end of Riffe Lake. It is managed for black-tailed deer, bald eagles, and waterfowl, and riparian forest, riparian shrub and emergent wetland habitats in general. In addition to several large fields that are hayed by contractors to maintain forage values, there are ponds and forest/shrub corridors. Three perennial creeks that flow into this unit are managed for cavity-nesting species and salmonids. A proposed project to create a 40-acre impoundment will provide additional emergent wetland habitat to benefit dabbling ducks, amphibians, and other wildlife.

  There is a boat launch operated by Cowlitz Wildlife Area staff on Riffe Lake:

  - **Kosmos** – On the north bank of Riffe Lake accessible from Kosmos Road West there is a year-round, non-ADA accessible boat launch for non-motorized boats with non-ADA restroom facilities.

- Mossyrock Park is operated by Tacoma Power and is located at the east end of Riffe Lake. It provides year-round camping, day use area, and a boat launch. There are152 individual campsites, 2 group camp areas, a 60-site group camp and a 10-site primitive group camp with coin-operated showers, laundry facilities, a store and concession stand, and ADA accessible restrooms. Public access to the lake includes a boat launch, fish cleaning station, and swimming area. Swimming and boat launching are lake level permitting.
- Mossyrock Dam View Point from U.S. Route 12 provides water-enjoyment visual access to the lake.
- Taidnapam Park is operated by Tacoma Power and is located at the east end of Riffe Lake. It provides a fishing bridge on Riffe Lake. It provides a forested campground with 163 individual RV sites, 24 walk-in tent sites, a 60-site group camp, and a 10-site primitive group camp with coin-operated showers, laundry facilities, and ADA accessible restrooms. The day-use area offers picnic tables, grills, horseshoes, swimming; outdoor showers and kids play equipment. Swimming and boat launching are lake level permitting.

  There are two boat launches open mid-May through mid-September:

  - Taidnapam boat launch
  - North Taidnapam boat launch

Near Mossyrock:

- Mossyrock Unit is a 750-acre unit of WDFW's Cowlitz Wildlife Area and is located northeast of Mossyrock. It is managed for black-tailed deer, waterfowl, and riparian forest habitats. The unit has several large fields, several ponds, and several riparian forest corridors. The fields are hayed by contractors and maintained as forage fields.

- Swofford Unit is a 300-acre unit of WDFW's Cowlitz Wildlife Area surrounding Swofford Pond southeast of Mossyrock and south of Riffe Lake. It is managed for elk, black-tailed deer, waterfowl, and riparian forest habitat. This unit has several large fields, a pond, and several riparian forest corridors. The fields are hayed by contractors and maintained as forage fields. The southern end borders industrial timberlands located on a steep slope. Formal public access is provided by a trail along the south shore of Swofford Pond that is accessed near an unimproved boat launch on the pond.

Near Morton:

- Peterman Ridge Unit is a 6,840-acre unit of WDFW's Cowlitz Wildlife Area and is located south of Morton. It is the largest unit in the Cowlitz Wildlife Area. It is managed for the pileated woodpecker (a sensitive species), black-tailed deer, and Douglas squirrels. Its forested wetland areas on Peterman Ridge also provide habitat for beaver, amphibians and other wetland- dependent species. Wildlife use throughout the unit is diverse, including elk, black bear, cougar, grouse, and turkey. There is approximately 10 miles of multi-use trail providing public access to the area. The trail is composed of single track trail connecting forest roads.

Near Randle:

- Spears Unit is a 418-acre unit of WDFW's Cowlitz Wildlife Area and is located south of Randle. The unit is managed for black-tailed deer, dabbling ducks, emergent wetland, forested wetland, riparian forest, and riparian shrub habitat. A large pond was created by the installation of a dike to retain water for mill operations prior to WDFW management. Two creeks flow through the unit and converge near the western boundary before draining into the Cowlitz River. Siler Creek, which flows along the southeastern boundary of the unit, is diked to keep water out of adjacent agricultural fields.
- Maple Grove Golf Course south of Randle provides water-enjoyment use through visual access to the Cowlitz River adjacent to the course.

On the Cispus River:

- Iron Creek Campground is a U.S. Forest Service campground in the Gifford Pinchot National Forest next to the Cispus River. It has 98 campground camping sites and 98 RV sites. Fishing in the Cispus River is available.
- Tower Rock Campground is a U.S. Forest Service campground in the Gifford Pinchot National Forest next to the Cispus River. It has 21 campground camping sites and 21 RV sites.
- The Cispus Learning Center in Cispus Valley serves more than 16,000 students and adults each year. It is located in the Gifford Pinchot National Forest operating under a special use permit with the U.S. Forest Service.

On Davis Lake:

- Davis Lake Unit is a 243-acre unit of WDFW's Cowlitz Wildlife Area and is located east of Morton. It is managed for black-tailed deer, waterfowl, salmonids, and riparian

forest habitat. In addition to several large fields that are mowed to maintain forage values, there is a large pond, wetlands and forested/shrub corridors.

On Kiona Creek:

- Kiona Creek Unit is a 243-acre unit of WDFW's Cowlitz Wildlife Area and is located off Savio Road west of Randle. It is managed for black-tailed deer, dabbling ducks, and other riparian forest and forested wetland habitat species. Three perennial creeks (Squaw, Kiona, and Oliver) have been largely altered to drain water from the agricultural fields that comprise the western portion of the unit. Squaw and Oliver creeks supply water to the large wetland area that comprises the eastern portion of the unit. In 2004, a wetland restoration plan was completed to optimize the habitat value and restore hydrology to more natural conditions.

On Lake Scanewa:

- The Lewis County Public Utility District operates Cowlitz Falls Park. The day-use park located at the east end of Lake Scanewa where the Cispus and Cowlitz Rivers meet. The falls are now buried beneath the Scanwea Reservoir after the Cowlitz Falls Dam was built in 1994. The park has picnic tables, a boat ramp with dock, a swimming area, and a restroom facility. There are several locations to fish.
- The Lewis County Public Utility District near Cowlitz Falls Park operates Cowlitz Falls Campground. It provides over 100 campsites, 40 with water and electric hookups. There is a picnic area with tables and barbecue units, a boat launch, a few nature trails and a kid's play area.

Chapman:

- West of the city of Morton, accessible from Chapman Road, there is a year-round, non-ADA accessible boat launch for non-motorized boats.

4.4.4.3. Shoreline Modifications

Table 4.53 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 this management area.

4.4.4.4. Reach Functional Assessment

Reaches in this management area scored between 19 and 34 in the functions assessment, indicating a wide range of functional values and impairments. The highest scoring reaches were lakes with significant associated wetlands, although several stream reaches scored between 29 and 31. This management area has an average score of 26, exhibiting moderate functional values and impairments similar to other management areas throughout the county with primarily rural shoreline jurisdictions. Impairments noted in the shoreline jurisdiction during the functions assessment included logging roads, armoring, lack of LWD, and water quality impairments, primarily high temperatures. Currently, the system of dams blocks all natural upstream passage and downstream migration. Downstream migrants are captured at the Cowlitz Falls Dam and transported below the dams. Lake Scanewa inundated the once

productive reaches of the upper Cowlitz increasing predation and reducing key habitat for spawning, incubation, and fry colonization (Wade 2000).

Table 4.53 Cowlitz – Cascade Lowlands Management Area Shoreline Modifications (Map Series 19 to 20).

Reach Number	Sum of Dike and Levee Length (feet) [a]	Other Shoreline Modifications [b]
4D-02	3,303	Limited bank armoring near Hwy 508
4D-03	3,093	Limited bank armoring near Hwy 508
4D-08	Unknown	Heavy armoring exists throughout the range of salmon habitat use on the East Fork Tilton (Murray Pacific 1993, as cited in Wade 2000).
4D-13	184	
4D-18	-	Bulkheads or armoring associated with residences/ docks along Lake Road
4D-19	-	Mossyrock Dam
4D-22	231	Low intensity development and vegetation removal along right bank
4D-29	1,781	
4D-30	8,687	Extensive armoring near confluence with Cowlitz River
4D-31	5,744	Limited armoring
4D-32	131	
4D-33	114	
4D-35	1,305	
4D-37	12,285	
4D-38	2,966	
4D-39	3,778	Most of reach is armored and has straightened channel
4D-40	3,850	
4D-46	73	
4D-47	1,879	Limited armoring in portion of reach
4D-55	3,342	Extensive armoring confines channel

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

A coniferous, old-growth stand exists in much of the riparian zone in the East Fork Tilton. Most of the smaller streams such as the tributaries of the Tilton River are naturally confined and have little, if any, floodplain habitat. The mainstem Tilton, below the West Fork confluence, is naturally unconfined and meanders. It becomes braided during times of high sediment supply. Above the confluence, the river is naturally confined.

Past management practices on private and public lands, especially road construction and timber harvests have contributed to increased peak flows, excessive sediment delivery to streams, bank instability, increased frequency of debris flows, and reduced riparian function and instream LWD. A number of roads adjacent to streams have also channelized the river

and isolated already limited off-channel rearing habitat. For example, side channel and off channel habitat is generally limited within the Tilton watershed, thus juveniles have minimal refuge from high flows that often flush them out of the river (Wade 2000). Side channel habitat below the town of Morton provides some critical areas with refuge from high flows. Despite these common impairments, some areas within the subbasin have relatively functioning habitat and recent forest management practices may eventually address many of the remaining problems related to forestry practices.

4.4.4.5. Restoration Opportunities

A restoration priority is to augment and restore side channel habitat along the mainstem of rivers and creeks. The Lower Cispus Side Channels Restoration project proposed by the Cowlitz Indian Tribe is a good example of off-channel habitat restoration. The project site is located in a Tier 1 reach (highest priority reach) in the Lower Columbia Salmon Recovery Plan (LCFRB 2010b).The project will re-create, restore, and connect off-channel habitat disconnected or destroyed over the past century along two historic side channels on the Cispus River. One side channel is located downstream of the confluence with the Cispus River and the North Fork Cispus while the other side channel is located above the confluence of the Cispus River and Yellowjacket Creek (Habitat Work Schedule 2013). One of the project goals is to excavate the existing side channels to increase the interception of shallow groundwater, which can provide excellent water quality conditions (thermal refugia) for salmonids.

Another restoration priority is to enhance ecosystem functioning in tributary streams. The Lower Yellowjacket Creek Design project proposed by the Cowlitz Indian Tribe would increase the volume of stable wood in the project reach, increase island stability, encourage riparian growth along stream banks and islands, and increase the overall wood volume in the project reach. Project reaches are located on the mainstem Yellowjacket Creek near its confluence with the Cispus River (Habitat Work Schedule 2013). The goal of the project is to evaluate the scale of action required to restore stream habitat in the lower Yellowjacket Creek over the long term. The lower Yellowjacket Creek mainstem is also designated as a Tier 1 reach in the Lower Columbia Salmon Recovery Plan (LCFRB 2010b).

Restoring volitional salmonid access above Mayfield, Mossyrock, and Cowlitz Falls Dams is another project opportunity suggested by the Lower Columbia Fish Recovery Board (2010a). The dam system on the Cowlitz River prevents volitional fish access to 300 or more linear miles of river and stream habitat.

In general, protection of anadromous salmon habitat within the Riffe Lake subbasin is not a high priority because of the existing passage problems through the Lake and through Mossyrock Dam for downstream migrants.

The limiting factors report for Cowlitz River watershed (Wade 2000) includes recommendations for addressing limiting factors and focusing protection efforts for salmon habitats. Examples are provided below. These, and recommendations for other subbasins that overlap with the management areas should be considered in developing the restoration plan for the Coalition's SMP update, to be prepared in a later phase of the SMP update process.

The Cispus and Tilton River are included in the Fisheries and Hatchery Management Plan Update for the Cowlitz River Project (Tacoma Power 2011). The plan was developed to fulfill

requirements of the settle agreement between Tacoma Power and FERC for the Cowlitz River Hydroelectric Project. The agreement states that "The emphasis of this agreement is ecosystem integrity and the restoration and recovery of wild, indigenous salmonid runs, including ESA-listed and unlisted stocks to harvestable levels." The plan includes actions to supplement and monitor fish populations to support harvest goals. For example, it includes the transport of hatchery coho salmon and steelhead to the Tilton River where they are released from acclimation ponds to colonize available habitat.

Recommendations for addressing limiting factors in the Cispus River subbasin include the following:

- Native fish reintroduction efforts in the entire subbasin are dependent upon successful operation of the Cowlitz Falls Fish Collection Facility. It is critical to the recovery of anadromous fish that capture efficiency at the dam be monitored and improved over time.
- The USFS should continue to address road related problems that reduce floodplain connectivity and limit rearing habitat within the subbasin.
- Enhance existing instream habitat by supplementing LWD abundance. Utilize LWD that collects at Mossyrock Dam for projects within the Cispus subbasin.
- Manage early- and mid-structural stands within riparian reserves to develop late structural characteristics in the Cispus subbasin.
- Flow thresholds for drawdowns should be reevaluated, and if possible increased, to assure that juveniles are not flushed over the dam into Riffe Lake.

Habitats that may be suited for protection in the Cispus River subbasin include the following:

- The North Fork Cispus provides some of the best functional habitat in the subbasin and protection of this system is the highest priority in the subbasin.
- Off-channel habitat within the mainstem Cispus between Iron Creek (RM 8.2) and the North Fork Cispus (RM 19.9) provides important rearing habitat for juveniles.
- Enhance the fair-quality habitats in the North Fork Cispus, Yellowjacket Creek, and Greenhorn Creek (in order of priority).
- Maintain the high-quality habitats in Woods, Orr, and Iron creeks.

Habitats that may be suited for protection in the Tilton subbasin include the following:

- Winston Creek supports a "healthy" run of resident cutthroat trout that need protection.
- Some of the best habitat within the Tilton watershed occurs within the South Fork Tilton, the mainstem Tilton from Nineteen Creek (RM 22.9) to the falls (RM 25), and in the W.F. Tilton.
- Coon, Snow, and Trout creeks, tributaries to the North Fork Tilton, have coarse, unembedded substrates with pocket water and complex, shallow, channel margins that are ideal as summer-rearing areas for steelhead and resident trout.

- The lower W.F. Tilton contains especially productive coho habitat, and good summer and winter habitat is available for all salmonid species and life stages.

4.4.5. Cowlitz – Cascade Highlands

The Cowlitz – Cascade Highlands management area is located along the eastern-most portion of the county. It encompasses 356 square miles of steep, glaciated, dissected mountains and ridges with high to medium gradient streams and glacial rock-basin lakes. This management area include the upper Cowlitz River and tributaries, the majority of the Johnson Creek and Smith Creek drainages, and the high elevation headwater tributaries of the Cispus River before they flow into Skamania County. This management area is entirely encompassed by the Gifford Pinchot National Forest and other state and federal managed forest lands, some of which is permanently protected as wilderness. Land cover is 89 percent forest and woodland, 7 percent recently disturbed, and 2 percent grassland, or developed. Ninety-nine percent of the land is in public ownership. Table 4.54 summarizes the physical characteristics of the Cowlitz – Cascade Highlands management area.

Table 4.54. Physical Characteristics of the Cowlitz – Cascade Highlands Management Area.

Physiography [a]	Steep, glaciated, dissected mountains and ridges with high to medium gradient streams and glacial rock-basin lakes
Elevation (feet) [b]	1,400-7,400
Lithology [a]	Oligocene-Miocene andesitic and basaltic lava flows and breccia
Mean Annual Precipitation (inches) [b]	70-115
Natural Vegetation [a]	Pacific silver fir, western hemlock, mountain hemlock, Douglas fir; some noble fir
Land Use / Land Cover [a]	Extensive Pacific silver fir/western hemlock/Douglas fir/mountain hemlock/noble fir/subalpine fir/grand fir/white fir forests; common land uses include forestry and recreation; important regional water source.

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

Shoreline jurisdiction includes 8,503 acres along 27 reaches in this management area; 20 of those are stream reaches and 7 are lakes. Many of the lakes are isolated from streams except for Packwood Lake that drains to Lake Creek and Walupt Lake, and an unnamed lake that are the headwaters of the Cispus River drainage. Table 4.55 lists the reaches in this management area.

Table 4.55. Cowlitz – Cascade Highlands Management Area Shoreline Reaches (Map Series 2).			
Reach Number	**Primary Waterbody Name**	**Shoreline Area (acres)**	**Map Reference (Township-Range)**
4E-01	Butter Creek	371.7	T13N-R09E, T14N-R09E
4E-02	Cowlitz River Muddy Fork	730.8	T14N-R09E, T15N-R09E
4E-03	Cowlitz River	85.3	T14N-R10E
4E-04	Ohanapecosh River	54.9	T14N-R10E
4E-05	Ohanapecosh River	437.1	T14N-R10E, T15N-R10E
4E-06	Cowlitz River Clear Fork	76.3	T14N-R10E
4E-07	Cowlitz River Clear Fork	736.4	T13N-R11E, T14N-R11E
4E-08	Cortright Creek	310.4	T14N-R10E, T14N-R11E
4E-09	Summit Creek	820.5	T14N-R10E, T15N-R11E
4E-10	Coal Creek	171.6	T13N-R09E, T13N-R10E
4E-11	Lake Creek	206.2	T13N-R09E, T13N-R10E
4E-12	Packwood Lake	546.2	T13N-R10E
4E-13	Upper Lake Creek	350.9	T12N-R10E, T13N-R10E
4E-14	Johnson Creek	1036.7	T12N-R09E, T13N-R09E
4E-15	Smith Creek	336.1	T12N-R09E
4E-16	Cispus River North Fork	101.6	T11N-R09E, T11N-R10E
4E-17	Cispus River	142.2	T11N-R10E
4E-18	Cispus River	552.5	T11N-R10E, T11N-R11E
4E-19	Walupt Lake	469.8	T11N-R11E
4E-20	Walupt Creek	86.8	T11N-R11E
4E-21	Cispus River	514.6	T11N-R10E, T12N-R11E
4E-22	Frying Pan Lake	65.9	T14N-R11E
4E-23	Jug Lake	93.3	T14N-R11E
4E-24	Dumbbell Lake	81.2	T14N-R11E
4E-25	Lily Lake	50.2	T13N-R11E
4E-26	Unnamed Lake	35.3	T13N-R10E
4E-27	Goat Lake	38.2	T12N-R11E

4.4.5.1. Physical and Biological Characterization

The Cascade Highlands portion of the Cowlitz basin is relatively unaffected by human activity, compared to other management areas. Consequently, there is little information available that is specific to this portion of the basin. The lower elevations in this management area share characteristics with the Cowlitz – Cascade Lowlands management area (Section 4.4.3). Refer to Sections 3.2.3.2 and 3.2.3.3 for a general overview of the physical processes that influence shorelines in the terrain and land cover types found in this management area.

Table 4.56 summarizes known geologic hazard critical areas for this management area as whole and lists the shoreline reaches in which land subject to each hazard is found.

Table 4.56. Cowlitz - Cascade Highlands Management Geologic Hazards (Map Series 11 - 14, 28).

Hazard Type	Percentage of Total Area	Reaches Affected
Erosion Hazard [a]	<1%	01, 15
Seismic/Liquefaction [b]	28%	02, 05, 07-09, 12-13, 16-21, 23, 25
Rainier Blast Zone	49%	01-12, 14-15, 22-23, 25
Mudflow/Lahar	12%	02-06, 09
Channel Migration	<1%	02-03
Landslide Hazard	0%	–

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

Priority fish species are present in 21 reaches, all of the reaches in the management area except for the six isolated lakes. Chinook, coho and, steelhead are generally present in the lower reaches of Butter Creek, Muddy Fork and Clear Fork of the Cowlitz River, Ohanapecosh River, Johnson Creek, and Smith Creek. Some of these reaches provide known spawning habitat for Chinook and steelhead. Rainbow and cutthroat trout presence is mapped in the smaller tributaries higher in the systems that do not generally support the listed salmon species. Wetlands are mapped in several reaches, although they are not common in the high elevation forested terrain. They are primarily associated with the lakes or isolated to specific areas in a portion of the stream reaches; Laughingwater Creek, Summit Creek, and Smith Creek. As with other mountainous areas, this management area does not contain the priority habitats that are generally associated with lowland valley streams and shorelines. However, relatively undisturbed forested riparian zones are dominant in this management area, which, as mentioned previously, is entirely within managed federal and state forest lands.

There are 27 reaches in this management area. There are two listings for polluted conditions affecting two of the reaches. Pollution due to temperature is the cause of both listings. This management area also has three listings for threatened water quality conditions, two of these are associated with degradation based on biological assessment, and the third is due to elevated temperatures.

4.4.5.2. Shoreline Use Patterns

Existing Shoreline Land Use and Designations

The Comprehensive Land Use designations from the Lewis County Comprehensive Plan in the shoreline management area are provided in Table 4.57a. Land use designations reflect the community's goals and they will be used in the process of determining the environment designations for the county's shoreline jurisdiction.

Table 4.57a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in Lewis County for the Cowlitz - Cascade Highlands Shoreline Management Area.		
Description	**Typical Uses**	**Percentage of Management Area**
RRD 10	Residential Development, one dwelling per 10 acres	0.1%
Forest Resource Lands and Parks	Forested lands, forestry operations, state-owned conservation areas, and parks	99.9%

The current land use patterns that are found in the shoreline management area are provided in Table 4.57b. Existing land use patterns will be used in the process of determining the environment designations for the county'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 county was not available for this report.

Table 4.57b. Current Land Use Patterns in Lewis County for the Cowlitz - Cascade Highlands Shoreline Management Area.	
Current Land Use Patterns	**Percentage of Management Area**
Right-of-Way	0.2%
Cultural/Recreational	0.6%
Forest	19.4%
Vacant/Undeveloped	79.8%

The zoning designations from the Lewis County Code (Title 17 Land Use and Development Regulations) that are found in the shoreline management area are provided in Table 4.57c. 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 county's shoreline jurisdiction.

Table 4.57c. Current Zoning Designations in Lewis County for the Cowlitz - Cascade Highlands Shoreline Management Area.			
Description	**Symbol**	**Typical Uses**	**Percentage of Management Area**
Rural Development District 10	RDD-10	Residential development compatible with rural character, one dwelling unit per 10 acres	0.1%
Forest Resource Lands	Forest	Commercial forestry operation	54.5%
Wilderness	Wilderness	Federal or state forestlands	45.4%

Existing Public Access

The Cowlitz - Cascade Highlands shoreline management area has 156 miles of shoreline jurisdiction. There are a number of public access points in the shoreline management area.

Public access is provided in the Gifford Pinchot National Forest through camping sites and hiking trails in the warm months and trails for cross-country skiing, snowshoeing, and snowmobiling during the winter. The William O. Douglas, Tatoosh, and Goat Rocks Wilderness areas lie within the forest.

Shoreline Modifications

No dikes or levees for reaches are recorded in the available data, nor were 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 this management area. Given the remote location of most of the reaches in this management area, extensive shoreline modification is unlikely to be present.

4.4.5.3. Reach Functional Assessment

Reaches in this management area have functions assessment scores ranging between 23 and 33. The average score for the management area overall and across all functions was relatively high at 27.4 indicating good functional values and relatively low impairments from anthropogenic causes. This is consistent with the dominate land use and zoning designations for the management area. The lowest scored reach is Goat Lake, an isolated, high elevation, alpine lake with steep and mostly unvegetated slopes. The natural characteristics of this lake limit the functions score. Like many of the relatively small, high elevation isolated lakes in this management area there is also limited potential for habitat use by priority species, which are more commonly associated with shorelines in lower elevations that provide more suitable and diverse habitats, opportunities for foraging and breeding, and are more accessible. Most of the functions in this management area overall are limited by steep slopes and general lack of wetlands and off channel or backwater habitats. LWD may be limited in the Cispus River. Many of the reaches had reduced scores due to high temperature, and some for low dissolved oxygen, affecting water quality.

4.4.5.4. Restoration Opportunities

Restoring riparian and floodplain functioning on Johnson Creek should be a restoration priority for the Cowlitz – Cascades Highlands management area. The lower reach of Johnson Creek is designated as a Tier 1 reach (highest priority reach) for restoration (LCFRB 2010b). Riparian restoration can include livestock exclusion, tree planting, road relocation, invasive species eradication, and adjusting current land-use in the riparian zone (LCFRB 2010b).

As described for the Cowlitz - Cascade Lowlands, restoration opportunities may include those identified for subbasins in the management area by Wade (2000). Specific restoration actions in this management area may be relatively limited compared to other management areas, and the shoreline jurisdiction overall. Conservation and protection strategies may be more appropriate in this management area due to extensive federal and state land ownership, and existing levels of protection from development. Activities toward conservation, protection, or restoration would need to be coordinated closely with the agencies responsible for managing the lands in this management area.

4.5. City of Centralia

The city of Centralia is located near the northern border of Lewis County, surrounded by the Upper Chehalis – Puget Lowlands management area. It encompasses 16.3 square miles of developed floodplain and low hills. The city's SMP jurisdiction consists of 1,900 acres covering six stream reaches. The primary SMP streams within the city are the Chehalis River (covered by reaches CE-01, CE-03, and CE-04), the Skookumchuck River (covered by reaches CE-02 and CE-06), and Salzer Creek (reach CE-05). Plummer Lake is a shoreline of the state (covered by reach CE-03).

During the SMP update's shoreline jurisdiction determination process, Hayes Lake, Fort Borst Lake, China Creek, Coffee Creek, and Scammon Creek were evaluated to see if they individually qualified as potential shorelines of the state. Hayes Lake is less than 20 acres in size and does not meet the state's definition of a shoreline of the state (RCW 90.58.030(2)(e)). However, the entire lake falls within the shoreline jurisdiction of the Skookumchuck River (reach CE-02), so it is regulated under the SMA. Fort Borst Lake is less than 20 acres in size and does not meet the state's definition of a shoreline of the state (RCW 90.58.030(2)(e)). However, the entire lake falls within the shoreline jurisdiction of the Skookumchuck River (reach CE-02), so it is regulated under the SMA. Plummer, Fort Borst, and Hayes Lakes are former borrow pits that were created by the construction of Interstate 5 in the 1950s.

While they are regulated under other local and state laws, China Creek, Coffee Creek, and Scammon Creek do not meet the definition of shorelines of the state. RCW 90.58.030(2)(e) and WAC 173-18-040 define the point at which a stream becomes a shorelines of the state subject to the SMA as the point where a stream reaches a mean annual flow of twenty cubic feet per second down to the mouth of said stream or river. China Creek, Coffee Creek, and Scammon Creek do not cross this threshold. Both China and Coffee Creek are fish-bearing streams.

Portions of these three creeks, however, do fall into the shoreline jurisdiction defined for other shorelines of state in the city. For example, most of the length of China Creek falls within the 2010 flood channel study area of the Chehalis River (reach CE-03), so the portion of China Creek within the 2010 flood channel study area is regulated under the SMP. That portion of Coffee Creek that is within the 2010 flood channel study area of the Skookumchuck River is within the shoreline jurisdiction of the Skookumchuck River (reach CE-03), and is regulated under the SMP. That portion of Scammon Creek that falls within the 2010 flood channel study area of the Chehalis River is within the shoreline jurisdiction of the Chehalis River (reach CE-01), so it is regulated under the SMP.

There are three small lakes south of Reynolds Avenue related to Coffee Creek known as the Reynolds Lakes. They are also the result of gravel excavations. Coffee Creek runs north of the

largest of these lakes and adjoins the lake furthest to the west. The lakes themselves do not meet the definition of shorelines of the state, but they are within the 2010 flood channel study area of the Skookumchuck River, so they are within the shoreline jurisdiction of the Skookumchuck River (reach CE-03), and regulated under the SMP.

The Lakeside Gravel Pit (formerly reach CE-07 in the draft of this report) meets Ecology's criteria as an industrial water body and is not subject to the SMA. Industrial water bodies are artificial water bodies that, despite meeting the basic dimensional criteria in the SMA, have characteristics that make it appropriate to exclude them as shorelines of the state because they do not advance the policy objectives of the SMA. The Lakeside Gravel Pit is being actively mined, it operates under a current DNR Surface Mine Reclamation Permit, access to the gravel pit is restricted to people operating the facility, and the owner is in the process of filling in the pit, so there will not be a functioning lake once mining is completed. In addition, there are no connections to other surface water bodies, no recreation or other activities are allowed, and it was not intentionally built to support fish or wildlife habitat. As such, this reach was removed from the shoreline jurisdiction.

4.5.1. Citywide Physical and Biological Characterization

Centralia 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.

Citywide shoreline management area land cover is 16 percent developed, 41 percent agricultural vegetation or grassland, 27 percent forest or woodland, 13 percent recently disturbed, and 2 percent open water. Seventy-four percent of the land is privately owned; the remaining 26 percent is municipal, county, or state land. Table 4.58 summarizes the physical characteristics of the City's shoreline management area and the ecoregion in which it is located. Table 4.59 lists the reaches in the city's shoreline management area.

Table 4.58. Physical Characteristics of the Centralia Management Area (City of Centralia).

Physiography [a]	Rolling terraces and floodplains with meandering streams
Elevation (feet) [b]	140-510
Lithology [a]	Holocene alluvial deposits; Pleistocene alpine glacial outwash material
Mean Annual Precipitation (inches) [b]	45-49
Natural Vegetation [a]	Western red cedar, western hemlock; some Douglas fir, bigleaf maple, oak woodlands, prairies
Land Use / Land Cover [b]	Urban development including dense & low-density residential, commercial, and industrial land uses. Prairie land, hillside developments, some coniferous and deciduous forest, and urban floodplains

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

Table 4.59. City of Centralia Management Area (City of Centralia).Shoreline Reaches (Map Series 2).			
Reach Number	**Primary Waterbody Name**	**Shoreline Area (acres)**	**Map Reference (Township-Range)**
CE-01	Chehalis River	877.8	T14N-R02W, T15N-R03W
CE-02	Skookumchuck River	654.7	T14N-R02W, T15N-R02W
CE-03	Plummer Lake	111.1	T14N-R02W
CE-04	Chehalis River	64.1	T14N-R02W
CE-05	Salzer Creek	147.2	T14N-R02W
CE-06	Skookumchuck River	50.2	T15N-R02W

Five priority fish species are present in the city's shoreline management area including important salmon species including Chinook, coho, and steelhead, as well as coastal cutthroat trout and largemouth bass. Warm temperatures may limit fish access and habitat use in the Chehalis River near Centralia (Smith and Wenger 2001). In addition to fish, the city's shoreline management area contains four state listed priority habitats. Harlequin duck habitat and waterfowl concentrations, and oak woodlands. The NWI shows wetlands mapped throughout all six reaches in the city's shoreline management area.

Of the six reaches in the city's shoreline management area, there are 27 listings for polluted conditions affecting four of the reaches, many of the reaches are listed as polluted due to more than one pollutant. Pollution due to temperature is the cause of seven of the listings, fecal coliform bacteria are the cause of eight listings, and dissolved oxygen five listings. There is also one listing for dioxin, four listings for PCBs, and two for invasive species. The city's shoreline management area also has four listings for threatened water quality conditions, three of these are associated with pH, and the remaining threat is associated with fecal coliform bacteria.

Table 4.60 summarizes known geologic hazard critical areas for the city's shoreline management area as a whole and lists the shoreline reaches in which land subject to each hazard is found.

Table 4.60. Centralia Management Area (City of Centralia) Geologic Hazards (Map Series 11 – 14, 28).		
Hazard Type	**Percentage of Total Area**	**Reaches Affected**
Erosion Hazard [a]	1%	01, 02, 06
Seismic/Liquefaction [b]	78%	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		

4.5.2. Shoreline Use Patterns

4.5.2.1. Existing Shoreline Land Use and Designations

The Comprehensive Land Use designations from the city of Centralia Comprehensive Plan in the city's shoreline management area are provided in Tables 4.61a and 4.61b. 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.

The current land use patterns that are found in the city's shoreline management area are provided in Tables 4.61c and 4.61d. 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 Centralia Municipal Code (CenMC Title 20) that are found in the city's shoreline management area are provided in Table 4.61e and 4.61f. 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 4.62 summarizes the average parcel information within each of the six reaches within the city of Centralia.

Reach CE-01 – Centralia – Chehalis River

Current Land Use: The reach is characterized primarily by open fields used for agriculture or forest with a small number of single-family residences. The western portion of Fort Borst Park lies within this reach and includes the boat launch, some baseball fields, as well as historic structures. Next to the park are some single-family residences, a tree farm, and then farm buildings. From that point until the northern boundary of the City, there are open fields and forested areas. Near the eastern approach to the Galvin Road Bridge, site grading has been done for future industrial development. From the western approach of the Gavin Road Bridge south to the western approach of the Mellon Street Bridge, the shoreline jurisdiction is characterized by wooded steep slopes in the north and open fields used for agriculture and a small number of single-family residences. There are some single-family residences and open space immediately south of the western approach to the Mellen Street Bridge.

Water-dependent Uses and Water-related Uses: The boat launch facility on Fort Borst Park is a water-dependent use. The shoreline parkland with access to the river, Fort Borst Park and Discovery Trail represent water-related uses within the reach.

Future Land Use: The Comprehensive Plan includes very low-density residential, low-density residential, heavy industrial, medical/healthcare, and parks & open space/public facilities uses within this reach. Given the significant amount of publicly owned land and very low density residential designations coupled with the flood hazard restrictions, there is likely to be little new development.

As part of the city's floodplain management program, the city has adopted a "zero-rise floodplain overlay" in CenMC 16.21.165 to preserve areas of the floodplain that are most

Table 4.61a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in City of Centralia - Citywide.		
Description	**Typical Uses**	**Percentage of Management Area**
Very Low Density Residential (VLDR)	Single-family detached units not on sewer or water	24.27%
Low Density Residential (LDR)	Single-family detached units on sewer or water service	18.15%
Medium Density Residential (MDR)	Single-family detached units, but with some attached dwelling units	2.86%
Med-High Density Residential (M-HDR)	Single-family units, duplexes, town-homes, planned developments, twin homes, and multi-family units	0.41%
High Density Residential (HDR)	Multi-family	0.59%
Commercial General	Institutions, offices, and retail shops to service the residential and business community within both the city and the surrounding areas	5.60%
Limited Business District	Convenience goods (such as small retail establishments, pharmacies) and personal services (such as dry cleaners, retail stores) with limited hours of operation and medium-density residential uses	1.65%
Commercial Central Business District	Dense downtown development permitting taller structures with limited setback requirements, limited parking, parking garages or public parking lots, pedestrian facilities	0.02%
Light Industrial	Assembly, manufacturing, processing, warehousing, and limited retail sales of bulk or large-scale products	4.46%
Heavy Industrial	Assembly, manufacturing, processing, warehousing, distribution center, and other related uses such as concrete and asphalt batch plants	9.59%
Medical/Health Care	Commercial uses and activities that are usually health care in nature and that cater to the needs of the health care users and workers	1.46%
Public Facilities	Educational facilities, parks and recreation facilities and related uses, libraries, fairgrounds, government (municipal, state, county, federal) offices and other facilities, and public safety facilities	30.94%

Table 4.61b. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in City of Centralia by Reach.						
	Reach Number					
Description	CE-01	CE-02	CE-03	CE-04	CE-05	CE-06
Very Low Density Residential	40%	9%	7%	0%	1%	92%
Low Density Residential	11%	37%	0%	0%	0%	8%
Medium Density Residential	0%	4%	13%	6%	5%	0%
Medium High Density Residential	0%	1%	0%	0%	2%	0%
High Density Residential	0%	0%	1%	13%	0%	0%
General Commercial	0%	7%	12%	13%	25%	0%
Limited Business District	0%	2%	0%	0%	14%	0%
CBD Commercial	0%	0%	0%	0%	0%	0%
Light Industrial	0%	13%	0%	0%	0%	0%
Heavy Industrial	15%	5%	19%	0%	0%	0%
Medical/Healthcare	3%	0%	0%	0%	0%	0%
Parks & Open Space/Public Facilities	31%	21%	47%	69%	54%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 4.61c. Current Land Use Patterns in City of Centralia – Citywide.	
Current Land Use Patterns	**Percentage of Management Area**
Single-Family Residential	25.6%
Multi-Family Residential	3.3%
Commercial	1.5%
Utilities	0.1%
Industrial	1.9%
Right-of-Way	0.0%
Railroad	1.1%
Auto Parking	0.0%
Service/Government	17.1%
Cultural/Recreational	4.3%
Open Space	12.0%
Agriculture	12.4%
Forest	1.0%
Timber	2.9%
Fishing Activities	1.3%
Mining Activities	0.0%
Water	0.9%
Vacant/Undeveloped	14.4%
Unknown	0.0%

Table 4.61d. Current Land Use Patterns in City of Centralia by Reach.						
	Reach Number					
Current Land Use Patterns	**CE-01**	**CE-02**	**CE-03**	**CE-04**	**CE-05**	**CE-06**
SF Residential	23%	34%	24%	13%	3%	60%
All other Residential	2%	6%	5%	2%	0%	0%
Manufacturing	0%	5%	0%	3%	1%	0%
Transportation/Utilities	0%	3%	2%	6%	0%	0%
Commercial	0%	2%	0%	0%	9%	0%
Government/Services	17%	12%	21%	38%	35%	0%
Cultural/Recreational	3%	3%	0%	0%	22%	0%
Agriculture	32%	21%	2%	29%	15%	0%
Mining	0%	0%	0%	0%	0%	0%
Forest	0%	0%	0%	0%	0%	33%
Residential Land - Undivided	15%	13%	30%	9%	15%	6%
Open Water	0%	0%	16%	1%	0%	0%
Open Space	3%	0%	0%	0%	0%	0%
Timber	6%	1%	0%	0%	0%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 4.61e. Current Zoning Designations in City of Centralia – Citywide.			
Description	**Symbol**	**Typical Uses**	**Percentage of Management Area**
Very Low-Density Residential District	R2	Low density residential uses, maximum 2 units per acre	24.27%
Low-Density Residential District	R4	Low density residential uses, maximum 4 units per acre	18.15%
Moderate-Density Residential District	R8	Residential uses, up to 8 units per acre	2.86%
Medium-High-Density Residential District	R15	Residential uses, up to 15 units per acre	0.41%
High-Density Residential District	R20	Residential uses, up to 20 units per acre	0.59%
General Commercial District	C1	Restaurants, retail, personal and professional services, entertainment, automotive sales	3.25%
Highway Commercial District	C2	Uses in C1 zoning as well as commercial services for the traveling public	2.35%
Core Commercial District	C3	Restaurants, retail, entertainment, hotels, etc. located in downtown Centralia	0.02%
Health Service District	H1	Health care, child care, small retail establishments	1.46%
Limited Business District	LBD	Transition uses between commercial and residential land uses: residential and light commercial uses	1.65%
Light Industrial District	M1	Activates involving manufacturing, assembly, or repair	4.46%
Industrial District	M2	Warehousing and storage, food processing, manufacturing	5.78%
Open Space Public Facilities District	OSPF	Parks, recreational uses, government buildings, libraries, schools	30.94%
Port Master Plan District	PMP	Uses in the Centralia industrial park	3.81%

Table 4.61f. Current Zoning Designations City of Centralia by Reach.						
	Reach Number					
Description	CE-01	CE-02	CE-03	CE-04	CE-05	CE-06
C1	0%	1%	12%	13%	25%	0%
C2	0%	7%	0%	0%	0%	0%
C3	0%	0%	0%	0%	0%	0%
CG	0%	0%	0%	0%	0%	0%
EPF (F)	0%	0%	0%	0%	0%	0%
H1	3%	0%	0%	0%	0%	0%
LBD	0%	2%	0%	0%	14%	0%
M1	0%	13%	0%	0%	0%	0%
M2	6%	5%	19%	0%	0%	0%
OSPF	31%	21%	47%	69%	54%	0%
PMP	8%	0%	0%	0%	0%	0%
R15	0%	1%	0%	0%	2%	0%
R2	40%	9%	7%	0%	1%	92%
R20	0%	0%	1%	13%	0%	0%
R4	11%	37%	0%	0%	0%	8%
R8	0%	4%	13%	6%	5%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 4.62. City of Centralia Management Area (City of Centralia). Average Parcel Information.				
Primary Waterbody Name	Reach Number	Average Parcel Size (acre)	Average Parcel Width (feet)	Average Parcel Depth (feet)
Chehalis River	CE-01	9.01	400	744
Skookumchuck River	CE-02	2.06	181	390
Plummer Lake	CE-03	1.00	142	282
Chehalis River	CE-04	5.84	276	745
Salzer Creek	CE-05	8.53	362	810
Skookumchuck River	CE-06	12.18	494	723

prone to flooding and have no physical protection during flooding. This overlay covers most of the shoreline jurisdiction in reach CE-01. The "zero-rise floodplain overlay" strictly limits the uses allowed, establishes special regulations for filling and grading in the overlay, limits construction times during the year without prior approval from the city, and sets construction standards. The overall effect of the overlay is to limit opportunities for subdivision in these reaches.

Reach CE-02 – Centralia – Skookumchuck River

Current Land Use: The reach is characterized by parks and wetlands and limited low-density development throughout the reach. The western section of the reach contains a portion of Fort Borst Park, including baseball fields. Hayes Lake is also located within the reach. Riverside Park, located between Harrison Avenue and the Skookumchuck River lies within the reach boundary. The most intense development within the shoreline jurisdiction is auto-oriented commercial development located to the northeast of Hayes Lake along Harrison Avenue. The reach follows the Skookumchuck River until north of Harrison Avenue where the reach splits at approximately the Reynolds Lakes, the eastern portion follows the Skookumchuck River and the northern portion follows Coffee Creek.

Along the Skookumchuck River, there is limited development due to the presence of wetlands, floodway or the 2010 flood channel study area, and floodplain. Parkins Park is located within this low density area which contains open fields and a small number of single-family residences. Along the Coffee Creek and the associated wetlands portion of the reach, land use is predominantly low density residential; however, it does include some commercial uses and portions of a mobile home park.

Water-dependent Uses and Water-related Uses: There are no water-dependent uses in this reach. The shoreline parkland with access to the river, Fort Borst Park, Riverside Park, and Parkins Park represent water-related uses within the reach.

Future Land Use: The Comprehensive Plan includes very low-density residential, low-density residential, medium-density residential, medium-high density residential, general commercial, limited business district, light industrial, heavy industrial, and parks & open space/public facilities uses within this reach. A limited level of redevelopment is expected in this reach subject to flood hazard limitations.

As part of the city's floodplain management program, the city has adopted a "zero-rise floodplain overlay" in CenMC 16.21.165 to preserve areas of the floodplain that are most prone to flooding and have no physical protection during flooding. This overlay covers part of the western portion of reach CE-02. The "zero-rise floodplain overlay" strictly limits the uses allowed, establishes special regulations for filling and grading in the overlay, limits construction times during the year without prior approval from the city, and sets construction standards. The overall effect of the overlay is to limit opportunities for subdivision in these reaches.

Reach CE-03 – Centralia – Plummer Lake

Current Land Use: The reach is characterized by parks and established urban development. The reach begins at the west at the Chehalis River, includes a portion of Interstate 5,

Plummer Lake, and follows the China Creek floodway or the 2010 flood channel study area through downtown Centralia to the eastern boundary of the City's UGA. Plummer Lake is located adjacent to Interstate 5 and provides a boat launch and fishing opportunities. Single-family residences and a motel surround the lake. The reach follows the China Creek floodway or the 2010 flood channel study area through established residential and commercial areas of Centralia. China Creek goes through the heart of Centralia. It is piped under businesses and intersections, and is adjacent to numerous homes. It often overflows during large rain events and is used for stormwater drainage. The reach crosses through the northern portion of the Central Business District at approximately the location of City Hall, and continues north and west following the ordinary watercourse until the city boundary. The majority of land in the reach is developed, with a small average parcel size of approximately 1 acre indicating the densest development within the city of Centralia's shoreline jurisdiction.

Water-dependent Uses and Water-related Uses: The boat launch facility on Plummer Lake is a water-dependent use. The shoreline parkland with access to the river, Plummer Lake, represents water-related uses within the reach. The shoreline also includes the northern portion Cedar Street Park, although there is no direct water access. The majority of the reach is developed with little potential water-related use expansion.

Future Land Use: The Comprehensive Plan includes very low-density residential, medium-density residential, high-density residential, general commercial, heavy industrial, and parks & open space/public facilities uses within this reach. A limited level of redevelopment is expected in this reach subject to flood hazard limitations.

Reach CE-04 – Centralia – Chehalis River

Current Land Use: The reach is characterized by wetlands of the Chehalis River. There is little development in the reach, and no water-oriented uses. Interstate 5 and the UGA boundary disconnect the reach from the Chehalis River. In the north, the reach includes a small portion of land surrounding Interstate 5. The southern portion of the reach includes portions of the Centralia Christian School, Lewis County Waste Transfer Station, and an apartment building. A railroad line formerly under the ownership of Tacoma Rail also bisects the reach.

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 medium-density residential, high-density residential, general commercial, and parks & open space/public facilities uses within this reach. A limited level of redevelopment is expected in this reach subject to flood hazard limitations.

Reach CE-05 – Centralia – Salzer Creek

Current Land Use: The reach is characterized by wetlands and commercial development. The reach is located at the southern portion of the city of Centralia at the intersection of the cities of Centralia and Chehalis's Urban Growth Boundaries. The western portion of the reach contains Chehalis River and Salzer Creek associated wetlands. The land within this portion is undeveloped, and owned by the city of Centralia. To the east of the BNSF railroad tracks, the

reach includes portions of the Southwest Washington Fairgrounds. Portions of a large shopping plaza located along Gold Street are included in the reach. The eastern portion of the reach is characterized by undeveloped floodplain with limited single-family residential development.

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 very low-density residential, medium-density residential, medium-high density residential, general commercial, limited business district, and parks & open space/public facilities uses within this reach. A limited level of redevelopment is expected in this reach subject to flood hazard limitations.

Reach CE-06 – Centralia – Skookumchuck River

Current Land Use: The reach is characterized by low-density single-family residential and undeveloped forestland. The reach includes the Skookumchuck River and associated wetlands within the northeast City and UGA boundaries. Current use is predominantly low density residential. There is no public access.

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 very low-density residential and low-density residential uses within this reach. There is likely to be little new development in this reach.

Transportation and Utilities

Interstate 5 intersects with the city's shoreline jurisdiction within reaches CE-02 and CE-03. A portion of principal arterial Harrison Avenue intersects the city's shoreline jurisdiction within reaches CE-02 while South Tower Avenue and South Gold Street intersects with the city's shoreline jurisdiction within reaches CE-05. In addition to these larger roads, many local roads are present within the city's shoreline jurisdiction. In the city, there are two existing bridges across the Chehalis River at Mellen Street and Galvin Road, two existing bridges over the Skookumchuck River at Harrison Avenue and North Pearl Street (State Route 507), and one bridge over Salzer Creek at Fair Street.

The mainline of the BNSF intersects with the city's shoreline jurisdiction within reaches CE-02 and CE-05. and a very small part of CE-03. Secondary BNSF lines intersect the city's shoreline jurisdiction within reaches CE-02 and CE-04.

4.5.2.2. Existing and Potential Public Access

The city of Centralia shoreline management area has 11 miles of shoreline jurisdiction and there are a number of public access points to the shoreline. In addition, the city is planning to continue to improve the trail system in Borst Park along the Skookumchuck and Chehalis Rivers and in Riverside Park along the Skookumchuck River. The city is also working with agencies to develop a trail system along the Chehalis River. The city along with the Lewis County Community Trails group and Lewis County is working to connect the Borst Park trails system with the Airport Road trail coming from Chehalis.

Reach CE-01 – Centralia – Chehalis River

Public access opportunities in the reach include:

- The **Discovery Trail** along the Chehalis River, which is in Lewis and Thurston Counties and owned by the City, is a 1.5-mile long crushed gravel trail at the end of Goodrich Road. The trail follows the bank of the Chehalis River for over a mile on property purchased for the city's new wastewater treatment system. The Chehalis River Land Trust and the city's Utilities Department were instrumental in developing this trail. Volunteers have planted many trees to slow erosion and eventually help cool the river.

- **Fort Borst Park** is a 101-acre park located at the confluence of the Chehalis and Skookumchuck Rivers and is the location of the historic Borst homestead, schoolhouse, arboretum, and Fort Borst Blockhouse. The western portion of the park is within this reach.

- Water access includes adjacent river frontages and at the south end of the park a concrete boat ramp controlled by WDFW along the Chehalis River. The park has extensive athletic facilities and includes gardens and arboretum, trails, picnicking facilities and shelters.

Reach CE-02 – Centralia – Skookumchuck River

Public access opportunities in the reach include:

- **Fort Borst Park** is a 101-acre park located at the confluence of the Chehalis and Skookumchuck Rivers. The eastern portion of the park is within this reach.

  Water access includes adjacent river frontages and Fort Borst Lake. The park has extensive athletic facilities and includes gardens and arboretum, trails, picnicking facilities and shelters.

- **Bridge Street Park** is a 2.69-acre undeveloped waterfront property providing water access to Hayes Lake and the Skookumchuck River. This park is centrally located between Fort Borst Park and Rotary Riverside Park. It may play an important role in trail development along the Skookumchuck River. Minor site improvements would enhance the public's ability to utilize this unique urban open space. There is fishing and water access and natural areas. The lake was a gravel pit and created during the Interstate 5 construction. During high water, fish can go from the Skookumchuck River in to the lake. There are businesses located on the north side of the lake.

- **Riverside Rotary Park** is a 14.05-acre waterfront community park located along the banks of the Skookumchuck River between downtown and Interstate 5. The park has group picnic facilities, restrooms, shelters, play equipment, sport fields, and paved and soft-surface walking paths. The park provides critical open space and water access to the public. A 0.40-mile trail loop goes around the park and along the Skookumchuck River.

- **Wilbur Parkins Park** is a 5.07-acre park at the end of Meridian Avenue at the Skookumchuck River. This waterfront park was originally established in 1972 by a land

donation by Wilbur and May Parkins. Additional land was acquired in 1990 to expand park boundaries. Informal rustic improvements over the years are the result of the site's popularity with the community. This site provides fishing, gravel beaches, and water access to some secluded stretches of the river.

There are two boat launches in the reach:

- **Borst Park** – In the south end of Borst Park, there is a year-round, non-ADA accessible concrete boat launch operated and maintained by city of Centralia and the WDFW.
- **Plummer Lake** – From Lewis Street, there is a non-ADA accessible boat launch operated and maintained by city of Centralia and the WDFW.

Reach CE-03 – Centralia – Plummer Lake

Public access opportunities in the reach include:

- **Gold Street Mill Pond** is a 0.81-acre park located on the west side of Gold Street between Marion Street and Yakima. It consists of undeveloped wetland open space located north of downtown Centralia. This property contains a section of China Creek and mature riparian vegetation. China Creek goes through the heart of Centralia. It is piped under businesses and intersections and is adjacent to numerous homes. It often overflows during large rain events and is used for stormwater drainage.
- **Brick Wagner Park** is a 0.38-acre park at end of Tilley Street right-of-way at Plummer Lake. This small waterfront park provides access to Plummer Lake at the end of Tilley Street. This park was originally created in 1929 with the Tilley Street and Dobcaster Mill race right-of-way vacations, expanded, and reconfigured in 1934 and 1974. The park is a popular water access site and provides views of Plummer Lake. There is fishing and water access, picnic tables and benches, and natural areas. Plummer Lake was formally a gravel pit and now has single family homes on the east side of it and Interstate 5 on the west. The south side has a couple of homes and a commercial business. The north side has boat access and a few homes.

Reach CE-04 – Centralia – Chehalis River

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

Reach CE-05 – Centralia – Salzer Creek

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

Reach CE-06 – Centralia – Skookumchuck River

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

4.5.3. Shoreline Modifications

Table 4.63 lists the total length of dikes and levees for the 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 SMP jurisdiction.

Table 4.63. Centralia Management Area (City of Centralia) Shoreline Modifications (Map Series 19 to 20).		
Reach Number	**Sum of Dike and Levee Length (feet) [a]**	**Other Shoreline Modifications [b]**
CE-01	160	–
CE-02	3,883	Significant bank armoring and development
CE-03	–	Simplified stream channel
CE-04	1,463	Railroad dike, impervious surface, and altered vegetation
CE-05	–	Heavily altered by commercial development, impervious surface, & roads
[a] Data Source: Lewis County Dikes and Levees shapefile [b] Aerial Photography: Google Earth, May 2013		

Table 4.64 summarizes the percent impervious surface for the six reaches within the city of Centralia.

Table 4.64. City of Centralia Management Area (City of Centralia) Additional Shoreline Modifications (Map Series 16).			
Primary Waterbody Name	**Reach Number**	**Length of Stream Shorelines (miles)**	**Impervious Percentage**
Chehalis River	CE-01	3.49	3.3%
Skookumchuck River	CE-02	3.75	12.3%
Plummer Lake	CE-03	0.77	16.8%
Chehalis River	CE-04	-	12.3%
Salzer Creek	CE-05	0.51	31.1%
Skookumchuck River	CE-06	0.60	1.5%

4.5.4. Reach Functional Assessment

The overall functions scores in the city's shoreline management area range between 16 and 26, indicating a higher level of impairment compared to other management areas as shown in the appendix. The scores are evidence of higher level of development and more intensive land use that is present. The lowest scored reach (CE-03) is influenced by extensive impervious surface, simplified channel, and riparian vegetation reduced by development Along the Skookumchuck River (CE-02) significant bank armoring and development including residential uses have likely reduced channel complexity. Habitat corridors are disconnected. Along the Chehalis River (CE-04) the floodplain and connectivity with the river is impacted by a dike, impervious surface, and altered vegetation. Wetlands are highly disturbed and separated by a dike.

Development related impacts such as altered riparian vegetation, altered banks, and impervious surfaces, are relatively common in the city's shoreline management area compared to others in the shoreline jurisdiction. These alterations are notable, for example,

along the drainage leading into Plummer Lake where it is simplified and lacking diverse habitat structure. Areas along the Skookumchuck River are comparatively less developed and may have potential for restoration or protection.

Most reaches scored low for riparian vegetation function related to temperature moderation. Two reaches (reaches CE-01 and CE-06) scored moderate. Consistent with this, all reaches scored moderate for functions related to hyporheic flow and groundwater exchange.

Impervious surface is likely a key functional impairment in the city's shoreline management area where reaches such as CE-03 and CE-05 are characterized by extensive impervious surface within the shoreline jurisdiction. Impervious surface can result in altered flow regime and introduction of pollutants from stormwater runoff. Impervious surfaces reduce the amount of vegetation and fragment habitats, which can further degrade conditions important to fish and other wildlife.

Table 4.65 summarizes the functional scores for the six reaches within the city of Centralia.

Table 4.65. City of Centralia Management Area (City of Centralia) 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	
Chehalis River	CE-01	3	3	1	2	2	1	3	2	2	2	2	2	**25**
Skookumchuck River	CE-02	2	3	1	1	1	1	2	2	2	2	2	2	**21**
Plummer Lake	CE-03	1	2	1	1	1	1	1	2	1	2	2	1	**16**
Chehalis River	CE-04	2	1	1	1	1	2	1	2	1	2	2	1	**17**
Salzer Creek	CE-05	3	2	3	2	1	2	1	2	1	2	2	1	**22**
Skookumchuck River	CE-06	3	3	3	2	2	2	2	1	2	2	2	2	**26**
Centralia Average														**21.2**

Table 4.66 summarizes the reach characteristics for parcels within the six reaches in the city of Centralia.

Table 4.66. City of Centralia Management Area (City of Centralia) Reach Functional Assessment and Characteristics (Map Series 8).

Primary Waterbody Name	Reach Number	Reach Functional Assessment	% Public Ownership	% Wetland	% Floodway	% 100 Year
Chehalis River	CE-01	25	26%	21%	88%	98%
Skookumchuck River	CE-02	21	18%	26%	64%	90%
Plummer Lake	CE-03	16	16%	24%	26%	27%
Chehalis River	CE-04	17	61%	78%	18%	66%
Salzer Creek	CE-05	22	50%	47%	49%	80%
Skookumchuck River	CE-06	26	0%	13%	73%	75%

4.5.5. Restoration Opportunities

A study conducted by the Lewis County Conservation District documented several fish passage barriers in Salzer Creek, China Creek, and several unnamed tributaries (Verd 2004d).

With a significant portion (29 percent) of the city's shoreline management area designated for commercial and industrial land uses, it will be important to address impervious surface and stormwater management in the SMP provisions. Minimizing the amount of impervious surface from new development in the shoreline jurisdiction and encouraging low impact development techniques for future development and stormwater management is a conservation strategy that can help achieve no net loss of ecological functions.

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.						
	Reach					
Description	**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%
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

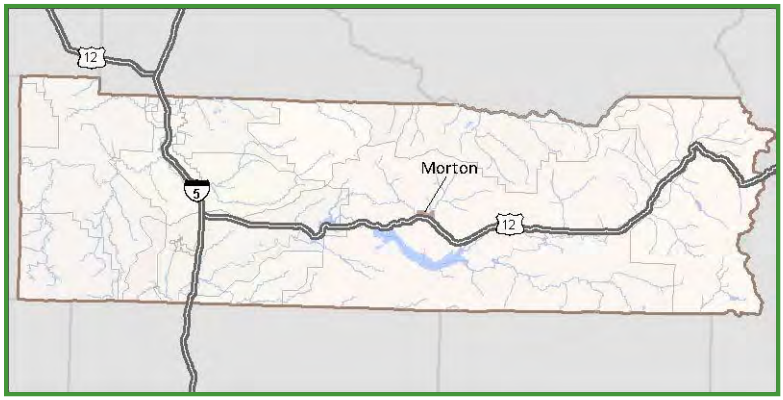
One restoration priority for the city of Chehalis is to improve tributary stream habitat for salmonids. A conceptual project proposed by the city of Chehalis for Dillenbaugh Creek would improve habitat conditions greatly. The current configuration of lower Dillenbaugh Creek passes under Interstate 5 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.

4.7. City of Morton



The city of Morton 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. The city's shoreline management area is surrounded the Cowlitz – Cascade Lowlands management area. The city's shoreline management area contains three reaches. Two of the reaches cover the Tilton River (reaches MO-01 and MO-02), and one reach covers Johnson Creek, which flows from Davis Lake (reach MO-03).

4.7.1. Citywide Physical and Biological Characterization

Morton is located in the Cascade Lowland section of the Cowlitz basin. Prior to development, it would have experienced ecosystem processes similar to those in adjacent undeveloped floodplain areas. Urban and agricultural development has altered those processes. Sections 3.2.3.1 and 3.2.3.2 provide general descriptions of the physical processes that influence shorelines in both pre-development and developed states in the city's shoreline management area.

Table 4.76 summarizes the physical characteristics of the city's shoreline management area and the ecoregion in which it is located. Table 4.77 lists the reaches in the city's shoreline management area.

Priority fish presence in the city's shoreline management area includes listed Chinook, coho, and steelhead, as well as rainbow trout. All four species are present in both reaches. Wetlands are also present in both reaches but are most extensive in the Johnson Creek reach where approximately 130 acres of wetlands are mapped. These wetlands are primarily

associated with Davis Lake. A significant portion of each reach is also within mapped adopted floodway or the 2010 flood channel study area and floodplains.

Table 4.76. Physical Characteristics of the Morton Management Area (City of Morton).

Physiography [a]	Westerly trending ridges and valleys with reservoirs and medium gradient rivers and streams; U-shaped, glaciated valleys in the east
Elevation (feet) [b]	880-1,200
Lithology [a]	Oligocene-Eocene andesitic, basaltic, and rhyolitic lava flows and breccia
Mean Annual Precipitation (inches) [b]	65-75
Natural Vegetation [a]	Western hemlock, western red cedar, Douglas fir
Land Use / Land Cover [a]	Douglas fir/western hemlock/western red cedar/vine maple/red alder forests are widespread. Forestry and recreation are important land uses and pastureland occurs in lower valleys

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

Table 4.77. City of Morton Management Area (City of Morton) Shoreline Reaches (Map Series 2).

Reach Number	Primary Waterbody Name	Shoreline Area (acres)	Map Reference (Township-Range)
MO-01	Tilton River	57.8	T12N-R04E, T13N-R04E
MO-02	Tilton River	111.5	T12N-R04E, T13N-R04E
MO-03	Johnson Creek	104.9	T12N-R04E, T13N-R04E

None of the reaches has any known water quality impairments or known or suspected threats to water quality.

Table 4.78 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 4.78. Morton Management Area (City of Morton) Geologic Hazards (Map Series 11 - 14, 28).

Hazard Type	Percentage of Total Area	Reaches Affected
Erosion Hazard [a]	4%	01-02
Seismic/Liquefaction [b]	92%	01-02
Rainier Blast Zone	0%	–
Mudflow/Lahar	0%	–
Channel Migration	0%	–
Landslide Hazard	<1%	02

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

4.7.2. Shoreline Use Patterns

4.7.2.1. Existing Citywide Shoreline Land Use and Designations

The Comprehensive Land Use designations from the city of Morton Comprehensive Plan in the city's shoreline management area are provided in Tables 4.79a and 4.79b. 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 4.79a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in City of Morton - Citywide.

Description	Typical Uses	Percentage of Management Area
R1 – Residential Single Family	Single-family housing	41.6%
RM – Residential Multi-Family	Multi-family and attached housing	11.6%
I – Industrial	Manufacturing, processing, storage, and other industrial uses	20.7%
C – Commercial	Offices, retail, or similar uses	4.5%
CS – Community Services	Public utility services, parks and recreation opportunities, and other public institutional land uses	21.5%

The current land use patterns that are found in the shoreline management area are provided in Tables 4.79c and 4.79d. 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.

Table 4.79b. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in City of Morton by Reach.

Description	Reach Number		
	MO-01	MO-02	MO-03
R1 – Residential Single Family	98%	31%	22%
RM – Residential Multi-Family	1%	28%	0%
I – Industrial	1%	34%	17%
C – Commercial	0%	0%	12%
CS – Community Services	0%	7%	49%
Grand Total	**100%**	**100%**	**100%**

The zoning designations from the city of Morton Zoning and Development Regulations that are found in the city's shoreline management area are provided in Tables 4.79e and 4.79f. 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. The zoning designations from the city of Morton Zoning and Development Regulations that are found in the city's shoreline management area are

provided in Tables 4.79e and 4.79f. 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 4.79c. Current Land Use Patterns in City of Morton - Citywide.

Current Land Use Patterns	Percentage of Management Area
Single-Family Residential	8.5%
Multi-Family Residential	6.5%
Commercial	1.6%
Utilities	0.8%
Industrial	5.0%
Right-of-Way	4.5%
Railroad	2.1%
Airport	3.2%
Service/Government	13.3%
Cultural/Recreational	3.8%
Agriculture	10.3%
Fishing Activities	0.6%
Forest	1.1%
Water	0.2%
Vacant/Undeveloped	38.5%

Table 4.79d. Current Land Use Patterns in City of Morton by Reach.

	Reach		
Current Land Use Patterns	**MO-01**	**MO-02**	**MO-03**
SF Residential	24%	7%	2%
All other Residential	9%	6%	6%
Manufacturing	0%	11%	2%
Transportation/Utilities	0%	8%	9%
Commercial	0%	2%	0%
Government/Services	0%	3%	36%
Cultural/Recreational	0%	10%	0%
Agriculture	8%	0%	25%
Mining	0%	0%	0%
Forest	4%	1%	0%
Residential Land - Undivided	54%	51%	20%
Open Water	0%	0%	0%
Open Space	0%	0%	0%
Timber	0%	0%	0%
Grand Total	**100%**	**100%**	**100%**

Table 4.79e. Current Zoning Designations in City of Morton - Citywide.			
Description	**Symbol**	**Typical Uses**	**Percentage of Management Area**
Residential	R1	Single-family residential	41.6%
Multifamily	RM	Single family, multi-family residential units, and mobile homes	11.6%
Commercial Use	C-1	Retail and service businesses	4.5%
Community Service	CS	Schools, churches, and other public and semipublic uses	21.5%
Industrial Use	I-1	Manufacturing, assembly, storage, and production uses	20.7%

Table 4.71f. Current Zoning Designations in City of Morton by Reach.			
	Reach Number		
Description	**MO-01**	**MO-02**	**MO-03**
R1	98%	31%	22%
RM	1%	28%	0%
C-1	0%	0%	12%
CS	0%	7%	49%
I-1	1%	34%	17%
Grand Total	**100%**	**100%**	**100%**

Table 4.72 summarizes the average parcel information for each of the three reaches within the city of Morton.

Table 4.72. City of Morton Management Area (City of Morton). Average Parcel Information.				
Primary Waterbody Name	**Reach Number**	**Average Parcel Size (acre)**	**Average Parcel Width (feet)**	**Average Parcel Depth (feet)**
Tilton River	MO-1	11.07	497	807
Tilton River	MO-2	4.88	336	671
Johnson Creek	MO-3	5.75	382	685

Reach MO-01 – Morton – Tilton River

Current Land Use: The reach is characterized by undeveloped open space. The reach is located in the western portion of Morton along the Tilton River. Much of the land is undeveloped due to floodway, floodplain, and wetland constraints. Development within the reach is primarily low-density residential. Washington State Fish Hatcheries own a portion of the reach although there is no active hatchery on the site.

Water-dependent Uses and Water-related Uses: There is no public access or water-oriented uses in the reach.

Future Land Use: The Comprehensive Plan includes single-family residential and negligible amounts multi-family residential and industrial uses within this reach. A very limited level of redevelopment is expected in this reach subject to flood hazard limitations.

Reach MO-02 – Morton – Tilton River

Current Land Use: The reach is characterized by open space and high intensity industrial uses. The western portion of the reach is undeveloped. The northeastern portion of the reach is intensely developed and it includes TMI Forest Products and Hampton Lumber Mills. Gus Backstrom City Park is located near the center of the reach. The majority of residential land within the reach is undivided and undeveloped.

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

Future Land Use: The Comprehensive Plan includes single-family residential, multi-family residential, industrial, and community service uses within this reach. A limited level of redevelopment is expected in this reach subject to flood hazard limitations.

Reach MO-03 – Morton – Johnson Creek

Current Land Use: The reach follows Johnson Creek along Highway 12 and includes wetlands east of the city boundary within the UGA. Land use is characterized by transportation and utilities, which includes Highway 12, as well as undivided residential and agricultural uses. Undeveloped land in the eastern part of the reach is owned by the Morton School District and is adjacent to the Morton Junior-Senior High School.

Water-dependent Uses and Water-related Uses: There are no water-dependent or water-related uses within the reach.

Future Land Use: The Comprehensive Plan includes single-family residential, industrial, commercial, and community service uses within this reach. A limited level of redevelopment is expected in this reach subject to flood hazard limitations.

Transportation and Utilities

State Route 508 intersects with the city's shoreline jurisdiction within reach MO-02. In addition to this primary road, many local roads are present within the city's shoreline jurisdiction. In the city, there is one existing bridge for State Route 508 over the Tilton River within reach MO-02.

4.7.2.2. Existing and Potential Public Access

The city of Morton shoreline management area has 43.2 miles of shoreline jurisdiction. There are a number of public access points in the city's shoreline management area.

The floodplain, wetlands, and fish and wildlife habitats along the Tilton River and its tributaries are considered by the city as green belt areas that serve as corridors for wildlife through the city. Gus Backstrom Park is situated on the western edge of Morton along the Tilton River. It serves as a buffer between the city's urban core and the Tilton River, protecting the floodplain and providing recreation and public access opportunities. Riverside

access is available for fishing and splashing. The park has a playground, covered picnic area, baseball field, campfire pits, restrooms, and an RV park with 24-hour on-site caretakers.

4.7.3. Shoreline Modifications

No significant dikes or levees for reaches are recorded in the available data, nor were 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. Given the remote location of most of the reaches in the city's shoreline management area, extensive shoreline modification is unlikely to be present.

Table 4.73 summarizes the percent impervious surface for the three reaches within the city of Morton.

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

Primary Waterbody Name	Reach Number	Length of Stream Shorelines (miles)	Impervious Percentage
Tilton River	MO-01	0.77	9.7%
Tilton River	MO-02	1.71	20.8%
Johnson Creek	MO-03	0.74	6.5%

4.7.4. Reach Functional Assessment

In the city's shoreline management area, one stream reach, Johnson Creek, has a score of 25 while the two reaches for Tilton River have scores of 29 and 26 for overall functions. Johnson Creek flows into the city from a large headwater wetland in the adjacent Cowlitz - Cascade Lowlands management area. The stream is straight and confined along the Strom Field landing strip and along Highway 12 before passing under the Highway and converging with the Tilton River. The stream exhibits impairments related to lack of woody vegetation and simplified channel structure. This reduced the functions including the stream's ability to maintain cool water temperature, stabilize sediments, attenuate flows, and provide organic material into the system.

The reaches in the Tilton River have limited LWD and encroaching development on the left bank (MO-02) reduces the potential for LWD recruitment, channel migration, and habitat forming processes, and may increase the desire for bank armoring to protect existing structures. Armoring at State Route 508 bridge may impair natural stream bed and bank forming process. Vegetation and recruitable LWD is limited due to the railroad, Highway 7, and log yard upstream of Highway 508, and residential development downstream of State Route 508. Reach MO-01 exhibits slightly better conditions than the upstream reach of the Tilton River due primarily to a higher level of tree cover along the shoreline.

Table 4.74 summarizes the functional scores for the three reaches within the city of Morton.

Table 4.75 summarizes the reach characteristics for parcels for the three reaches within the city of Morton.

Table 4.74. City of Morton Management Area (City of Morton) 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	
Tilton River	MO-01	3	2	3	2	3	1	3	2	3	2	2	3	**29**
Tilton River	MO-02	3	2	3	2	2	1	2	2	2	2	2	3	**26**
Johnson Creek	MO-03	2	2	3	1	2	1	2	2	2	3	2	3	**25**
Morton Average														**26.7**

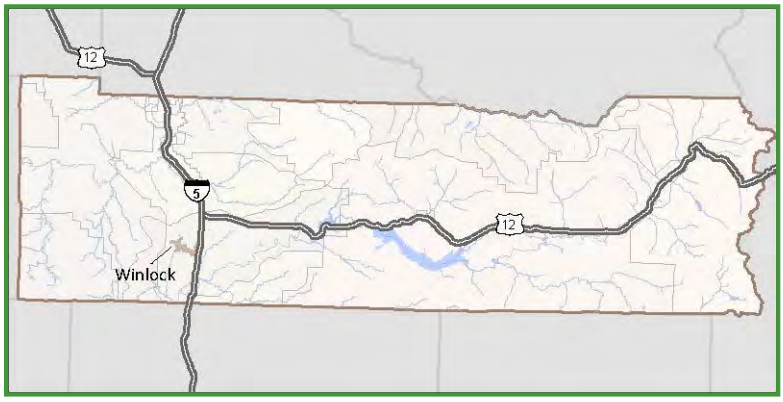
Table 4.75. City of Morton Management Area (City of Morton) Reach Functional Assessment and Characteristics (Map Series 8).						
Primary Waterbody Name	Reach Number	Reach Functional Assessment	% Public Ownership	% Wetland	% Floodway	% 100 Year
Tilton River	MO-01	29	2.8%	44%	N/A	45%
Tilton River	MO-02	26	16.2%	45%	N/A	84%
Johnson Creek	MO-03	25	94%	76%	N/A	43%

4.7.5. Restoration Opportunities

The Tilton River carries a significant sediment load. Fortunately, most development within the City is outside of the floodplain and the river can migrate in response to this sediment load, but removing the remaining infrastructure (e.g., riprap, berms, and commercial development) in the floodplain should be a high priority. The largest single opportunity is immediately adjacent to the Morton Wastewater Treatment Plant. There is currently fill in the Tilton River floodplain that disrupts floodplain processes, and otherwise covers area that could be used for fish as well as flood water and sediment storage. The area could also be reforested in those locations where water levels are sufficiently low and woody vegetation sustainable. There may be other opportunities associated with the replacement of the State Route 508 Bridge once its design life has been exhausted. The bridge and the fill associated with its abutments constrict the channel and the floodplain, disrupting geomorphic processes and increasing flood elevations further upstream.

4.8. City of Winlock

The city of Winlock 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. The city's shoreline management area is surrounded by the Cowlitz - Puget Lowlands management area. The city's



shoreline management area contains three stream reaches comprised of Olequa Creek (reaches WI-02 and WI-03) and King Creek (reach WI-01). The two reaches in Olequa Creek are separated by the confluence of King Creek.

4.8.1. Physical and Biological Characterization

Winlock 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.

Citywide shoreline management area land cover is 33 percent developed, 16 percent agricultural vegetation or grassland, 48 percent forest or woodland, and 2 percent recently disturbed. Eighty-nine percent of the land is privately owned; the remaining 11 percent is municipal or county land. Table 4.76 summarizes the physical characteristics of the City's shoreline management area and the ecoregion in which it is located. Table 4.77 lists the reaches in the city's shoreline management area.

Table 4.76. Physical Characteristics of the Winlock Management Area (City of Winlock).

Physiography [a]	Rolling terraces and floodplains with meandering streams and oxbow lakes
Elevation (feet) [b]	260-490
Lithology [a]	Holocene alluvial deposits
Mean Annual Precipitation (inches) [b]	47-53
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 4.77. Winlock Management Area (City of Winlock) Shoreline Reaches (Map Series 2).

Reach Number	Primary Waterbody Name	Shoreline Area (acres)	Map Reference (Township-Range)
WI-01	King Creek	31.1	T12N-R02W
WI-02	Olequa Creek	44.9	T12N-R02W
WI-03	Olequa Creek	46.7	T12N-R02W

Similar to many of the reaches in the Cowlitz – Puget Lowlands management area, the three reaches in the city's shoreline management area provide habitat for priority fish species including Chinook, coho, steelhead, as well as rainbow and cutthroat trout. The habitat in these reaches supports coho and steelhead spawning. Olequa Creek downstream from the

King Creek confluence is also important rearing habitat for listed steelhead. Wetlands are present, but they have a limited extent (1.63 acres).

None of the three reaches in the city's shoreline management area has any known (reported) water quality impairments or known or suspected threats to water quality.

Table 4.78 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 4.78. Winlock Management Area (City of Winlock) Geologic Hazards (Map Series 11 - 14, 28).

Hazard Type	Percentage of Total Area	Reaches Affected
Erosion Hazard [a]	15%	01-03
Seismic/Liquefaction [b]	51%	01-03
Rainier Blast Zone	0%	-
Mudflow/Lahar	0%	-
Channel Migration	0%	-
Landslide Hazard	0%	-

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

4.8.2. Shoreline Use Patterns

4.8.2.1. Existing Citywide Shoreline Land Use and Designations

The Comprehensive Land Use designations from the city of Winlock Comprehensive Plan in the city's shoreline management area are provided in Tables 4.79a and 4.79b. 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.

The current land use patterns that are found in the city's shoreline management area are provided in Tables 4.79c and 4.79d. 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 Winlock Development Code that are found in the city's shoreline management area are provided in Tables 4.79e and 4.79f. 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 4.79a. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in City of Winlock - Citywide.		
Description	**Typical Uses**	**Percentage of Management Area**
Low Density Residential	Low-density residential uses	14.3%
Medium Density Residential	Low density residential uses	17.0%
High Density Residential	Single and multi-family residential uses, 8-16 units per acre	38.5%
Commercial	General commercial and retail uses	6.0%
Industrial	Manufacturing, wholesale trade, and distribution activities	11.7%
Other	Government buildings, schools, and libraries, transportation uses and utilities	12.5%

Table 4.79b. Comprehensive Plan Designations Representing Planned Land Use (Map Series 4) in City of Winlock by Reach.			
	Reach Number		
Description	**WI-01**	**WI-02**	**WI-03**
Low Density Residential	5%	30%	5%
Medium Density Residential	67%	0%	0%
High Density Residential	28%	10%	73%
Commercial	0%	0%	16%
Industrial	0%	28%	4%
Other	0%	32%	2%
Grand Total	**100%**	**100%**	**100%**

Table 4.79c. Current Land Use Patterns in City of Winlock - Citywide.	
Current Land Use Patterns	**Percentage of Management Area**
Single-Family Residential	24.3%
Multi-Family Residential	5.6%
Commercial	1.4%
Utilities	0.3%
Industrial	17.7%
Right-of-Way	9.4%
Railroad	0.1%
Auto Parking	0.1%
Service/Government	3.6%
Cultural/Recreational	6.4%
Agriculture	6.4%
Timber	6.1%
Vacant/Undeveloped	9.7%
Unknown	8.9%

Table 4.79d. Current Land Use Patterns in City of Winlock by Reach.			
	Reach		
Current Land Use Patterns	**WI-01**	**WI-02**	**WI-03**
SF Residential	58%	2%	37%
All other Residential	12%	2%	8%
Manufacturing	2%	37%	20%
Transportation/Utilities	1%	0%	1%
Commercial	0%	0%	1%
Government/Services	0%	0%	13%
Cultural/Recreational	0%	23%	0%
Agriculture	3%	20%	0%
Mining	0%	0%	0%
Forest	0%	0%	0%
Residential Land - Undivided	9%	5%	19%
Open Water	0%	0%	0%
Open Space	0%	0%	0%
Timber	15%	11%	0%
Grand Total	**100%**	**100%**	**100%**

Table 4.79e. Current Zoning Designations in City of Winlock - Citywide.			
Description	**Symbol**	**Typical Uses**	**Percentage of Management Area**
Low Density Residential 6	LDR 6	Low density residential uses, one dwelling unit per 6 acres	14.3%
Low Density Residential 10	LDR 10	Low density residential uses, one dwelling unit per 4 acres	17.0%
Moderate Density Residential	MDR	Single and multi-family residential uses, 8-16 units per acre	38.5%
Commercial	C1	General commercial and retail uses	6.0%
Light Industrial	LI	Manufacturing, wholesale trade, and distribution activities	11.7%
Public Facilities	PF	Government buildings, schools, and libraries	12.5%

Table 4.79f. Current Zoning Designations in City of Winlock by Reach.			
	Reach		
Description	WI-01	WI-02	WI-03
LDR 6	5%	30%	5%
LDR 10	67%	0%	0%
MDR	28%	10%	73%
C1	0%	0%	16%
LI	0%	28%	4%
PF	0%	32%	2%
Grand Total	**100%**	**100%**	**100%**

Table 4.80 summarizes the average parcel information for each of the three reaches within the city of Winlock.

Table 4.80. City of Winlock Management Area (City of Winlock). Average Parcel Information.				
Primary Waterbody Name	Reach Number	Average Parcel Size (acre)	Average Parcel Width (feet)	Average Parcel Depth (feet)
King Creek	WI-01	2.49	234	445
Olequa Creek	WI-02	3.44	272	471
Olequa Creek	WI-03	1.20	141	259

Reach WI-01 – Winlock – King Creek

Current Land Use: The reach is characterized by low-density residential uses and open space. The reach follows King Creek from Olequa Creek to Winlock's western UGA boundary. There is low-density residential development and agricultural land throughout the reach as well as a small portion of land classified as timber.

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, medium-density residential, and high-density residential uses within this reach. A limited level of redevelopment is expected in this reach subject to flood hazard limitations.

Reach WI-02 – Winlock – Olequa River

Current Land Use: The reach is characterized by manufacturing, which includes a lumber mill in the southeastern portion of the reach. The reach is characterized by parks, low density residential, and timber uses in the western and northern portions. While land uses surrounding the reach are high intensity, the majority of the reach is undeveloped.

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

Future Land Use: The Comprehensive Plan includes medium-density residential, high-density residential, industrial, and other uses within this reach. A limited level of redevelopment is expected in this reach subject to flood hazard limitations.

Reach WI-03 – Winlock – Olequa River

Current Land Use: This reach follows Olequa Creek through the southern boundary of the Winlock UGA to the confluence of Olequa Creek and King Creek. The reach is characterized by residential, commercial, and industrial development. The majority of land use is established residential. The reach includes developed portions of Winlock and includes a portion of Winlock Miller Elementary School.

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 medium-density residential, high-density residential, commercial, industrial, and other uses within this reach. A limited level of redevelopment is expected in this reach subject to flood hazard limitations.

Transportation and Utilities

West Walnut Street and Northwest Fir Street intersect with the city's shoreline jurisdiction within reach WI-03. Kerron Avenue (State Route 306) is within the city's shoreline jurisdiction within reach WI-02 while Tennessee Road intersects with the city's shoreline jurisdiction within reach WI-01. In addition to these larger roads, many local roads are present within the city's shoreline jurisdiction. In the city, there are three existing bridges across the Olequa Creek at Kerron Avenue (State Route 306), West Walnut Street, and Northwest Fir Street and one bridge over King Creek at Tennessee Road.

The mainline of the BNSF intersects with the city's shoreline jurisdiction within reach WI-02 and a very small part of WI-03.

4.8.2.2. Existing and Potential Public Access

The city's shoreline management area has 2.3 miles of shoreline jurisdiction. Winolequa Park provides access to the shoreline. The park is located on Rhoades Road North. Amenities include a covered kitchen and picnic area, elevated stage, open air picnic areas with barbeques, playground, and softball fields. Overnight camping is also available for recreational vehicles and tents. Olequa Creek flows through the center of the park, which is surrounded by evergreen and deciduous forest.

4.8.3. Shoreline Modifications

Table 4.81 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 4.82 summarizes the percent impervious surface for the three reaches within the city of Winlock.

Table 4.81. Winlock Management Area (City of Winlock) Shoreline Modifications (Map Series 19 to 20).		
Reach Number	**Sum of Dike and Levee Length (feet) [a]**	**Other Shoreline Modifications [b]**
WI-01	0	Roads and development
WI-02	0	
WI-03	0	Residential development
[a] Data Source: Lewis County Dikes and Levees shapefile [b] Aerial Photography: Google Earth, May 2013.		

Table 4.82. City of Winlock Management Area (City of Winlock) Additional Shoreline Modifications (Map Series 16).			
Primary Waterbody Name	**Reach Number**	**Length of Stream Shorelines (miles)**	**Impervious Percentage**
King Creek	WI-01	0.56	9.2%
Olequa Creek	WI-02	0.92	5.0%
Olequa Creek	WI-03	0.79	23.9%

4.8.4. Reach Functional Assessment

Reaches in the city's shoreline management area have scores of 21, 22, and 26, indicating a moderate level of functional values and impairments primarily associated with residential development and road impacts on vegetation structure in the shoreline jurisdiction. The stream segment between Northwest Firs Street and Southwest Canyon Loop is confined by development, and exhibits a low level of channel complexity. Due to the existing development, this area is unlikely to benefit from protection or restoration actions, although future shoreline modifications such as bank armoring to protect existing structures may be desired in the future but should be avoided. In other areas within the shoreline jurisdiction, impervious surfaces and disturbed areas may be considered for restoration. Protection or conservation to preserve existing functions should be considered for the wetland and forested area occupying much of the northern portion of the City. This could include prohibiting development, building setbacks, or provisions that require low impact development practices to be used in future development.

Table 4.83 summarizes the functional scores for the three reaches within the city of Winlock.

Table 4.83. City of Winlock Management Area (City of Winlock) 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**	
King Creek	WI-01	3	1	3	2	2	1	2	1	2	1	2	2	**22**
Olequa Creek	WI-02	3	1	3	2	3	1	3	1	3	1	2	3	**26**
Olequa Creek	WI-03	3	1	3	2	1	1	2	1	1	1	2	3	**21**
Winlock Average														**23.0**

Table 4.84 summarizes the reach characteristics for parcels for the three reaches within the city of Winlock.

Table 4.84. City of Winlock Management Area (City of Winlock) Reach Functional Assessment and Characteristics (Map Series 8).

Primary Waterbody Name	Reach Number	Reach Functional Assessment	% Public Ownership	% Wetland	% Floodway	% 100 Year
King Creek	WI-01	22	4.9%	0%	N/A	4%
Olequa Creek	WI-02	26	17.5%	4%	N/A	19%
Olequa Creek	WI-03	21	8.7%	0%	N/A	26%

4.8.5. Restoration Opportunities

Wade (2000) recommended focusing riparian restoration efforts the city's shoreline management area in the more productive streams of the lower Cowlitz River subbasin, including Olequa Creek. Olequa Creek runs through developed areas throughout the city. Most of this land is in private ownership. However, there are several parcels within the City limits where woody riparian vegetation has been completely removed along Olequa Creek. These areas could be revegetated, thereby providing food sources (e.g., insects) to fish and lowering stream temperatures in the summer. Outreach to the community may be useful in encouraging riparian planting and revegetation. Land acquisition and revegetation by the city might also be considered in some locations.

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.

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:

    - **Lewis County**: Small Town Industrial (STI), Freeway Commercial (FC), and Rural Area Industrial (RAI)
    - **Centralia**: C-1 General Commercial District, C-2 Highway Commercial District, C-3 Core Commercial District, H-1 Health Services District, M-1 Light Industrial District, M-2 Industrial District, and PMP Port Master Plan District
    - **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

- **Morton**: Commercial (C-1) and Industrial (I-1)
- **Winlock**: Downtown Commercial (C-1), Community Commercial (C-2), Light Industrial (LI)

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

- **Lewis County**: Small Town Mixed Use (STMU), Small Town Residential (STR), and Crossroads Commercial (CC).
- **Centralia**: R:15 Medium-High-Density Residential District, R:20 High-Density Residential District and LBD Limited Business District
- **Chehalis**: R-3 – Multifamily, Medium Density, R-4 – Multifamily, High Density, and R-UGA – Urban Growth Area Residential
- **Morton**: RM – Residential Multi-Family
- **Winlock**: Medium Density Residential (MDR-16)

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

5.2.1. Nisqually (WRIA 11)

The shoreline jurisdiction in the Nisqually shoreline management area contains 628 parcels. Of these parcels, 61 percent are vacant and it appears that there are no parcels protected from development by public or conservation group ownership, conservation easements, or similar mechanisms. There is a non-conforming use that does not comply with the applicable zoning designation on 5 percent of the parcels.

Parcels in the shoreline jurisdiction of the Nisqually management area are designated entirely for rural land uses. County land use designations in the shoreline jurisdiction include RDD-5, -10, and -20, Small Town Mixed Use, Cities, UGAs and LAMIRDS, Forest Resource Lands and Parks, and Mineral Resource Lands. Based on these designations, the most intense use of property appears to be Small Town Mixed Use designated lands, which accounted for less than 0.1 percent of the total shoreline jurisdiction.

The majority of new residential development capacity, or 83 percent of total capacity in the shoreline jurisdiction, exists in the RDD-5, -10, and -20 and Small Town Mixed Use designations. Although approximately 14.5 percent of the residential development capacity in the shoreline jurisdiction occurs on lots too small to be subdivided under the current county code, some larger subdivision opportunities exist, particularly on the Nisqually River.

Although a small amount of Rural Industrial land exists in the shoreline jurisdiction, there is no measurable additional commercial or industrial development capacity. A small amount, eight acres, of Small Town Industrial land on the south side of Nisqually allows industrial priority uses within the shoreline jurisdiction, though the area is developed currently with little or no additional development capacity.

The existing zoning districts allow some opportunity for non-water-oriented uses in the Nisqually shoreline jurisdiction, particularly in the Small Town Mixed Use, Small Towns

Industrial, and the Mine zoning districts. These zones allow a wide variety of uses, providing the potential for future use conflicts. However, when considering the existing shoreline regulations that the county applies in the shoreline jurisdiction, it appears that future use conflicts would be unlikely.

The shoreline jurisdiction contains land for shoreline uses such as single-family residential and water-enjoyment uses associated with recreation at the campground south of the Nisqually River and the boat launches on Mineral Lake.

5.2.2. Deschutes (WRIA 13)

The Deschutes shoreline jurisdiction contains five parcels. All these parcels are vacant and are owned by the Weyerhaeuser Company.

The area is designated entirely for rural land uses and is classified completely as Forest Land. The county land use designation in the shoreline jurisdiction is exclusively Forest Resource Lands and Parks. The designation supports the use of this land for commercial forestry purposes. There is no new residential development capacity within the shoreline jurisdiction. There is no measurable commercial or industrial development capacity in the shoreline jurisdiction.

The existing zoning of Forest Resource Lands allows for non-water oriented commercial forestry uses in the shoreline jurisdiction.

5.2.3. Upper Chehalis (WRIA 23)

5.2.3.1. Upper Chehalis – Coast Range

The Upper Chehalis – Coast Range shoreline jurisdiction contains 56 parcels. All of these parcels are vacant and it appears that there are no parcels protected from development by public or conservation group ownership, conservation easements, or similar mechanisms. None of the parcels contains a non-conforming use.

Parcels within the shoreline jurisdiction are designated entirely for rural land uses and is classified completely as Forest Land. The county land use designation in the shoreline jurisdiction is exclusively Forest Resource Lands and Parks. The designation supports the use of this land for commercial forestry purposes. There is no new residential development capacity within the shoreline jurisdiction. There is no measurable commercial or industrial development capacity in the shoreline jurisdiction.

The existing zoning of Forest Resource Lands allows for non-water oriented commercial forestry uses in the shoreline jurisdiction.

5.2.3.2. Upper Chehalis - Willapa Hills

The Upper Chehalis - Willapa Hills shoreline jurisdiction contains 1,275 parcels. Of these parcels, 54 percent are vacant, and approximately 4 percent are protected from development by public or conservation group ownership, conservation easements, or similar mechanisms. It was not possible to determine what parcels have a non-conforming use.

The shoreline jurisdiction is designated entirely for rural land uses. County land use designations in the shoreline jurisdiction include RDD-5, -10, and -20, Cities, UGAs and LAMIRDS, Agricultural Resource Lands, Forest Resource Lands and Parks, and Mineral Resource Lands. Based on these designations, the most intense use of property appears to be within the Agricultural Resource Lands and RDD designated lands found on approximately 93 percent of developable parcels in the shoreline jurisdiction. The majority of new residential development capacity in the shoreline jurisdiction exists in these designations.

Although approximately 92 percent of the residential development capacity in the shoreline jurisdiction occurs on lots too small to be subdivided under the current county code, some larger subdivision opportunities exist in the shoreline jurisdiction. Although a small amount of Rural Industrial land exists in the shoreline jurisdiction, these accounted for less than 0.1 percent of the total shoreline jurisdiction. There is no measurable additional commercial or industrial development capacity.

The existing zoning allows some opportunity for nonwater-oriented uses in the shoreline jurisdiction, particularly in the Rural Area Industrial and the Mine zoning districts. These zones allow a wide variety of uses, providing potential for future use conflicts. However, when considering the existing shoreline regulations the county applies in the shoreline jurisdiction, it appears that future use conflicts would be unlikely.

The shoreline jurisdiction contains land for shoreline uses such as single-family residential and water-enjoyment uses associated with recreation at the state park and other public lands. A small amount of Industrial land, approximately two developable acres on the south side of shoreline jurisdiction allows industrial priority uses, though the area is developed currently with little or no additional development capacity.

5.2.3.3. Upper Chehalis - Puget Lowlands

The Upper Chehalis - Puget Lowlands shoreline jurisdiction contains 1,313 parcels. Of these parcels, 51 percent are vacant and approximately 4 percent are protected from development by public or conservation group ownership, conservation easements, or similar mechanisms. It was not possible to determine what parcels have a non-conforming use.

The shoreline jurisdiction is designated entirely for rural land uses. County land use designations in the shoreline jurisdiction include RDD-5, -10, and -20, Cities, UGAs and LAMIRDS, Agricultural Resource Lands, Forest Resource Lands and Parks, and Mineral Resource Lands. Based on these designations, the most intense use of property appears to be the RDD designated lands found in most of the shoreline jurisdiction. The majority of new residential development capacity in the shoreline jurisdiction exists in these designations.

Although approximately 87 percent of the residential development capacity in the shoreline jurisdiction occurs on lots too small to be subdivided under the current county code, some larger subdivision opportunities exist. A small amount of Rural Industrial land exists in the shoreline jurisdiction and there is approximately 22 acres of vacant or under-utilized commercial and industrial land.

The existing zoning allows some opportunity for nonwater-oriented uses in the shoreline jurisdiction, particularly in the Mining and Small Town Industrial zoning districts. These zones

allow a wide variety of uses, providing potential for future use conflicts. However, when considering the existing shoreline regulations that the county applies in the shoreline jurisdiction, it appears that future use conflicts would be unlikely.

The shoreline jurisdiction contains land for residential shoreline uses, water-enjoyment uses associated with recreation at state and county parks and other public lands. A small amount of Small Town Industrial land on the south side of the shoreline jurisdiction allows industrial priority uses, though the area has little or no additional development capacity. There are approximately 19 acres of Small Town Mixed Use and Crossroad Commercial with development or redevelopment potential.

5.2.3.4. Upper Chehalis – Western Foothills

The Upper Chehalis – Western Foothills shoreline jurisdiction contains 447 parcels. Of these parcels, 55 percent are vacant and approximately 1 percent is protected from development by public or conservation group ownership, conservation easements, or similar mechanisms. It was not possible to determine what parcels have a non-conforming use.

The shoreline jurisdiction is designated entirely for rural and urban land uses. County land use designations in the shoreline jurisdiction include RDD-5, -10, and -20, Cities, UGAs and LAMIRDS, Agricultural Resource Lands, Forest Resource Lands and Parks, and Mineral Resource Lands. Based on these designations, the most intense use of property appears to be the RDD designated lands found in most of the shoreline jurisdiction. The majority of new residential development capacity in the shoreline jurisdiction exists in these designations. All of the residential development capacity occurs on lots too small to be subdivided under the current county code.

The existing zoning allows some opportunity for nonwater-oriented uses in the shoreline jurisdiction, particularly in the Rural Area Industrial and Mineral Resource Lands zoning districts. These zones allow a wide variety of uses, providing potential for future use conflicts. However, when considering the existing shoreline regulations that the county applies in the shoreline jurisdiction, it appears that future use conflicts would be unlikely.

The shoreline jurisdiction contains land for residential shoreline uses and associated water-dependent uses, and water-enjoyment uses associated with recreation at Shaffer Park. In the northern portion of the Upper Chehalis - Western Foothills Management area, land is zoned Rural Area Industrial to accommodate the TransAlta coal power plant.

5.2.3.5. Upper Chehalis - Cascade Lowlands

The Upper Chehalis - Cascade Lowlands shoreline jurisdiction contains 54 parcels. Of these parcels, 70 percent are vacant and approximately 6 percent are protected from development by public or conservation group ownership, conservation easements, or similar mechanisms. None of the parcels contains a non-conforming use.

The shoreline jurisdiction is designated entirely for rural land uses. County land use designations in the shoreline jurisdiction include RDD-10 and Forest Resource Lands. Based on these designations, the most intense use of property occurs with RDD-10 designated lands in the shoreline jurisdiction. All but one of the residential parcels in the shoreline jurisdiction

have existing improvements, illustrating limited development opportunities within the shoreline jurisdiction.

There is no Rural Industrial land in the shoreline jurisdiction, and therefore there is no measurable additional commercial or industrial development capacity. The existing zoning of Forest Resource Lands and Rural Development District 10 zoning districts do not allow the opportunity for nonwater-oriented uses in the shoreline jurisdiction.

5.2.4. Cowlitz (WRIA 26)

5.2.4.1. Cowlitz - Willapa Hills

The Cowlitz - Willapa Hills shoreline jurisdiction contains 88 parcels. Of these parcels, 42 percent are vacant and none is protected from development by public or conservation group ownership, conservation easements, or similar mechanisms. At least one of the parcels contains a non-conforming use where existing land use does not comply with the parcel's zoning designation.

The shoreline jurisdiction is designated entirely for rural land uses. County land use designations in the shoreline jurisdiction include RDD-5 and -20, Forest Resource Lands and Parks, and Agricultural Resource Lands. Based on these designations, the most intense use of property appears to be the RDD designated lands in the shoreline jurisdiction. All new residential development capacity exists in these designations. There is no Rural Industrial land in the shoreline jurisdiction. As a result, there is no measurable additional commercial or industrial development capacity.

5.2.4.2. Cowlitz - Puget Lowlands

The Cowlitz - Puget Lowlands shoreline jurisdiction contains 1,323 parcels. Of these parcels, 55 percent are vacant and approximately 8 percent are protected from development by public or conservation group ownership, conservation easements, or similar mechanisms. It was not possible to determine what parcels have a non-conforming use.

The shoreline jurisdiction is designated entirely for rural and small town land uses. County land use designations in the shoreline jurisdiction include RDD-5, -10, and -20, Rural Residential Center (RRC)-.5, -1, -2, -10000, Small Town Mixed Use, Cities, UGAs and LAMIRDS, Forest Resource Lands and Parks, Agricultural Resource Lands, and Mineral Resource Lands. Based on these designations, the most intense use of property in the shoreline jurisdiction appears to be the RDD designated lands.

The majority of new residential development capacity, or 66 percent or total capacity, in the shoreline jurisdiction exists in RDD designations. Although approximately 95 percent of the residential development capacity in this the shoreline jurisdiction occurs on lots too small to be subdivided under the current county code, new large lot residential development opportunities exist.

Although there is a small amount of developable Rural Industrial land in the shoreline jurisdiction, there is very little additional commercial or industrial development capacity. Approximately 5 acres of commercial or industrial land is under-utilized or vacant.

Existing zoning districts allow some opportunity for nonwater-oriented uses in the shoreline jurisdiction, particularly in the Crossroads Commercial, Freeway Commercial, Rural Area Industrial, Small Town Mixed Use, and Mine zoning districts. These zones allow a wide variety of uses, providing potential for future use conflicts. However, when considering the existing shoreline regulations that the county applies in the shoreline jurisdiction, it appears that future use conflicts would be unlikely.

The shoreline jurisdiction contains land for shoreline uses such as single-family residential and water-enjoyment uses associated with recreation at Lewis and Clark State Park, Ike Kinswa State Park, and other public lands.

5.2.4.3. Cowlitz – Western Foothills

The Cowlitz – Western Foothills shoreline jurisdiction contains 89 parcels. Of these parcels, 76 percent are vacant and all are privately owned. It was not possible to determine what parcels have a non-conforming use.

The shoreline jurisdiction is designated entirely for rural land uses. County land use designations in the shoreline jurisdiction include RDD-20, Forest Resource Lands and Parks, and Mineral Resource Lands. Based on these designations, the most intense use of property appears to be the Forest Resource designated lands where there are non-conforming residential and agricultural land uses. There is very little residential development capacity (one unit total) in the shoreline jurisdiction, and it falls within the RRD-20 zoning designation. There is no Rural Industrial or Commercial land in the shoreline jurisdiction and, as a result, there is no measurable commercial or industrial development capacity.

The existing zoning allows some opportunity for nonwater-oriented uses in the shoreline jurisdiction, particularly in the Mineral Resource Land zoning district. This zone allows a wide range of mining and extraction uses, providing the potential for future use conflicts. However, when considering the existing shoreline regulations that the county applies in the shoreline jurisdiction, it appears that future use conflicts would be unlikely.

The shoreline jurisdiction contains very little land for residential shoreline uses and water-enjoyment uses associated with recreation at state parks and other public lands, as all of the land is privately owned.

5.2.4.4. Cowlitz - Cascade Lowlands

The Cowlitz - Cascade Lowlands shoreline jurisdiction contains 2,447 parcels. Of these parcels, 90 percent are vacant and approximately 10 percent are protected from development by public or conservation group ownership, conservation easements, or similar mechanisms. It was not possible to determine what parcels have a non-conforming use.

The shoreline jurisdiction is designated entirely for rural and small town land uses. County land use designations in the shoreline jurisdiction include RDD-5, -10, and -20, Rural Residential Center (RRC) -1 and -2, Small Town Mixed Use, Small Town Industrial, Cities, UGAs and LAMIRDS, Forest Resource Lands and Parks, Agricultural Resource Lands, and Mineral Resource Land

Based on these designations, the most intense use of property appears to be the RDDs and Rural Residential Center designated lands. The majority of new residential development capacity in shoreline jurisdiction exists in the relatively undeveloped Small Town Mixed Use designations, where allowable density is high compared to other rural residential designations. Although approximately 75 percent of the residential development capacity in the shoreline jurisdiction occurs on lots too small to be subdivided under the current county code, some subdivision opportunities exist.

A small amount of Rural Industrial land exists in the central portion of the shoreline jurisdiction surrounding Johnson Creek. There is approximately 33 acres of vacant and under-utilized commercial or industrial development capacity in the shoreline jurisdiction.

The existing zoning allows some opportunity for nonwater-oriented uses in the shoreline jurisdiction, particularly in the Mining and Industrial zoning districts. These zones allow a wide variety of uses, providing the potential for future use conflicts. However, when considering the existing shoreline regulations that the county applies in the shoreline, it appears that future use conflicts would be unlikely.

The shoreline jurisdiction contains land for shoreline uses such as single-family residential and water-enjoyment uses associated with recreation at Winston Creek Campground, Mossyrock Park, and other state parks and campgrounds and other public lands. A small amount of Rural Area Industrial and Small Town Industrial land east of Morton in the shoreline jurisdiction allows industrial priority uses. The area is underdeveloped and provides potential development capacity.

5.2.4.5. Cowlitz - Cascade Highlands

The Cowlitz - Cascade Highlands shoreline jurisdiction contains 62 parcels. Of these parcels, 95 percent are vacant and approximately 92 percent are protected from development by public or conservation group ownership, conservation easements, or similar mechanisms. No parcels have a non-conforming use.

The shoreline jurisdiction is designated entirely for forest and wilderness use. The county land use designation in the shoreline jurisdiction is completely Forest Resource Lands and Parks. The designation supports the conservation of this land as National Forest. There is no new residential development capacity or measurable commercial or industrial development capacity within the shoreline jurisdiction.

The existing zoning of Forest Resource Lands does not allow the opportunity for nonwater-oriented uses in the shoreline jurisdiction. Water-enjoyment uses, such as campgrounds and trails associated with recreation in the Gifford Pinchot National Forest, Rainier National Park, and Wilderness areas are found within the shoreline jurisdiction.

5.2.5. City of Centralia

The city of Centralia shoreline jurisdiction, which includes the City's associated UGA, contains 1,263 parcels. Of these parcels, 27 percent are vacant and approximately 7 percent are protected from development by public or conservation group ownership, conservation

easements, or similar mechanisms. It was not possible to determine what parcels have a non-conforming use.

The city's shoreline , which includes the City's associated UGA is designated entirely for urban land uses. City land use designations in the shoreline jurisdiction include Very Low Density Residential (VLDR), Low Density Residential (LDR), Medium Density Residential (MDR), Med-High Density Residential (M-HDR), High Density Residential (HDR), Commercial General, Limited Business District, Commercial Central Business District, Commercial Central Business District, Light Industrial, Heavy Industrial, Medical/Health Care, and Public Facilities.

Based on these land use designations, the most intense use of property appears to be within the residentially designated lands found in a majority of the city's shoreline jurisdiction. Most of new residential development capacity in shoreline jurisdiction exists in the residential land use designations. Although approximately 40 percent of the residential development capacity in the shoreline jurisdiction occurs on lots too small to be subdivided under the city's code, some larger subdivision opportunities exist, particularly along the Chehalis River, except where limited by flood hazard areas (see Map Series 8C).

Commercial and industrial land uses are found in the city's shoreline jurisdiction. Approximately 352 acres of vacant and underutilized commercial and industrial land is within the city's shoreline jurisdiction. The existing zoning allows some opportunity for nonwater-oriented uses in the city's shoreline jurisdiction, particularly in the General Commercial and Highway Commercial zoning districts. These zones allow a wide variety of uses, providing the potential for future use conflicts.

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

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.

5.2.7. City of Morton

The city of Morton shoreline jurisdiction contains 100 parcels. Of these parcels, 48 percent are vacant and approximately 14 percent are protected from development by public or conservation group ownership, conservation easements, or similar mechanisms. 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 districts in the shoreline jurisdiction include R1 - Residential Single Family, RM - Residential Multi-Family, I - Industrial, C - Commercial, and CS - Community Services. Based on these designations, the most intense use of property appears to be the in the two Residential designations. The majority of new residential development capacity in the city's shoreline jurisdiction exists in the R1 and RM designations. Although approximately 34 percent of the residential development capacity in the shoreline jurisdiction occurs on lots too small to be subdivided under the city code, some larger subdivision opportunities exist, particularly along the Tilton River.

A small amount of Urban Industrial land exists in the city's shoreline jurisdiction, and there is approximately 22 under-utilized or vacant acres of commercial and industrial development capacity.

The existing zoning allows some opportunity for nonwater-oriented uses in the city's shoreline jurisdiction, particularly in the Commercial, Industrial, and Light Industrial land use designations. These zones allow a wide variety of uses, providing potential for future use conflicts. However, when considering existing shoreline regulations that the city applies in the shoreline jurisdiction, it appears that future use conflicts would be unlikely.

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

5.2.8. City of Winlock

The city of Winlock shoreline jurisdiction contains 179 parcels. Of these parcels, 30 percent are vacant and approximately 6 percent are protected from development by public or

conservation group ownership, conservation easements, or similar mechanisms. 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 districts in its shoreline jurisdiction include Low Density Residential, Medium Density Residential, High Density Residential, Commercial, Industrial, and Other. Based on these designations, the most intense use of property appears to be the Moderate Density Residential designated lands found in most of the city's shoreline jurisdiction. There is no identifiable new residential development capacity in the city's shoreline jurisdiction.

Although a small amount of Urban Industrial land exists in shoreline jurisdiction in the city, there is approximately 2 acres of measurable additional commercial or industrial development capacity.

The existing zoning allows some opportunity for nonwater-oriented uses in the city's shoreline jurisdiction, particularly in the Commercial zoning districts. These zones allow a wide variety of uses, providing potential for future use conflicts. However, when considering existing shoreline regulations that the city applies in the shoreline jurisdiction, it appears that future use conflicts would be unlikely.

The city's shoreline jurisdiction contains land for shoreline uses such as single-family residential and water-enjoyment uses associated with recreation at Winolequa Park. A small amount of Mixed Use and Light Industrial land on the east side of the city allows industrial priority uses, however this land lies outside of the city's shoreline jurisdiction.

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.

The key recreational goals of Lewis County that related to the shoreline include:

- Maintaining and enhancing existing parks, including joint ventures and adopt-a-park projects with the power utilities, small towns, and service clubs
- Supporting state activities, including two new state parks near Packwood and Dodge Road
- Supporting improvement of Tacoma Power and PUD recreational proposals along Riffe and Mayfield Lakes as identified in FERC relicensing proposals, which identify recreational opportunities and obligations of the power companies
- Promoting public/private partnerships and opportunities for rural recreational activities
- Acquiring public lands for access to lakes and rivers
- Identifying revenue sources

The following Natural Environment objectives and policies from the Lewis County Comprehensive Plan provide direction for the development of the public access element of the Coalition's SMPs:

Objective NE 4 *Maintain the quality of the County's environmentally sensitive critical areas.*

Policy NE 4.1 *Preserve hazardous areas (subject to geologic and flood hazards) as open space wherever possible.*

Policy NE 4.2 *Encourage the preservation of natural buffers along the County's rivers, lakes, and streams.*

Policy NE 4.3 *Encourage the preservation of wetlands, open lands, and habitat areas for the benefit of the County's indigenous fish and wildlife and quality of life of County residents.*

Policy NE 4.4 Promote responsible, multiple uses of the land that minimize impacts to outdoor recreation, fish and wildlife habitats, and watersheds.

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.

6.2.1.1. Nisqually (WRIA 11)

The county's Comprehensive Plan does not specify any expansion of public access in this area. Most of the Nisqually shoreline management area contains resource lands and there is limited formal shoreline public access such as parks or trails. Outside of the boat launches on Mineral Lake, there is need for more access and trail connections within the other shoreline areas of the shoreline management area, especially on the south shore of Lake Alder. Protected lands can offer the opportunity to create public access through trail connections and shoreline vistas. Public access improvements in the management area will require coordination with the U.S. Forest Service and the National Park Service.

6.2.1.2. Deschutes (WRIA 13)

The county's Comprehensive Plan does not specify any expansion of public access in this area. Most of the Deschutes shoreline management area contains resource lands and there is no formal shoreline public access such as parks or trails. Protected lands can offer opportunities for trail connections and shoreline vistas.

6.2.1.3. Upper Chehalis (WRIA 23)

Upper Chehalis – Coast Range

The Upper Chehalis – Coast Range shoreline management area has no public access points or publicly owned shoreline jurisdiction. It is primarily private forestland.

Upper Chehalis – Willapa Hills

The county's Comprehensive Plan does not specify any expansion of public access in this area. Most of the Upper Chehalis – Willapa Hills shoreline management area contains resource lands

as well as Rainbow Falls State Parks and Willapa Hills Trail. Continuing the improvements and extension of the Willapa Hills Trail will be a major opportunity to increase public access to a large part of the shoreline management area. Protected lands can offer trail connections and shoreline vistas. Working with the Chehalis River Basin Land Trust on additional opportunities for public access would be a strategy to consider in the shoreline management area. Opportunities exist for improving public access to the shoreline jurisdiction within the shoreline management area through limited road end improvements.

Upper Chehalis – Puget Lowlands

The county's Comprehensive Plan does not specify any expansion of public access to shorelines in this area. Working with the Chehalis River Basin Land Trust to improve the limited opportunities in the shoreline management area for public access would be a strategy to consider. Opportunities exist for improving public access to the shoreline jurisdiction within the shoreline management area through limited road end improvements.

Upper Chehalis – Western Foothills

The county's Comprehensive Plan does not specify any expansion of public access in this area. Most of the Upper Chehalis – Western Foothills shoreline management area contains resource lands and mining and power plant properties. Improvements can be made to Schaeffer County Park to increase public access opportunities on the Skookumchuck River. Working with the Chehalis River Basin Land Trust to improve the limited opportunities in the shoreline management area for public access would be a strategy to consider. Protected lands can offer opportunities for trail connections and shoreline vistas.

Upper Chehalis – Cascade Lowlands

The county's Comprehensive Plan does not specify any expansion of public access in this area. Most of the Upper Chehalis - Cascades shoreline management area contains resource lands, and there is limited to no formal shoreline public access such as parks or trails. Protected lands can offer opportunities for trail connections and shoreline vistas.

6.2.1.4. Cowlitz (WRIA 26)

Cowlitz – Willapa Hills

The county's Comprehensive Plan does not specify any expansion of public access in this area. Most of the Cowlitz – Willapa Hills shoreline management area contains resource lands and there is limited to no formal shoreline public access such as parks or trails. Protected lands can offer opportunities for trail connections and shoreline vistas.

Cowlitz – Puget Lowlands`

The county's Comprehensive Plan does not specify any expansion of public access in this area. The Cowlitz – Puget Lowlands shoreline management area contains a number of existing opportunities for public access to the Cowlitz River below the Mayfield Dan including state, county, and private facilities along Mayfield Lake. Maintaining and improving these facilities would be a strategy to consider in the shoreline management area. Protected lands can offer opportunities for trail connections and shoreline vistas.

Cowlitz – Western Foothills

The county's Comprehensive Plan does not specify any expansion of public access in this area. Most of the Cowlitz – Foothills shoreline management area contains resource lands and there is limited to no formal shoreline public access such as parks or trails. Protected lands can offer opportunities for trail connections and shoreline vistas.

Cowlitz – Cascade Lowlands

The county's Comprehensive Plan does not specify any expansion of public access in this area. The Cowlitz –Cascade Lowlands shoreline management area contains a number of existing informal opportunities for public access to the Cowlitz River as well as formal WDFW and Tacoma Power facilities along Riffe Lake.

Maintaining and improving these facilities would be a strategy to consider in the shoreline management area. Protected lands can offer opportunities for trail connections and shoreline vistas. Public access improvements in the area will require coordination with the U.S. Forest Service, including facilities along the Cispus River, and with the Lewis County Public Utility District on Lake Scanewa.

Cowlitz – Cascade Highlands

The county's Comprehensive Plan does not specify any expansion of public access in this area. Most of the Cowlitz –Cascade Highlands shoreline management area contains resource lands and federal forest or wilderness areas. Protected lands can offer additional opportunities for trail connections and shoreline vistas. Public access improvements in the area will require coordination with the U.S. Forest Service and the National Park Service.

6.2.1.5. City of Centralia

In Section 2A of the city's 2007 Centralia Parks and Recreation Master Plan, one of the city's vision statements is to:

> *"Plan for the future so adequate open space, historical elements, recreation facilities and programs are provided for future generations."*

The relevant city Parks, Trails, Open Space & Recreation policies that support the maintenance of open space areas within the shoreline jurisdiction for public access opportunities include:

> *Policy P-1.7 - Cooperate with public and private agencies and with private landowners to set aside lands and resources within the urban growth areas, especially along the Skookumchuck and Chehalis Rivers and the proposed Lewis County Trail.*
>
> *Policy P-1.8 - Preserve and protect significant environmental features for park and open space use including unique wetlands, open spaces, woodlands, shorelines, and waterfronts, which reflect Centralia's natural heritage.*
>
> *Policy P-1.10 - Provide for public access in unique and/or important natural areas such as shorelines and forested area (including acquisition) and integrate them into the park and open space systems.*

Policy P-2.3 - Increase natural area and open space preservations within the urban area and extend trails through riverine corridors, such as the Skookumchuck River, to provide a diverse sampling of local landscapes.

Policy P-2.4 - In cooperation with other public and private agencies, preserve waterfront access for recreational activities including canoeing, kayaking, rafting, and power boating, as appropriate, along the Chehalis and Skookumchuck Rivers.

Policy P-4.4 - Cooperate with the Centralia School District, Lewis County, and the City of Chehalis to improve joint recreation facilities. Cooperate with other municipalities, state and federal agencies, school districts, nonprofit organizations and the private sector in fulfilling the recreational and open space needs of the urban area.

Survey responses gathered during the preparation of the city's draft Parks, Trails, Open Space & Recreation Plan indicated a shift in local values regarding the park system to one that more heavily favors open space corridors and natural areas over traditional park facilities. The desire for more trail facilities reinforced this shift.

Existing city facilities within the shoreline jurisdiction are listed in Section 4. Proposed future park facility management issues and improvements that can serve as both active and passive public access opportunities include:

- **Fort Borst Park** - Minimizing site impacts associated with future Interstate 5 improvements and monitoring water quality, invasive aquatic plant growth, and bank erosion associated with natural and artificial impacts at Fort Borst Lake.
- **Riverside Rotary Park** - Completing park access and parking lot improvements at the skate park and Bridge Street entrances, repairing asphalt pathways, and expanding accessible park circulation system throughout site.
- **Wilbur Parkins Park** - Providing basic maintenance to ensure public access and safety, preparing a master plan for the site to guide future development and acquisitions, and considering linking park to natural areas on the west bank of the Skookumchuck River, utilizing abandoned railroad trestle abutments
- **Brick Wagner Park** - Considering adding ADA accessible fishing platforms or piers and preparing a master plan for the site to guide future trailhead and trail development at Plummer Lake
- **Bridge Street Properties** – This is an undeveloped 2.7-acre waterfront property providing water access to Hayes Lake and the Skookumchuck River. This centrally located site is strategically situated between Fort Borst Park and Rotary Riverside Park. It could be an important part in trail development along the Skookumchuck River. Minor site improvements would enhance the public's ability to utilize this unique urban open space.
- **Ed S. Mayes Park** - A small parcel of land (0.3 acre) located at the intersection of First Street and Harrison Avenue adjacent to the bridge over the Skookumchuck River. The

parcel was purchased in 1910, and planted with rhododendrons to create a landscaped gateway.

- **Gold Street Mill Pond** - A 0.8-acre undeveloped wetland open space located in downtown Centralia. This property contains a section of China Creek and mature riparian vegetation. This site has potential for wetland and stream restoration projects and educational opportunities.
- **Plummer Lake Boat Launch (WDFW)** - Replacing aged and worn site and park furnishings and adding ADA accessible fishing platforms or piers

The following is a summary of trail recommendations for facilities within the city's shoreline jurisdiction that can serve as both active and passive public access opportunities and include the following actions:

- Pursuing grants in partnership with utility providers to facilitate trail acquisition and development along major water courses
- Establishing a multi-purpose community trail link between Borst Park and Rotary-Riverside Park
- Developing and restoring trail facilities located within Borst and Rotary-Riverside Parks
- Acquiring and developing a 7-mile regional trail along the Chehalis River from the Old Treatment Plant to Borst Park to the new Public Works facility at Goodrich Road
- Assessing the feasibility of acquiring and developing a regional trail along the Skookumchuck River from Rotary-Riverside Park to Wilbur Parkins Park to Schaefer County Park
- Assessing the feasibility of establishing a partnership to develop a rail-trail project along 2.5 miles of the Tacoma Rail Railroad through the city of Centralia

The Plan indicates that the city will seek funding through a variety of mechanisms. Opportunities exist for improving public access to the shoreline jurisdiction within the city through limited street end improvements.

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.

6.2.1.7. City of Morton

The city of Morton's 2004 Parks and Recreation Comprehensive Plan was adopted separately from the Comprehensive Plan and is maintained as a separate document, but is incorporated by reference to the Comprehensive Plan as the Parks and Recreation Element. The Parks Plan includes goals and objectives for recreational opportunities and conservation lands, as well as detailed plans for capital improvements to parks facilities. It is anticipated that that the city will continue with improvements to Gust Backstrom Park on the Tilton River as funding allows. Opportunities exist for improving public access to the shoreline jurisdiction within the city through limited street end improvements.

6.2.1.8. City of Winlock

The vision statement in the city of Winlock's Parks, Trail, & Open Space Element of its 2005 Comprehensive Plan states that the city places a high priority on the acquisition, development and maintenance of park and recreational facilities. The city currently has 36.3 acres of parkland all located in the Winolequa Park. While the city meets the level of service standards established in the Comprehensive Plan for community parkland, it is looking at adding neighborhood parks and trails and coordinating with the county on connections with regional facilities. Opportunities exist for improving public access to the shoreline jurisdiction within the city through limited street end improvements.

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.

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.

9. REFERENCES

Anchor QEA. 2012. Draft Chehalis River Basin Comprehensive Salmonid Habitat Enhancement Plan. Prepared for Chehalis River Basin Authority, Lewis County Board of County Commissioners, Chehalis, Washington, by Anchor QEA, LLC, Seattle, Washington. May 2012.

Battin, J., M.W. Wiley, M.H. Ruckelshaus, R.N. Palmer, EKorb, K.K. Bartz, and H. Imaki. 2007. Projected impacts of climate change on salmon habitat restoration. Proceedings of the National Academies of Science 104:6720-6725.

Beschta, R.L. 1993. Rain-on-snow hydrologic analysis: East Fork Tilton River watershed administrative unit. Murray Pacific Corporation, Tacoma, Washington. http://fortress.wa.gov/dnr/forestpractices/lhzproject/wsasmt/tilton_e_fork/appendix_a1.pdf.

Bretz, J.H. 1913. Glaciation of the Puget Sound Region, Bulletin No. 8, Washington Geological Survey.

Cakir, R. and T.J. Walsh. 2012. Loss Estimation Pilot Project for Lahar Hazards from Mount Rainier, Washington. Washington Division of Geology and Earth Resources Information Circular 113. May 2012.

Carleton, J. and J. Jacobson. 2009. South Lewis County Habitat Analysis Report. Washington Department of Fish and Wildlife. May 14, 2009.

CBPHWG (Chehalis Basin Partnership Habitat Work Group). 2008. The Chehalis Basin Salmon Habitat Restoration and Preservation Work Plan for WRIA 22 and 23. Prepared by the Chehalis Basin Partnership Habitat Work Group with Assistance by Lee Napier, Lead Entity Coordinator, Grays Harbor County; Chad Stussy, Washington Department of Fish and Wildlife; Brett Demond, Streamworks, LLP, John Kliem, Consultant, Creative Community Solutions. Updated September 2008.

Chehalis, City of. 2013. History of Chehalis. Last update March 11, 2013. http://ci.chehalis.wa.us/cityclerk/history-chehalis-0. Accessed May 1, 2013.

Chehalis Tribe. 2009. The Chehalis Tribe: Our Story. http://www.chehalistribe.org/our-story/index.html. Accessed April 17, 2013.

DAHP. 2013. Washington Information System for Architectural and Archaeological Records Data (WISAARD). Washington State Department of Archaeology and Historic Preservation. http://dahp.wa.gov/. Accessed May 6, 2013.

Dragovich, J.D., M.J. Brunengo, and W.J. Gerstel. 1993a. Landslide inventory and analysis of the Tilton Creek-Mineral River area, Lewis County, Washington. Part 1: Terrain and geologic factors. Washington Geology 21(3):9-18.

Dragovich, J.D., M.J. Brunengo, and W.J. Gerstel. 1993a. Landslide inventory and analysis of the Tilton Creek-Mineral River area, Lewis County, Washington. Part 2: Soils, harvest age, and conclusions. Washington Geology 21(4):18-30.

Dulière, V., Y. Zhang, and E.P. Salathè. 2011. Extreme precipitation and temperature over the U.S. Pacific Northwest: A comparison between observations, reanalysis data, and regional models. Journal of Climate 24:1950-1964.

Durack, P.J., S.E. Wijffels, and R.J. Matear. 2012. Ocean salinities reveal strong global water cycle intensification during 1950 to 2000. Science 336:455-458.

Ecology. 2013a. Inventory of Dams in Washington State. Washington Department of Ecology, Water Resources Program, Dam Safety Office. Publication #94-16. Revised edition. January 2013.

Ecology. 2013b. Carlisle Lake – Lewis County monitoring summary sheet. Washington Department of Ecology. http://www.ecy.wa.gov/programs/eap/lakes/wq/docs/lkcarle1.html. Accessed May 3, 2013.

Ecology. 2010. SMP Handbook, Chapter 7, Shoreline Inventory and Characterization. http://www.ecy.wa.gov/programs/sea/shorelines/smp/handbook/Chapter7.pdf. Accessed May 26, 2013.

Ecology. 2007. Washington State Averaged Annual Temperatures. Washington Department of Ecology. http://www.ecy.wa.gov/services/gis/maps/state/temp/atma.pdf. Accessed January 16, 2013.

Elsner, M.M., L. Cuo, N. Voisin, J.S. Deems, A.F. Hamlet, J.A. Vano, K.E.B. Mickelson, S. Lee, and D.P. Lettenmaier. 2010. Implications of 21st century climate change for the hydrology of Washington State. Climatic Change 102:225-260.

Evans, R.L. and W.R. Fibich. 1987. Soil Survey of Lewis County Area, Washington. U.S. Department of Agriculture, Soil Conservation Service.

Evarts, R.C. and R.P. Ashley. 1993. Geologic map of the Cowlitz Falls quadrangle, Lewis and Skamania Counties, Washington. U.S. Geologic Survey Geologic Quadrangle 1682.

GeoEngineers, Inc. 2007. Channel Migration and Avulsion Potential Analyses, Upper Nisqually River, Pierce County, Washington. Pierce County Public Works and Utilities, Public Works Division.

GeoEngineers, Inc. 2009. Geomorphic Evaluation and Channel Migration Zone Analysis Addendum, Cowlitz River, Near Packwood and Randle, Lewis County, Washington. Lewis County Public Works Department.

Gustafson, R.G., M.J. Ford, D. Teel, and J.S. Drake. 2010. Status review of eulachon (*Thaleichthys pacificus*) in Washington, Oregon, and California. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-NWFSC-105, 360 p.

Habitat Work Schedule. 2013. Washington State Recreation and Conservation Office, Washington Department of Fish and Wildlife, and U.S. Fish and Wildlife Service. http://hws.ekosystem.us. Accessed March 19, 2013.

Hajda, Y. 1990. Southwestern Coast Salish. In Handbook of North American Indians. Volume 7, Northwest Coast, William C. Sturtevant, general editor, and Wayne Suttles, volume editor, pp. 503-517. Smithsonian Institution, Washington DC.

Harza. 2000. Cowlitz River Hydroelectric Project, FERC No. 2016. 1999 Technical Study Reports. Prepared for Tacoma Power. March 2000.

Hay, D.E. and P.B. McCarter. 2000. Status of the eulachon *Thaleichthys pacificus* in Canada. Department of Fisheries and Oceans Canada, Canadian Stock Assessment Secretariat, Research Document 2000-145. Ottawa, Ontario.

Hays, D.W., K.R. McAllister, S.A. Richardson, and D.W. Stinson. Washington State Recovery Plan for the Western Pond Turtle. Washington State Department of Fish and Wildlife. Olympia, Washington. August 1999.

Herrera. 2001a. Jones Creek Stream Habitat Survey: Pe Ell McDonald Road Crossing, Milepost 2.0. Prepared for Lewis County Department of Public Works by Herrera Environmental Consultants, Inc., Seattle, Washington. August 30, 2001.

Herrera. 2001b. Lucas Creek Stream Habitat Survey: Lucas Creek Road Crossing, Milepost 5.2. Prepared for Lewis County Department of Public Works by Herrera Environmental Consultants, Inc., Seattle, Washington. August 27, 2001.

Herrera. 2001c. Scammon Creek Stream Habitat Survey: Cooks Hill Road Crossing, Milepost 1.0. Prepared for Lewis County Department of Public Works by Herrera Environmental Consultants, Inc., Seattle, Washington. August 30, 2001.

Herrera. 2001d. Sterns Creek Tributary Stream Habitat Survey: Haywire Road Crossing, Milepost 2.6. Prepared for Lewis County Department of Public Works by Herrera Environmental Consultants, Inc., Seattle, Washington. August 30, 2001.

Herrera. 2001e. Sterns Creek Tributary Stream Habitat Survey: Pleasant Valley Road Crossing, Milepost 7.4. Prepared for Lewis County Department of Public Works by Herrera Environmental Consultants, Inc., Seattle, Washington. August 30, 2001.

Herrera. 2001f. Wildcat Creek Stream Habitat Survey: Lincoln Creek Road Crossing, Milepost 13.7. Prepared for Lewis County Department of Public Works by Herrera Environmental Consultants, Inc., Seattle, Washington. August 30, 2001.

Hoblitt, R.P., J.S. Walder, C.L. Driedger, K.M. Scott, P.T. Pringle, J.W. Vallance. 1998. Volcano Hazards from Mount Rainier, Washington, Revised 1998. U.S. Geological Survey Open-File Report 98-428.

Irwin, J.W. 2011. The Dispossessed: The Cowlitz Indians in Cowlitz Corridor. Reprinted from The Columbian, 1994 Summer, with author's permission.

http://www.cowlitz.org/index.php/component/content/article/38-history/23-the-dispossessed. Accessed April 17, 2013.

King5.com. 2012. Neighbor blames erosion along Chehalis River for boy's drowning. http://www.king5.com/news/local/8-year-old-boy-drowns-in-Chehalis-River-150525165.html

Knight, K. 2009. Land Use Planning for Salmon, Steelhead and Trout. Washington Department of Fish and Wildlife, Olympia, Washington.

Krauss, M.E. 1990. Kwalhioqua and Clatskanie. In Handbook of North American Indians. Volume 7, Northwest Coast, William C. Sturtevant, general editor, and Wayne Suttles, volume editor, pp. 530-532. Smithsonian Institution, Washington, D.C.

Lasmanis, R. 1991. The Geology of Washington. Rocks and Minerals 66:262-277.

LCCD (Lewis County Conservation District). 2013. Conservation Programs. Chehalis, Washington. http://lewiscountycd.wordpress.com/conservation-programs/. Accessed April 1, 2013.

LCFRB (Lower Columbia Fish Recovery Board). 2010a. Washington Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan: Volume II. Chapter G. Lower Cowlitz Subbasin. May 2010.

LCFRB (Lower Columbia Fish Recovery Board). 2010b. Washington Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan: Volume II. Chapter F. Upper Cowlitz Subbasin. May 2010.

Mantua, N.J., I. Tohver, and A.F. Hamlet. 2010. Climate change impacts on streamflow extremes and summertime stream temperature and their possible consequences for freshwater salmon habitat in Washington State. Climatic Change 102:187-223.

Mass, C., A. Skalenakis, and M. Warner. 2011. Extreme precipitation over the west coast of North America: Is there a trend? Journal of Hydrometeorology. 12:310-318.

Min, S., X. Zhang, F.W. Zwiers, and G.C. Hegerl. 2011. Human contribution to more-intense precipitation extremes. Nature 470:378-381.

Mongillo, P.E. and M. Hallock. 1999. Washington State Status Report for the Olympic Mudminnow. Washington Department of Fish and Wildlife. October 1999.

Montgomery, B., J. Shannon, and P. Schlenger. Chehalis River Basin Comprehensive Salmonid Enhancement Plan Presentation. Anchor QEA. May 17, 2012.

Murray Pacific. 1993. Connelly Creek Watershed Analysis. Murray Pacific Corporation. Prepared for the Washington Department of Natural Resources. June 1993.

NMFS. 2012. Proposed ESA Recovery Plan for Lower Columbia River Coho Salmon, Lower Columbia River Chinook Salmon, Columbia River Chum Salmon, and Lower Columbia River Steelhead. National Marine Fisheries Service. April 2012.

NMFS. 2013. Pacific Eulachon/Smelt (*Thaleichthys pacificus*) fact sheet. National Marine Fisheries Service. http://www.nmfs.noaa.gov/pr/species/fish/pacificeulachon.htm. Accessed April 15, 2013.

Nisqually Indian Tribe. 2010. Nisqually Indian Tribe: Our History. http://www.nisqually-nsn.gov/content/our-history. Accessed April 17, 2013.

Olson, P., and M. Cramer. 2009. Emigh Property Bank Erosion Assessment. Unpublished Manuscript.

Ott, J. 2008. Centralia – Thumbnail History. HistoryLink File #8487. February 12, 2008. http://www.historylink.org/index.cfm?DisplayPage=output.cfm&file_id=8487. Accessed May 1, 2013.

Pall, P., T. Aina, D.A. Stone, P.A. Stott, T. Nozawa, A.G.J. Hilberts, D. Lohman, and M.R. Allen. 2011. Anthropogenic greenhouse gas contribution to flood risk in England and Wales in autumn 2000. Nature 470:382-385.

Pater, D.E., S.A. Bryce, T.T. Thorson, J. Kagan, C. Chappelle, J.M. Omernik, S.H. Azevedo, and A.J. Woods. 1998. Ecoregions of Western Washington and Oregon. (2-sided color poster with map, descriptive text, summary tables, and photographs.) U.S. Geological Survey, Reston, Virginia. Scale 1:1,350,000.

Pringle, P.T. 2008. Roadside geology of Mount Rainier National Park and vicinity. Information Circular 107. Washington State Department of Natural Resources.

PRISM. 2013. Project Information System. Washington State Recreation and Conservation Organization. https://secure.rco.wa.gov/prism/search/projectsearch.aspx. Accessed March 21, 2013.

Reckendorf, F., D. Renner, R. Amrine, K. Verd, N. Wilson, M. Stevens, D. Fenwick. 2012. Chehalis River Basin Studies Inventory and Evaluation. Lewis County Conservation District. http://lewiscountycd.wordpress.com/chehalis-studies-2/

Reclamation. 2011. Literature Synthesis on Climate Change Implications for Water and Environmental Resources. Technical Memorandum 86-68210-2011-01, prepared by Bureau of Reclamation, U.S. Department of Interior. 266 pp.

Rosenberg, E.A., P.W. Keys, D.B. Booth, D. Hartley, J. Burkey, A.C. Steinemann, and D.P. Lettenmaier. 2010. Precipitation extremes and the impacts of climate change on stormwater infrastructure in Washington State. Climatic Change 102:319-349.

Sarikhan, I.Y. and T.A. Contreras. 2009. Landslide field trip to Morton, Glenoma, and Randle, Lewis County, Washington. Open File report 2009-1. Washington State Department of Natural Resources. Washington Division of Geology and Earth Resources.

Scott, W.E., R.M. Iverson, J.W. Vallance, and W. Hildreth. 1995. Volcano Hazards in the Mount Adams Region, Washington. U.S. Geological Survey Open-File Report 95-492.

Smith, C.J. 2005. Salmon Habitat Limiting Factors in Washington State. Washington State Conservation Commission, Olympia, Washington.

Smith, C.J. and M.Wenger. 2001. Salmon and Steelhead Limiting Factors, Chehalis Basin and Nearby Drainages Water Resource Inventory Areas 22 and 23. Washington State Conservation Commission Final Report. May 2001.

Smith, W.E. and R.W. Saalfeld. 1955. Studies on the Columbia River smelt, (*Thaleichthys pacificus*). Washington Department of Fisheries, Fisheries Research Papers 1(3):3-26.

Sparkman, L.M. 1994. From Homestead to Lakebed. Sparkman Publications (as cited in Wikipedia 2013).

Suttles, W. and B. Lane. 1990. Southern Coast Salish. In Handbook of North American Indians. Volume 7, Northwest Coast, William C. Sturtevant, general editor, and Wayne Suttles, volume editor, pp. 485-502. Smithsonian Institution, Washington, D.C.

Swanson, D.A. 1991. Geologic map of the Tower Rock quadrangle, Southern Cascade Range, Washington. U.S. Geological Survey Open-File Report 91-314.

Swanson, D.A. 1993. Geologic map of the Blue Lake quadrangle, southern Cascade Range, Washington. U. S. Geological Survey Open-File Report 93-297.

Swanson, D.A. 1996a. Geologic map of the Hamilton Buttes quadrangle, southern Cascade Range, Washington. U. S. Geological Survey Open-File Report 96-0016.

Swanson, D.A. 1996b. Geologic map of the Packwood Lake quadrangle, southern Cascade Range, Washington. U. S. Geological Survey Open-File Report 96-704.

Tacoma Power. 2011. Cowlitz River Project, FERC Number 2016, Fisheries and Hatchery Management Plan. Tacoma Power. November 2011.

Trenberth, K.E. 2011. Changes in precipitation with climate change. Climate Research 47:123-138.

Tumwater. 2005. The Oregon Trail – How did they get to South Puget Sound? City of Tumwater, Washington, Research Center. http://www.ci.tumwater.wa.us/researchOTpg14.htm. Accessed April 9, 2013.

U-S-History.com. Undated. Confederated Tribes of the Chehalis. http://www.u-s-history.com/pages/h1552.html. Accessed May 1, 2013.

USFWS. 2013. Bald Eagles fact sheets. U.S. Fish and Wildlife Service, Pacific Region. http://www.fws.gov/pacific/eagle/permits.html. Accessed July 9, 2013.

Verd, K. 2003. Middle Chehalis Watershed and Culvert Assessment. Lewis County Conservation District, Chehalis, Washington.

Verd, K. 2004a. Lincoln and Scammon Creeks Watersheds Culvert Assessment. Lewis County Conservation District, Chehalis, Washington.

Verd, K. 2004b. Independence and Garrard Creek Watersheds and Culvert Assessment. Lewis County Conservation District, Chehalis, Washington.

Verd, K. 2004c. Scatter Creek and Prairie Creek Watersheds Culvert Assessment. Lewis County Conservation District, Chehalis, Washington.

Verd, K. 2003d. Middle Chehalis Watershed and Culvert Assessment. Lewis County Conservation District, Chehalis, Washington.

Wade, G. 2000. Salmon and steelhead habitat limiting factors Water Resource Inventory Area 26 final report. Washington State Conservation Commission.

Wall, B. 2008. "History of Winlock, Washington by Bill Wall." May 6, 2008. http://www.geocities.com/siliconvalley/lab/7378/winlock.htm. Accessed April 17, 2013.

Wall, C.C. 1952. A History of Winlock, Washington. http://www.winlockwa.govoffice2.com/vertical/Sites/%7B131FF39D-640A-4A04-8D6F-F1B120929459%7D/uploads/%7BAF9467A8-11F6-435F-B3B2-5C830CF7957E%7D.PDF. Accessed May 1, 2013.

Watershed GeoDynamics. 2012. Geomorphology/sediment transport/large woody debris report, Chehalis River fish study. Chehalis River Basin Flood Authority, Chehalis, Washington.

WDFW. 2002. Integrated Streambank Protection Guidelines. Washington State Aquatic Habitat Guidelines Program.

WDFW. 2004. Washington State Salmonid Stock Inventory – Bull Trout/Dolly Varden. Washington Department of Fish and Wildlife. October 2004.

WDFW. 2013. SalmonScape database and mapping application. Washington Department of Fish and Wildlife. http://wdfw.wa.gov/mapping/salmonscape/index.html. Accessed July 5, 2013.

WDFW and ODFW. 2001. Washington and Oregon Eulachon Management Plan. Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife.

Wikipedia. 2013. Morton, Washington. Last update March 11, 2013. http://en.wikipedia.org/wiki/Morton,_Washington. Accessed May 1, 2013.

Wilma, D. 2008. Lewis County – Thumbnail History. HistoryLink File #7449. September 1, 2005, updated December 18, 2007, and January 28, 2008. http://www.historylink.org/index.cfm?DisplayPage=output.cfm&file_id=7449. Accessed April 9, 2013.

Yakima Valley Historical Society. Undated. Wagon Train Party Over Cowlitz Trail, Yakima Valley Historical Society Minutes and Historical Papers Vol 1. – September 20, 1917, to July 25, 1946. http://www.start-wa.com/yakima_notes.html. Accessed April 17, 2013.