FINAL

SHORELINE INVENTORY AND CHARACTERIZATION REPORT

for Portions of Clallam County Draining to the Strait of Juan de Fuca

Clallam County Shoreline Master Program Update

Ecology Grant No. G1000062

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Prepared by:

Environmental Science Associates (ESA) in cooperation with Kramer Consulting, Coastal Geologic Services and Ann Seiter

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1. BACKGROUND AND PURPOSE OF THE REPORT

Clallam County is undergoing a comprehensive update of its shoreline master program (SMP) in 2011-12 to improve protection of the shoreline environments and ensure their continued use and enjoyment. The County adopted its first SMP in 1976 and has not undertaken a comprehensive review of the program in more than 35 years. The update is also required by the Shoreline Management Act (SMA) of 1971 and the implementing rules known as the shoreline guidelines[1].

One of the first steps in the SMP update process is to inventory and characterize shoreline conditions (Figure 1-1). This involves assessing the lakes, rivers and marine waters that are classified as "shorelines of the state" and their adjoining "shorelands" and characterizing the broader landscape surrounding these lands and waters. The Inventory and Characterization Report (ICR) must be based on the most current, accurate, and complete scientific and technical information available that is applicable to the issues of concern. The ICR serves multiple purposes, such as:

- Identify shoreline resources and areas that provide value to County residents, recreationists, property owners, businesses and other stakeholders to ensure they are managed appropriately according to the goals of the SMA;
- Assess and document current shoreline conditions to establish a baseline against which future conditions can be compared;
- Provide a basis of information to assign of Shoreline Environment Designations (which is one of the next tasks in the update process), and;
- Present information for future SMP policy and regulatory decisions related to shoreline use and development, shoreline ecology, and public access.

A team of consultants[2] prepared this ICR at the request of the County, using grant funds provided by the Washington Department of Ecology (Ecology). This report also presents initial information to support the County's assessment of "no net loss," which is funded by a grant from the Environmental Protection Agency (EPA).

A draft ICR was submitted for public review in December 2011. This final ICR incorporates and reflects the input obtained during the public review.

[1] Revised Code of Washington (RCW) 90.58 and Washington Administrative Code (WAC) 173-26, Part III.

[2] ESA is the lead consultant for the SMP update with support from Coastal Geologic Services, Kramer Consulting, Carol Macilroy Consulting, and Ann Seiter Technical Writing and Editing.

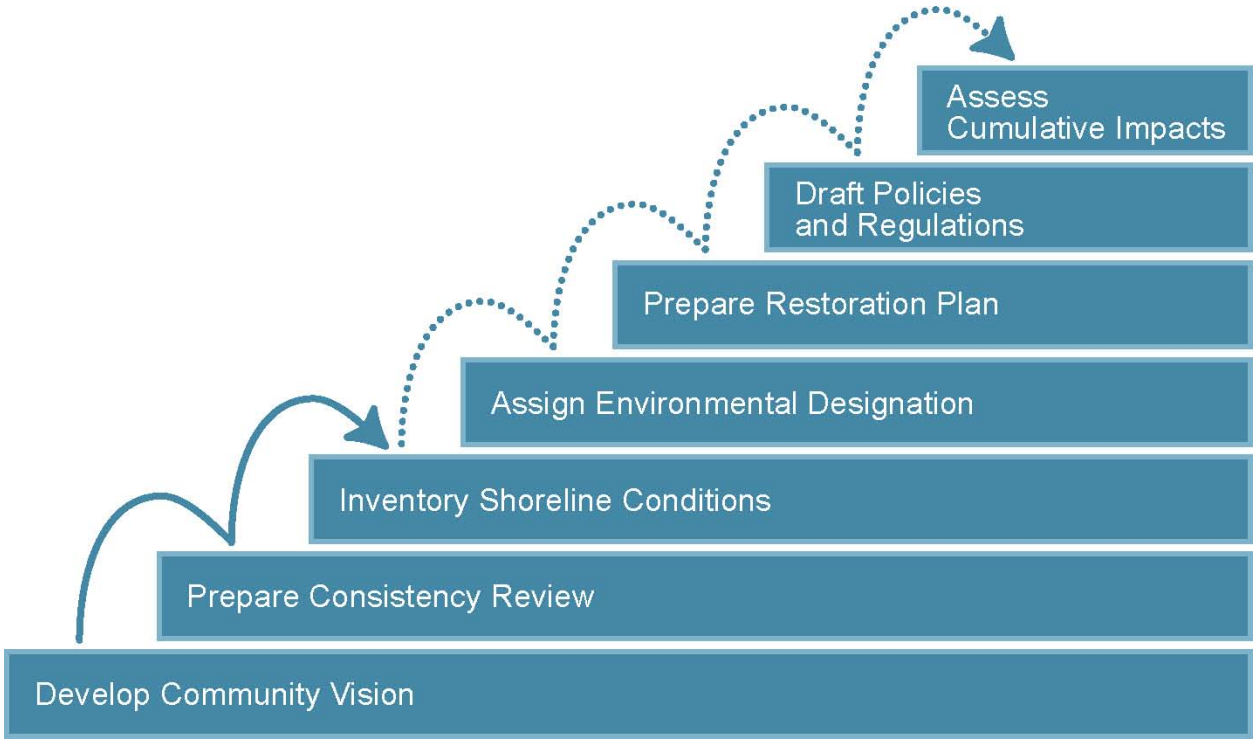


Figure 1-1. Steps in the shoreline master program update process; the public will have opportunities to review and comment on each of the technical products shown here.

Unless stated otherwise, the information presented in this report is limited to that portion of Water Resource Inventory Areas (WRIAs) 17, 18 and 19 within unincorporated Clallam County that drain to the Strait of Juan de Fuca. The emphasis is on portions of the study area that area subject to the Shoreline Management Act (see box). In general is a relatively narrow zone of land and water associated with designated shorelines of the state.

The shorelines within the municipal limits of the cities of Port Angeles and Sequim are not included in this analysis as these shores are under the management of the respective cities. Lands owned by the Jamestown S'Klallam Tribe and Lower Elwha Klallam Tribe are included in the inventory even though tribal lands are not subject to Shoreline Management Act jurisdiction. The Makah Reservation is not included in the inventory because it is geographically fairly isolated.

Shoreline Jurisdiction – Definitions and Terminology

The County's SMP governs all non-federal and non-tribal shorelines of the state as defined in RCW 90.58.030, including shorelines and shorelines of statewide significance.

Shorelines are rivers and streams (or segments thereof) with a mean annual flow of 20 cubic feet per second (cfs) or more, lakes greater than 20 acres, and marine waters between the ordinary high water line and extreme low tide, together with their underlying lands and associated shorelands.

Shorelines of Statewide Significance include rivers with mean annual flow of 1,000 cfs or more; lakes 1,000 acres or larger; and marine waters seaward of extreme low tide.

Shorelands refers to the lands extending landward for 200 feet in all directions from the ordinary high water line; floodways and contiguous floodplain areas landward 200 feet from such floodways; and all associated wetlands and river deltas. Shorelands can include critical areas that occur within shoreline jurisdiction and their buffers.

The shoreline water bodies described in this report include: Dungeness River, McDonald Creek, Morse Creek, Elwha River, Salt Creek, Lyre River/Boundary Creek, Indian Creek/Little River, East Twin River, West Twin River, Deep Creek, Pysht River, Clallam River, Little Hoko River, Hoko River, Sekiu River (and North and South Forks), Bullman Creek; Lake Sutherland; and the Strait of Juan de Fuca. The Strait of Juan de Fuca and the Elwha River are also Shorelines of Statewide Significance.

For information concerning shorelines in WRIA 20 refer to **http://www.clallam.net/RealEstate/html/shoreline_management.htm**

As shown in Figure 1-2, portions of Clallam County that drain to the Pacific Coast (WRIA 20) are addressed in a separate inventory and characterization report being prepared by the Olympic Natural Resources Center (ORNC)[3] for Clallam County.

[3] Access the ONRC website at: http://www.onrc.washington.edu/

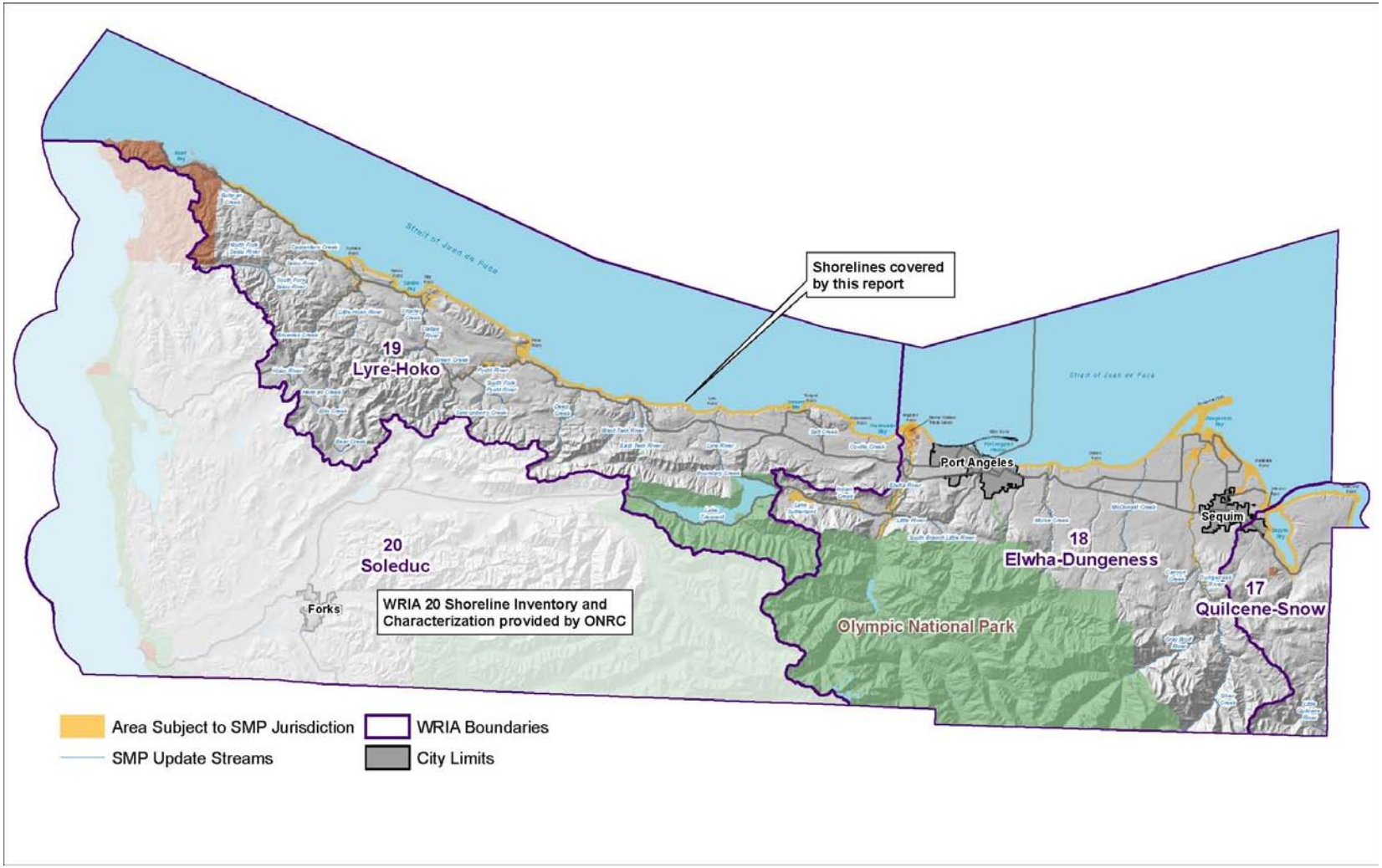


Figure 1-2. Clallam County Shorelines of the State in WRIAs 17, 18 and 19 (purple outline shows the areas covered by this report)

The ICR is one of several sources of information the County will consider in deciding which, if any, shoreline master program policies or regulations need to change. Other sources of information that contribute to the SMP update include the County's Consistency Review report (ESA 2011), public comment and testimony (gathered in accordance with the Public Participation Plan), review of other regulatory plans and programs, and comments from the Department of Ecology. State law requires that Ecology review and approve the updated SMP before it takes effect.

The County and consultant team are working on a separate shoreline restoration plan that will identify and describe restoration needs and opportunities. That report will be issued for public review and comment in March 2012.

1.1 *Report Organization*

The SMP guidelines require a description of existing data, shoreline conditions, and development patterns (inventory), as well as a characterization of the ecological processes and functions of the shoreline and management considerations. The information presented here for the north coast of Clallam County is generally divided geographically, from east to west (Figure 1-2), and is divided into separate "reaches" or segments of marine and freshwater shorelines. **For each reach, a summary sheet illustrating the key inventory features provides an 'at-a-glance' reference to accompany the characterization text**. These "reach sheets" supplement the text—a *Reach Sheet Explainer* is provided to explain the information and data sources used to create both the marine and freshwater reach sheets. Information on cultural/archeological/historic resources will be provided in the final report.

Chapter 2 provides an overview the North Olympic Coast study area describing population, existing land use and zoning. The chapter also examines the future development potential of the lands under the jurisdiction of the County's shoreline master program.

Chapter 3 contains an overview of the marine shoreline processes pertinent to the Strait of Juan de Fuca in Clallam County. This chapter describes physical shore types, feeder bluffs, landslide/erosion hazards and provides a summary of baseline conditions according to specific indicators of ecological function. Potential implications of future development on marine shoreline conditions are also described. Initial shoreline management considerations are summarized in this chapter.

Chapter 4 contains detailed reach-by-reach descriptions of the 18 marine shoreline segments, with baseline conditions, future land use potential, and management issues and opportunities specific to that reach. At the end of this chapter are the "reach sheets" describing each marine reach.

Chapter 5 is overview of the freshwater processes pertinent to WRIAs 17, 18 and 19 in Clallam County. This chapter provides a summary of baseline conditions according to specific indicators of ecological function. Potential implications of future development on freshwater shoreline conditions are also described. Initial shoreline management considerations are summarized in this chapter.

Chapter 6 contains detailed reach-by-reach descriptions of the freshwater shoreline segments with baseline conditions, future land use potential, and management issues and opportunities specific to that reach. "Reach sheets" for Lake Sutherland and each river and stream are included at the end of Chapter 6.

Chapter 7 summarizes the relationship between the shoreline master program and other land use / regulatory plans and programs**.**

Chapter 8 is a list of the references used to prepare this report.

Abbreviations and terms are explained in the **Glossary and Abbreviations** section. **Maps** depicting important information referenced in the text are provided in Appendices A and B (Table 1-1).

Table 1-1. Clallam County Shoreline Inventory Map Themes and Numbers

Map Theme*	Content	Region of the County		
		East	Central	West
Physical Characteristics	• Feeder bluffs • Drift cells • Shoreform types • Stream confinement	1a	1b	1c
Hazard Areas**	• Shoreline slope stability • Erosion and landslide hazards • Floodplains • Tsunami hazards	2a	2b	2c
Ecological Characteristics (Marine)	• Fish distribution • Eelgrass and kelp • Forage fish • Marine mammal haulouts • Wetlands	3a	3b	3c
Ecological Characteristics (Freshwater)	• Fish distribution • Bald eagle habitat • Wetlands • Waterfowl habitat • Shorebird concentrations	4a	4b	4c
Land Use	• Public and private land ownership • Commercial forests • Land Use	5a	5b	5c
Shoreline Modifications	• Fish passage barriers • Armoring • Breakwaters/Jetties • Dikes/Levees/Riprap • Overwater structures • Nearshore fill	6a	6b	6c

*See Appendix A. Inventory maps cover only portions of WRIAs 17, 18, and 19 under County jurisdiction. Federal Land and Incorporated Areas are excluded. WRIA 20 is covered separately.

**Channel Migration Zone (CMZ) mapping is presented in Appendix B.

2. POPULATION, LAND USE, AND SHORELINE DEVELOPMENT IN THE NORTH OLYMPIC COAST STUDY AREA

Clallam County occupies a unique location at the northwest tip of the contiguous United States on the geographically remote Olympic Peninsula. County residents are occasionally reminded of the remoteness when the Hood Canal Bridge goes out or flooding cuts off the single highway that leads to the communities along the Strait of Juan de Fuca. The location and landscape have created diverse, linked communities of people, plant species, and wildlife. Within the space of a few miles are nearshore and alpine ecosystems, rivers and forests, and culturally distinct towns and settlements.

This chapter describes the general extent and types of existing land use and the magnitude of potential future shoreline development to provide context for ecological information contained in the chapters that follow. Understanding existing and future opportunities for human use and enjoyment of shorelines is an essential aspect of the Shoreline Master Program update.

2.1 *Geographic Overview*

For purposes of this report, the North Olympic Coast study area includes the northern portion of Clallam County draining to the Strait of Juan de Fuca. This area includes the north slope of the Olympic Mountains as well as the major population centers of Port Angeles, Sequim and the unincorporated Urban Growth Areas of Clallam Bay-Sekiu, Carlsborg, and Joyce. A majority of the County's 71,404 residents live in this portion of the County (slightly more than half in incorporated areas).

Along the North Olympic Coast are some major differences in existing and expected future land use. These differences have evolved in response to disparate patterns of human settlement; regional, national and global economic cycles; regulatory changes; and the availability and value of fisheries, forest products, and other natural resources. To address the geographic, ecological, and cultural diversity within the County, the North Olympic Coast study area can be considered in three planning areas--East, Middle and West (Figure 2-1).

2.1.1 East Planning Region

The East Planning Region extends from the Jefferson County line at Discovery Bay to the east edge of the Morse Creek watershed. This area encompasses a small portion of Discovery Bay, the Miller Peninsula, and Sequim Bay (all located in Water Resource Inventory 17), as well as portions of East WRIA 18 including Dungeness Spit and Green Point. The river systems that are large enough to be designated as shorelines of the state in this planning region are the Dungeness River and its major tributaries, McDonald Creek, and the upper reaches of the Little Quilcene River (which drains to Hood Canal through Jefferson County. Other important streams in this area include Eagle Creek (draining to Discovery Bay); Jimmycomelately, Dean and Johnson

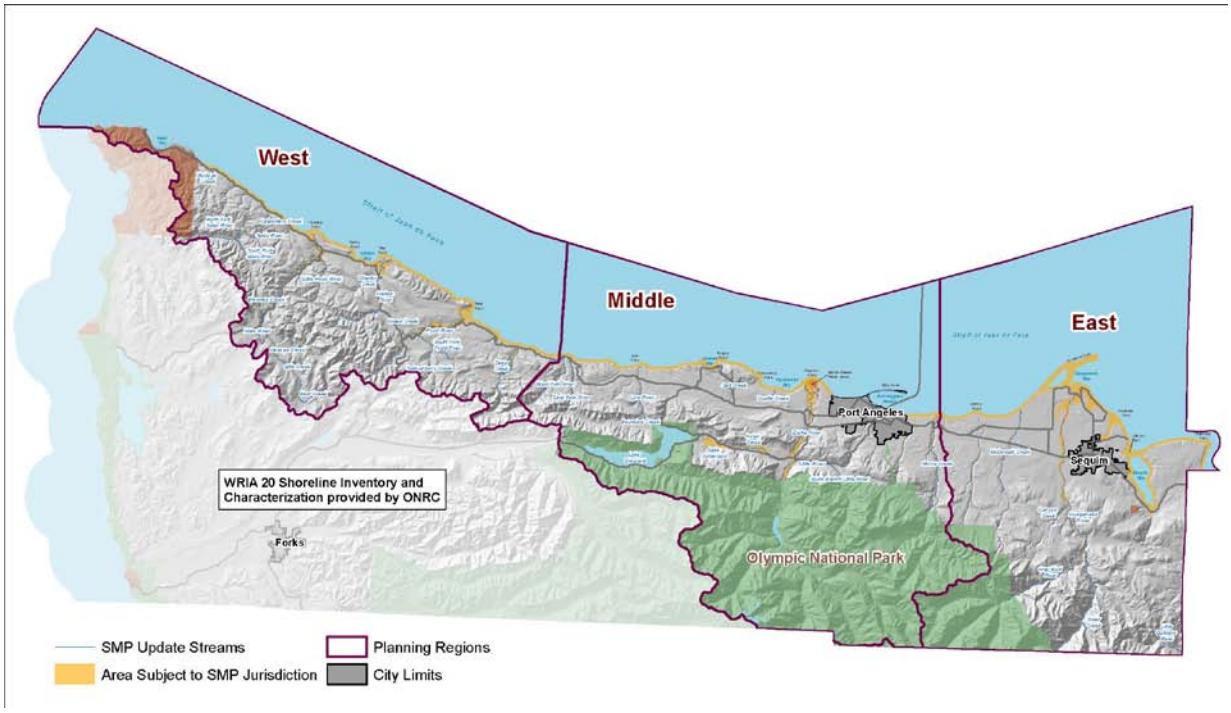


Figure 2-1. East, Middle and West planning regions in Clallam County

Creeks (Sequim Bay tributaries); and independent streams directly entering the Strait of Juan de Fuca including Siebert, Gierin, Cooper, Meadowbrook, and Cassalary Creeks.

The East Planning Region has only one incorporated area, the City of Sequim, and two designated Urban Growth Areas (UGAs), the Sequim UGA and the Carlsborg UGA. The Jamestown S'Klallam Tribe Reservation is located along Sequim Bay in the Blyn area and the Tribe has several commercial and administrative facilities on or near the marine shoreline. Most tribal members live outside of the reservation boundaries and tribal shoreline development is non-residential. Publicly owned shorelands in this region include the Sequim Bay State Park, Miller Peninsula State Park and the Dungeness National Recreation Area.

The only water-dependent commercial facility on the shoreline in this planning region is the John Wayne Marina located on Sequim Bay within the City of Sequim. Public access to the shorelines for recreation and enjoyment is available in many areas. Dungeness Spit and Dungeness Bay, the shoreline between Sequim Bay and Discovery Bay, and numerous parks and open spaces throughout the East Planning Region provide access to the water. County parks include the Dungeness Recreation Area, Panorama Vista, Marlyn Nelson, Dungeness Landing, Three Waters and Cline Spit. Other public lands also abut shorelines.

Residential use has become the most prevalent form of development. Agricultural uses are concentrated in the inland portions of the County, with only a small percent of the shorelines in agricultural production. Although this portion of the County has seen the largest population growth in recent years, there are still large portions of the shorelines that are undeveloped.

2.1.2 Middle Planning Region

The Middle Clallam County planning region includes the Strait of Juan de Fuca shorelines from and including the Morse Creek watershed on the east to the Twin Rivers watershed on the west; the City of Port Angeles and the Lower Elwha Klallam Tribe Reservation are located in this region. Shorelines of the state in this region are the Strait of Juan de Fuca, Lake Sutherland, the Elwha River, Colville Creek, Salt Creek, the Lyre River, and the East and West Twin Rivers. Removal of the Elwha River dams from 2011 to 2014 is expected to dramatically affect the river environment downstream of the dam and at the delta. Among other changes, dam removal is expected to create substantial shifts in sediment loading and transport along the lower river and marine shorelines.

Residential development along the shoreline occurs primarily in eastern portions of this region, particularly at the mouth of Morse Creek, Freshwater Bay and bluff areas near the Elwha River. West of Freshwater Bay shoreline land use is predominately public and private commercial timber management. Lake Sutherland is heavily developed with single family residential homes. Public access to shorelines in the middle region is available at Salt Creek and Striped Peak recreation areas near Tongue Point, Freshwater Bay and areas along the Elwha River. There is also a public boat launch at Lake Sutherland (maintained by the Washington Department of Fish and Wildlife). Steep erodible banks preclude public access to public lands in several areas. Private campgrounds are operated at Whiskey Creek, Crescent Beach and the Lyre River.

2.1.3 The West Planning Region

The West Planning Region extends from the eastern boundary of the Makah Tribal Reservation to the Deep Creek watershed. In addition to the marine shorelines along the Strait of Juan de Fuca, shorelines of the state in this area include Deep Creek, the Pysht River, Clallam River, the Hoko and Sekiu Rivers, and Bullman Creek.

Land use in the west planning region is predominately commercial forest. With the exception of the Clallam Bay/Sekiu UGA, most of the marine shoreline is undeveloped. Additional pockets of moderate to high density residential development are located at Bullman Beach and the Hoko River estuary. Water-dependent commercial facilities include several private resorts. Highway 112 is located within the SMP jurisdiction in several locations.

The Clallam Bay shoreline is the most heavily developed area of the western planning region and several water-dependent commercial facilities are located along the shoreline. There are two marina breakwaters and several docks supporting these facilities.

Public access to the shoreline in this region is generally limited to informal access along State Highway 112, Pillar Point County Park, and the Clallam Bay/Sekiu area. Private access is available from resort areas. Although there are substantial public forest lands along the marine shorelines, most of the area is not accessible by land. Washington State Parks has recently acquired land in the Hoko River estuary and additional public access is possible in the future.

2.2 *Population*

The total population in Clallam County (including WRIA 20) increased by 10.7 percent from 2000 to 2010, as compared to the 14.2 percent overall population increase for Washington State.

Population growth in the unincorporated areas of Clallam County was only slightly lower at 9.19 percent for the same time period, while growth in the incorporated areas has varied widely (OFM 2011). Population growth in the eastern portion of the County (Sequim and Sequim UGA) has been much higher than other portions of the County (Table 2-1).

Table 2-1. Clallam County Population Growth by Region

Area	Total Population in 2000	Total Population in 2010[1]	Percent Growth
Total County	64,525	71,404	10.7%
Unincorporated County	38,674	42,228	9.2%
East Planning Region			
Sequim	4,334	6,606	52.4%
Sequim UGA	5,923	6,364[1]	7.4%
Carlsborg UGA	806	828[1]	2.7%
Middle Planning Region			
Port Angeles	18,397	19,038	3.5%
Port Angeles UGA	21,080	21,610[1]	2.5%
Joyce UGA	58	581	0
West Planning Region			
Clallam Bay-Sekiu UGA[2]	462	435	-5.8%

Source: Washington State OFM, Census 2010 Redistricting Data for Washington, 2011.
[1] Population estimates for the county UGAs is not yet available from the 2010 census. For the purposes of this report, the OFM population estimates for 2006 were used.
[2] The Clallam Bay-Sekiu UGA population obtained from OFM does not include the prison population at the Clallam Bay Correction Facility.

The County used a 20-year planning period for comprehensive planning and based its plans on the population estimates from the Washington State Office of Financial Management (OFM). The population of Clallam County over the planning period is expected to increase by 10,000 to 12,000 people by 2025 (Clallam County, 2007b). The 2007 State population estimate for Clallam County was 68,500 persons (OFM, 2007). According to the Urban Growth Areas Analysis and 10-Year Review ("UGA Report"), growth trends support using the State growth management 2000 – 2025 High Series Population Forecast (OFM, 2002) for Clallam County of 86,927 persons. Based on this forecast, the County needs to plan for approximately 18,427 new people between 2007 and 2025. Most of this population increase is anticipated to occur within Central and Eastern Clallam County.

2.3 *Existing Land Use and Zoning*

The three planning regions vary in terms of the types of land use that occur adjacent to river, lakes and marine shorelines (Figures 2-2 and 2-3; note that timber extends beyond top of graph). Residential uses are a significant component of the east planning region while timber is the

dominant use in the middle and west regions. Agriculture comprises a modest percentage of the land use on the marine shore (mostly in the east planning region), but there is relatively little agricultural use occurring along freshwater shorelines in Clallam County. Commercial, industrial, and port-related land uses are even less common adjacent to County shorelines and are mostly limited to marinas, fishing resorts, campgrounds and other recreation-related enterprises.

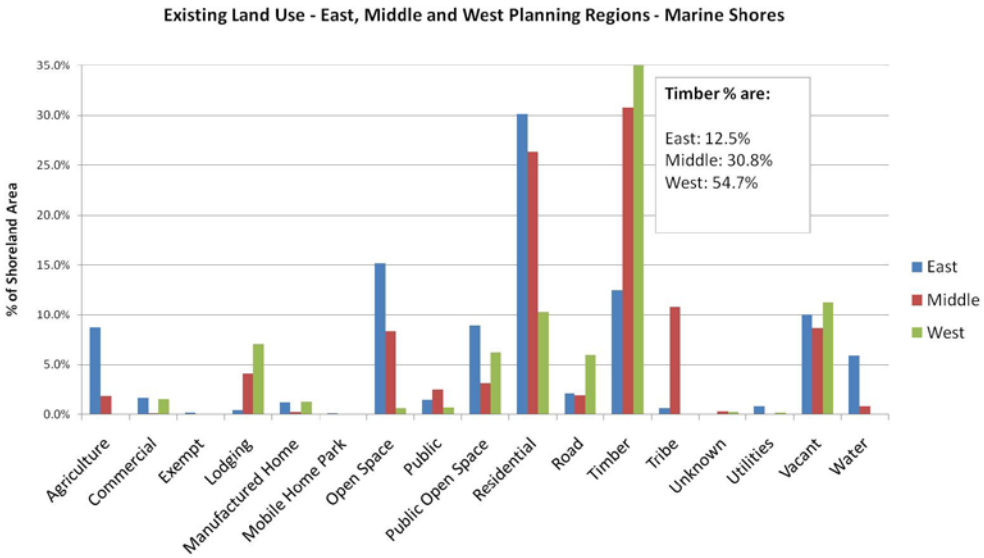


Figure 2-2. Existing land use as a percent of the marine shoreland area

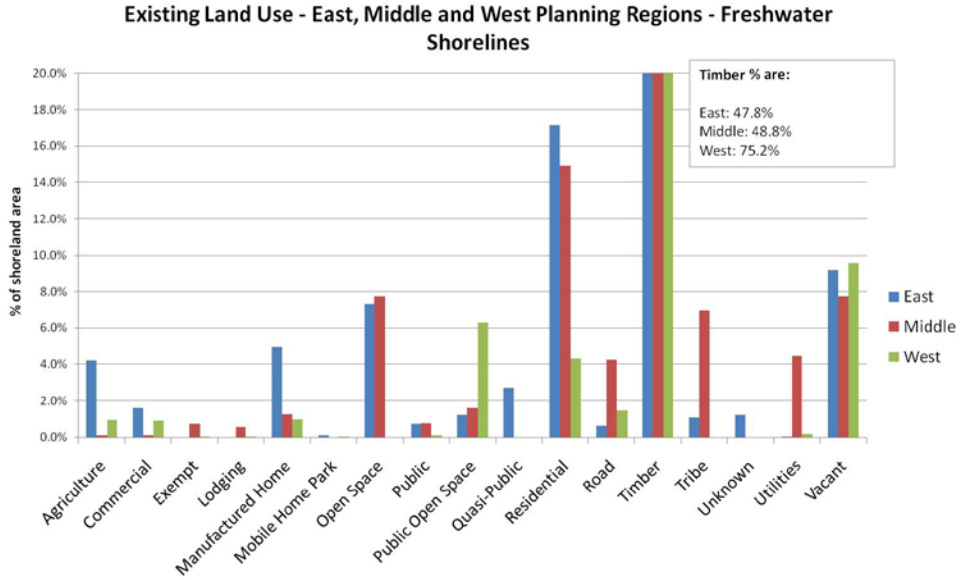


Figure 2-3. Existing land use as a percent of the freshwater shoreland area

Existing land use is fairly consistent with the current zoning, which is heavily weighted toward residential uses on all types of shorelines (river, lake and marine) in all three regions (Figure 2-4 and 2-5; note that timber extends off the top of the graph). Commercial forestry is the second

most prevalent shoreline zoning designating, accounting for as much as 66 percent of the marine and 40 percent of the freshwater shoreline area in the west alone.

These land use and zoning patterns suggest that, compared to other types of land use, residential uses and forest practices have the greatest potential to impact the future health and quality of the shoreline environment. Residential development is regulated as a priority use under the Shoreline Management Act, but forest practices are mostly governed by a different set of rules (known the Forest Practices Act, RCW 76.09); therefore residential uses are a major focus of this analysis and of the SMP update in general.

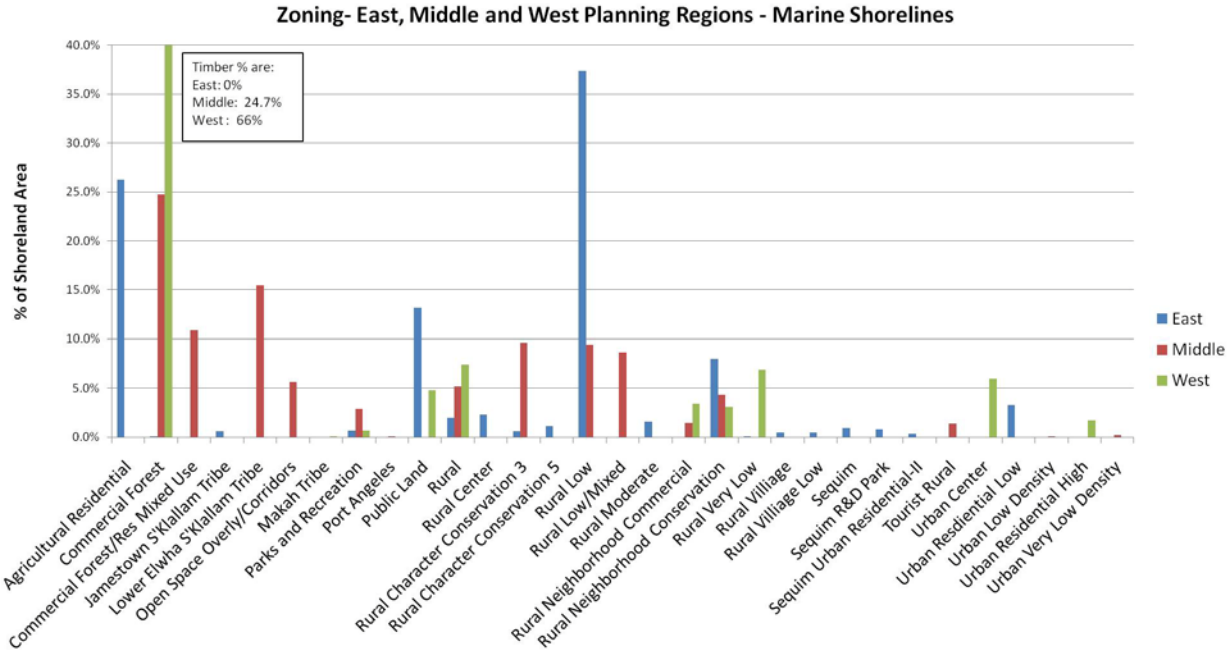


Figure 2-4. Percent of the marine shoreland area in each zoning category

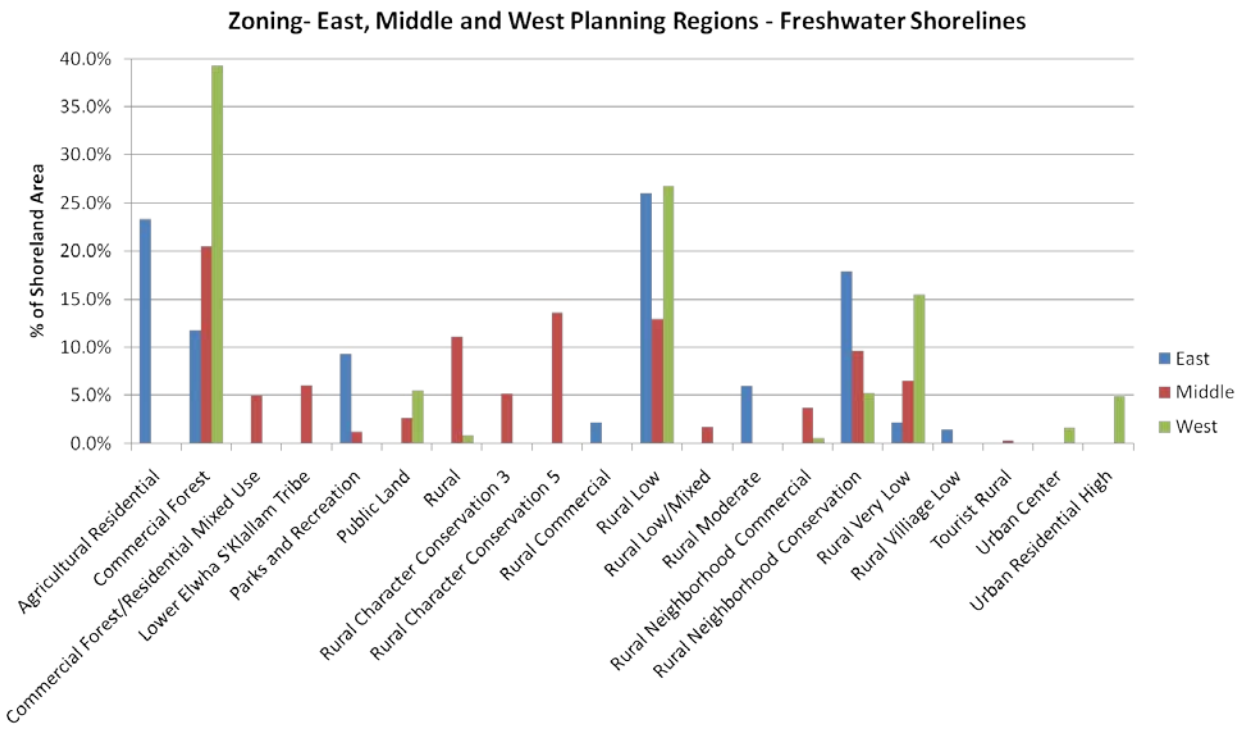


Figure 2-5. Percent of the freshwater shoreland area in each zoning category

2.4 *Future Development Potential in SMP Jurisdiction*

There are approximately 2,700 individual parcels of land that directly adjoin shorelines of the state in Clallam County (excluding WRIA 20). To understand the effect that residential and other types of land use could have on shoreline conditions, it is important to consider the future build out potential of the lands within the jurisdiction of the County's shoreline master program. Future development potential for the planning regions is shown in the following tables. These are rough estimates based on assessors' data.

These development potential data allow for a general comparison of the relative development potential of different areas of the County but are not a parcel-specific prediction of future development. There are many factors that can affect the development potential of a given parcel or area of the County including infrastructure availability, presence of critical areas, ability to meet on-site septic system requirements, lot configuration, etc. In addition, development intensity and type are controlled by County zoning regulations. For example, a parcel within an R1 zone (one dwelling per one acre) can be developed more intensively than a parcel in an R5 zone (one dwelling per five acres). On many parcels, the property boundaries include areas both within and outside of the shoreline jurisdiction. Therefore, future development on such lots could also occur near, but outside the SMP jurisdiction.

Private parcels that are zoned for commercial forestry are technically developable and can be subdivided, but most of this land is less likely to be developed in the relatively near future than non commercial forest lands. Therefore, commercial forest-zoned lands are not considered as "potentially developable" in the tables below. That said, these lands would be subject to ongoing

timber harvest and related forest practices (e.g., road building, etc). Most residential development on lands zoned for commercial forestry would require a conditional use permit and the newly created lots would have to be at least 80 acres. Other uses such as wood manufacturing are also allowed on these lands to support forestry uses.

2.4.1 Marine Shorelines

A substantial portion of the land within SMP jurisdiction along the Strait of Juan de Fuca is vacant or "underdeveloped" (meaning the parcel is partially developed, such as with one dwelling, but zoning regulations would allow parcel subdivision and additional development). These lands include both subdividable and non subdividable parcels and are likely to be developed in the future (Table 2-2).

Table 2-2. Potentially Developable Lands within SMP Jurisdiction along the Marine Shoreline (excluding WRIA 20)

Planning Region	Total Area Within SMP Jurisdiction (acres)	Potentially Developable Lands (acres)	Percent (%) Developable Lands
East	2,538	760	30%
Middle	866	146	17%
West	971	264	27%

In both the east and west planning regions, approximately one-third of the land area along the marine shoreline is vacant or underdeveloped, and could be more intensively developed. In the middle planning region a smaller but still significant portion (17%) of the land area along the marine shoreline is vacant or underdeveloped.

2.4.1 Freshwater Shorelines

As with lands along the Strait of Juan de Fuca marine shore, lands along Clallam County freshwater shorelines have potential for new subdivision and development (Table 2-3). The amount of developable lands increases from the east to the west planning regions from 12 to 45 percent.

Table 2-3. Potentially Developable Lands within SMP Jurisdiction along Freshwater Shorelines (excluding WRIA 20)

Planning Region	Total Area Within SMP Jurisdiction (acres)	Potentially Developable Lands (acres)	Percent (%) Developable Lands
East	3,601	434	12%
Middle	4,049	981	24%
West	6,814	3,073	45%

3. STRAIT OF JUAN DE FUCA ECOSYSTEM: MARINE SHORELINES

Clallam County marine shorelines are buffeted directly by wind and waves entering the Strait of Juan de Fuca from the Pacific Ocean. The shoreline is shaped by seasonal shifts in weather along with cycles of ocean temperature and long term climate change. The underlying geology of the Olympic Peninsula also affects the shape and character of the shoreline through erosion, landslides, sediment movement and beach formation.

The protected coves, bays and river mouths along the Strait of Juan de Fuca have been the sites for human settlements for thousands of years. More recently, the weather and spectacular views of wildlife have attracted development along exposed bluffs and beaches. What happens along the marine shoreline—through natural or human-generated activities—affects the people who live along the shorelines as well as resource-based businesses and the many species that depend on the nearshore for food, cover from predators migrating to the ocean.

The Strait of Juan de Fuca provides habitat and migration corridors for many species of Puget Sound and Fraser River salmon, marine mammals and thousands of migratory birds, including many State-identified "priority species" (Table 3-1). The nearshore ecosystem supports aquatic plants and animals that feed the upper levels of the food web.

Table 3-1. Priority wildlife species mapped along the Clallam County, Strait of Juan de Fuca shorelines (Sources: WDFW, WDNR)

Terrestrial Species	Aquatic Species
Bald eagle	Sand lance
Common loon	Surf smelt
Harlequin duck	Pacific herring
Taylor's checkerspot butterfly	Coho salmon
Wood duck	Chum salmon (fall and summer)
Band-tailed pigeon	Pink salmon
	Sockeye salmon
	Chinook salmon (fall and spring)
	Steelhead (summer and winter)
	Cutthroat trout

Terrestrial Species	Aquatic Species
	Rainbow trout
	Dolly Varden/Bull Trout
	Harbor seal
	Gray whale

This chapter provides an overview of the ecosystem processes at work along the shorelines of the Strait of Juan de Fuca, how structures, docks and other modifications affect long term shoreline processes and the baseline condition of Clallam County's marine shorelines. Additionally this chapter contains a brief discussion about projected changes to sea levels along the Puget Sound/Strait of Juan de Fuca marine shorelines.

3.1 *Overview of Marine Shoreline Ecosystem Processes*

Although the focus of this report and of the Shoreline Master Program update in general is on conditions within the jurisdiction of the Shoreline Management Act, the shoreline guidelines require Clallam County to look beyond the jurisdictional boundaries of the Act and assess the processes that shape and influence shoreline ecological functions. Knowing how these processes work can help determine which management strategies are appropriate for the marine shorelines in Clallam County.

3.1.1 Processes Affecting Marine Shorelines

The Strait of Juan de Fuca shoreline consists of several different shore types including bluff-backed beaches, barrier beaches (including spits), rocky platforms, stream deltas, inlets and embayments associated with protected lagoons and salt marshes. These features, which formed as a result of the County's unique geographic and oceanographic setting, are continually evolving and changing in response to dynamic physical processes such as sediment erosion and deposition, landslides and bluff retreat (Shipman 2004; Johannessen and MacLennan 2007).

The process of bluff erosion begins when sediment grains, blocks or slabs detach from the bluff face and slide down the slope. The eroded material deposited at the base or toe of the slope protects the bluff from wave attack for a while, but is gradually washed away by wind and wave action. Eventually, waves undercut the bluff toe, which destabilizes the slope making it more susceptible to failure (Johannessen and MacLennan 2007). Bluff toe erosion can occur rapidly during wet weather periods, storm surges or during extraordinary high tides. Evidence of marine or wave-induced bluff erosion is visible all along the Strait of Juan de Fuca (Figure 3-1).

Landslides are an extreme form of bluff erosion generally triggered by forces acting on the top of the bluff (as opposed to the toe). Landslides typically occur during periods of heavy precipitation, on bluffs where a combination of characteristics makes the bluff vulnerable to slope failure (Shipman 2009). These characteristics include the underlying geology, degree of

exposure (to wind and waves), groundwater and surface water conditions and the extent of development on the bluff. Heavy precipitation and/or high groundwater levels can cause concavities to form at the top of the bluff. These depressions can grow into gullies and larger slumps that initiate shallow failures or reactivate large, deep-seated landslides. Bluffs that lack vegetation due to clearing or other development-related actions are often at greater risk for these events (Shipman 2004, Johannessen and MacLennan 2007). Figure 3-2 shows evidence of a recent landslide near Shipwreck Point.

Figure 3-1. Erosion at base of bluff contributing sand, cobble and gravel to the nearshore (Photo by A. MacLennan)

Figure 3-2. Evidence of recent landslide activity near Shipwreck Point (Photo by A. MacLennan)

Buff erosion and landslides contribute sediment to beaches in large quantities (Keuler 1988). The volume of sediment and frequency of landsliding is variable and episodic throughout the region due to a number of variables. Two bluffs in close proximity can demonstrate significant variability in erosion rates due to minor changes in shore orientation, stratigraphy, exposure and/or land use. In addition, some bluffs supply sediment to many miles of down-drift shoreline, others may be of only local significance (Coastal Geologic Services 2011).

Tidal range also affects bluff erosion rates (Rosen, 1977). Erosion tends to increase with decreasing tidal range. This is because a small tidal range focuses wave energy at a narrow vertical band, in comparison to higher tidal ranges which dissipate energy over a larger vertical band. The Strait of Juan de Fuca has a low-moderate tidal range meaning wave energy is focused on the upper beach and bluff toe a substantial percentage of the time (more so than in Hood Canal or portions of the Sound Puget Sound).

Bluff sediments are distributed along the shore by a process called littoral drift. Surface waves typically approach the shore at an angle from the northwest creating longshore currents that transport the sediment down-drift. Net shore-drift refers to the long-term, net result of littoral drift (Figure 3-3).

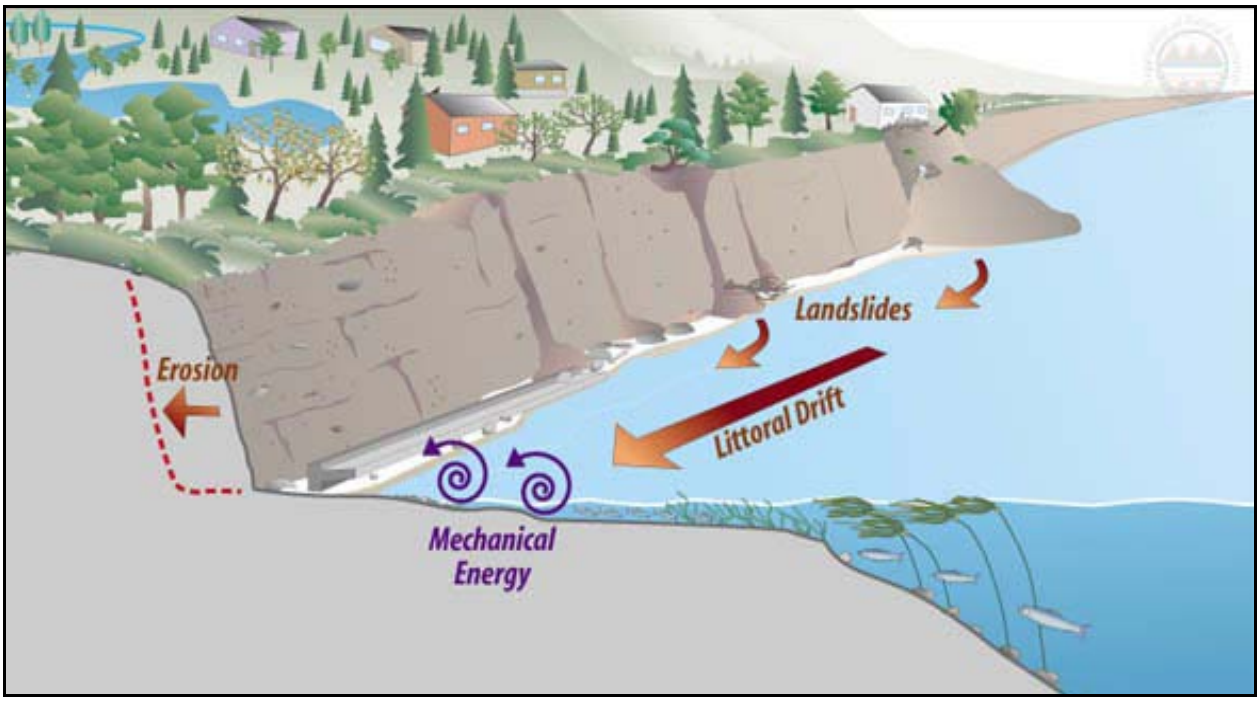


Figure 3-3. Bluff erosion, landslides and littoral drift (Source: King County)

This process of net shore-drift transporting sediment from an erosional feature to a spit or barrier beach creates unique drift cells. Each drift cell acts as a system consisting of three components: a sediment source (called a feeder bluff); a transport zone where sediment is moved alongshore by wave action with minimal sediment input; and a deposition zone where wave energy is no longer sufficient to transport the sediment. For example, the rapidly eroding bluffs down-drift of Dungeness Spit provide the sediment that maintains the spit. While bluff erosion is a natural process that maintains beaches, it can be detrimental to structures (and their occupants) that are built too close to the bluff edge (Figure 3-4).

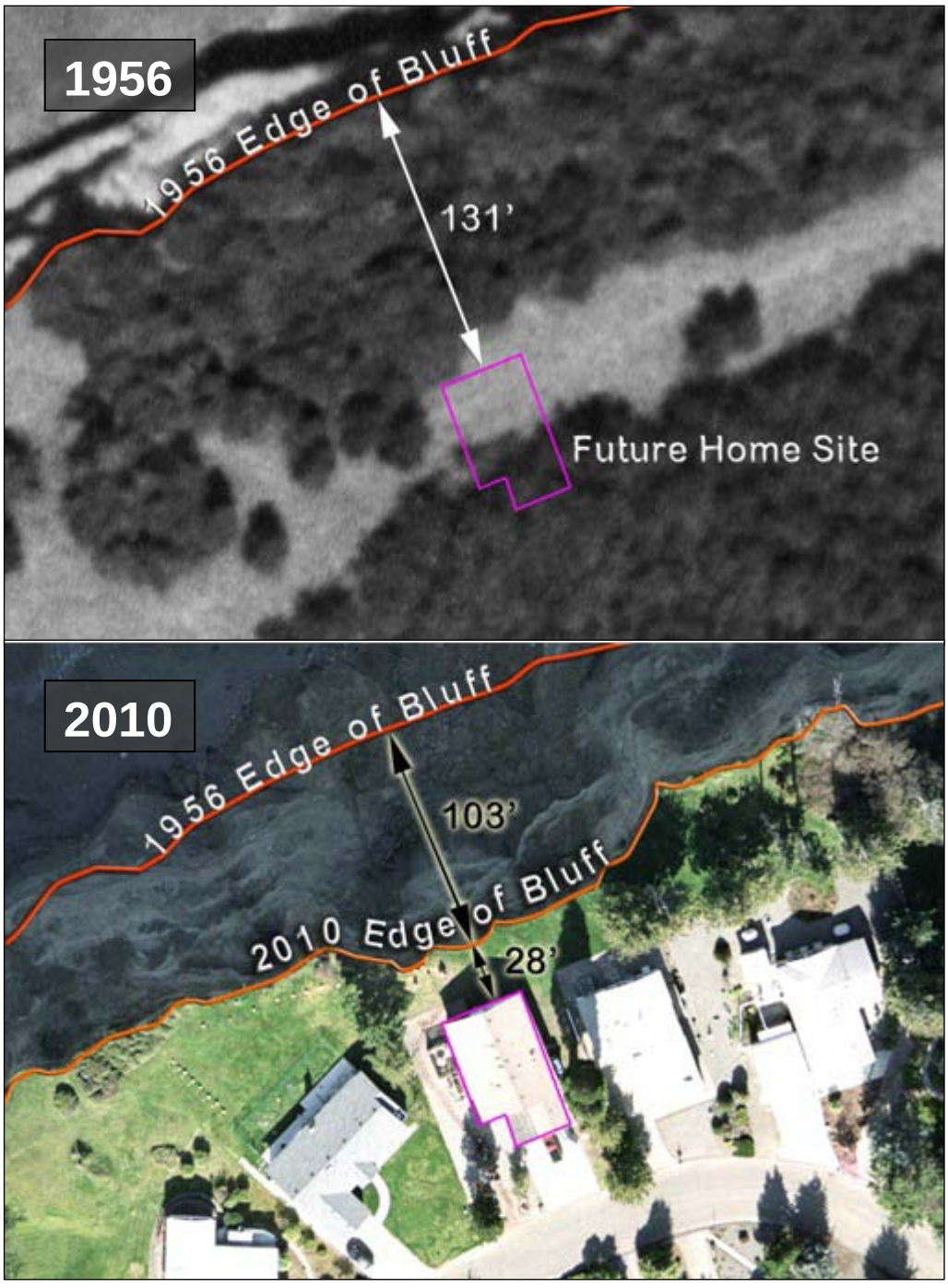


Figure 3-4. Bluff erosion threatening homes along Cypress Circle, west of Dungeness Spit (Source: Randy Johnson)

Properly functioning drift cells are essential for creating and maintaining nearshore habitats for salmon, shellfish and other species. For example, sand lance and surf smelt (called "forage fish") prefer to spawn on beaches of mixed sand and pea gravel (Penttila 2000). Given that littoral drift can rapidly transport particles of this size, the of presence feeder bluffs that erode at a fairly high

rate is directly linked to the extent of suitable sand lance and surf smelt spawning habitat (Shaffer and Ritchie, 2008c).

Eelgrass thrives in sediment-rich, low tide terraces (Hirschi 1999). Salmon and other species rely on forage fish for food, gently sloping beaches as safe havens from predators during migration and eelgrass beds for cover and foraging habitat (Groot and Margolis 1991). Overhanging vegetation provides shade for surf smelt and sand lance eggs, serves as a source of terrestrial insects for consumption by marine fishes and provides cover at high tide (Brennan and Culverwell 2004). Bluff-top trees are favorite nesting and perching spots for bald eagles and other bird species. When people build bulkheads, construct overwater structures such as piers and docks, remove vegetation or cause other shoreline modifications, these processes may become altered and diminish the functionality of the nearshore environment. Where drift cells support important features such as spits, the loss of sediment recruitment can have significant unintended impacts. An example is Ediz Hook in the city of Port Angeles, where large-scale shore-defense projects are required to compensate for the reduction of naturally derived sediment caused by shoreline modifications within the drift cell.

Rivers and streams also influence the character and quality of the marine environment. The coarse sediment from rivers and streams is typically transported alongshore in net shore-drift cells, such as at the mouth of the Elwha and Dungeness rivers. Freshwater input from rivers and streams is beneficial because it decreases the salinity of the water locally and can aid in the formation of ecologically valuable habitats including marshes, distributary channels, shallow water deltaic habitats and sand and mudflats.

3.1.1.1 Effects of Climate on Marine Shoreline Processes

Researchers at the University of Washington's Climate Impacts Group and others have devoted significant effort to modeling potential effects of climate change on the Pacific Northwest. They note that under most scenarios Puget Sound/Strait of Juan de Fuca rivers and shorelines will likely experience changes to snowpack and runoff (with increased potential for flooding), accelerated sea level rise and the loss of nearshore habitat.

Rising sea levels could have a major influence on the marine shoreline environment. There are two main components of sea level rise: "eustatic" (global) sea level rise, which is controlled by global processes such as the warming of the oceans and the melting of ice; and "relative" sea level rise, which is controlled by regional vertical land movement including, tectonic uplift and local land subsidence. Relative sea level (RSL) rise is most informative in support of regional land use planning. Even as eustatic sea level rises, geologic studies of the north Olympic Peninsula indicate that the land is also rising. Tectonic uplift is occurring along an east-west gradient with a small measure of change (-0.1– 0.1 mm/yr) in the eastern county (in vicinity of Port Townsend), considerably more uplift at Port Angeles (2.0 mm/yr) and the greatest uplift occurring at Neah Bay (3.5 – 4.0 mm/yr) (Mazzotti et al. 2008, Verdonck 2006). As a result, RSL is currently out-pacing eustatic SLR resulting in a RSL of -2.1 mm/yr in western Clallam County (Mazzotti et al. 2008). In contrast, in eastern Clallam County RSL is currently 1.9 mm/yr.

Estimates of relative sea level rise are anticipated to increase into the future, and it is unknown if the current trend of uplift out-pacing SLR will continue in western Clallam County. There is

considerable uncertainty surrounding the rate of accelerated global SLR. Research is currently in progress to address the sources of uncertainty, which are largely associated with the rate of ice sheet melt in Greenland and the West Antarctic Ice Sheet. Estimates of relative sea level rise for Puget Sound/Strait of Juan de Fuca are shown in Table 3-2 (NW Olympic Peninsula). These estimates are largely derived from Mote et al. (2008) which was based on the United Nations Environmental Programme's Intergovernmental Panel on Climate Change's Fourth Assessment Report (IPCC AR4). Considerable research has documented that the projections used in the AR4 are on the low side as they underrepresented not only the ice sheet component of global sea level rise but also the emissions scenarios. Mote et al. (2008) included additional SLR contribution from ice sheet loss but only in the very high SLR scenario, and a recent literature review of SLR science for local use noted that the Mote et al. projections are well below other scientific publications since the AR4 IPCC report (Clancy et al. 2010). Therefore, these estimates should be applied appropriately and planning measures should be put in place to assure that the most contemporary, accurate projections can be integrated into the planning process as they become available. The estimates in Table 3-2 are coarse approximations of sea level trends into the future with changes that may be nearly imperceptible from year to year. For these and other reasons, readers are advised not to place too much significance on absolute numbers, or significant digits, in this rapidly evolving area of scientific study.

Table 3-2. Relative sea level rise projections for major geographic areas of Washington State (Huppert et al. 2010, adapted from Mote et al. 2008)

Sea Level Rise Estimate	By the year 2050			By the year 2100		
	NW Olympic Peninsula	Central & Southern Coast	Puget Sound	NW Olympic Peninsula	Central & Southern Coast	Puget Sound
Very low	-5" (-12 cm)	1" (3 cm)	3" (8 cm)	-9" (-24 cm)	2" (6 cm)	6" (16 cm)
Medium	0" (0 cm)	5" (12.5 cm)	6" (15 cm)	2" (4 cm)	11" (29 cm)	13" (34 cm)
Very high	14" (35 cm)	18" (45 cm)	22" (55 cm)	35" (88 cm)	43" (108 cm)	50" (128 cm)

Nearshore areas will respond to sea level rise differently based on the type of landform and the dominant geomorphic processes at work in a given locality. Factors such as sediment supply, resistance to erosion, and the ability of the landform to move (translate) landward will determine how an area responds to SLR (Clancy et al. 2010). Rising sea levels will likely result in an increase in coastal flooding, mass-wasting, beach erosion and overwash, barrier migration, shifting tidal inlets, changes in tidal prism, marsh erosion and accretion, inlet dynamics and accelerated bluff retreat in Clallam County and the Puget Sound region (Clancy et al. 2010). Additional implications of climate change including more frequent and intense storms, El Niño conditions (which can temporarily increase sea level, Mote et al., 2008), and increasing wave heights (Ruggerio and Allen, 2010) are also predicted to occur, which contribute to the frequency

and magnitude of coastal flooding and erosion events. Landslides and flooding of freshwater streams and rivers may also increase along with increases in winter precipitation and altered rainfall patterns. These changes have the potential to affect the breeding, feeding and migration patterns of numerous fish and wildlife species and could have a major impact human health and safety (Casola et al. 2005b).

Implications of sea level rise and climate change will affect numerous nearshore processes, which will have forthcoming effects on the associated nearshore ecosystem. Processes most likely to be affected include: sediment supply and transport, beach erosion and accretion, distributary migration, tide channel process, freshwater input, tidal hydrology, detritus import and export and the exchange of aquatic organisms (Clancy et al. 2010). These implications are likely to result in greater change to the marine landscape at multiple scales. People are likely to respond to these changes by demanding engineered solutions to control and erosion and protect infrastructure. Engineered solutions come at a cost both financially and often to ecosystem processes and the habitats found therein. For example, shoreline armoring can be used to slow marine induced erosion, but inhibits the beach profile from naturally adapting to sea level rise, in a process referred to as *shoreline translation*. Armor not only precludes this natural process but results in intertidal habitat loss as the shoreline migrates landward against the armor.

3.1.2 Evaluation of Marine Nearshore Processes along the Strait of Juan de Fuca

By some measures, the processes that shape and maintain Strait of Juan de Fuca nearshore ecosystem are among the least altered in the Puget Sound basin. The Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) completed a comparative analysis that ranked each reach of the Puget Sound/Strait of Juan de Fuca shoreline based on the degree to which the following ecosystem processes were altered:

Sediment Input	Freshwater Input
Sediment Transport	Detritus Import and Export
Erosion and Accretion of Sediments	Exchange of Aquatic Organisms
Tidal Flow	Physical Disturbance
Distributary Channel Formation and Maintenance	Solar Input
Tidal Channel Formation and Maintenance	

The level of degradation was rated on a relative scale from most degraded to not degraded. It is important to note that PSNERP did not evaluate biological conditions (such as vegetation or habitat availability) per se, but assessed the configuration of the shoreline compared to historic conditions and the presence of modifications or ecological stressors such as fill, armoring, marinas, dams and other features. Overall the reaches of the Strait were less degraded than most other areas of Puget Sound (Schlenger et al. 2010) (Figure 3-5). The low level of degradation

will provide the County with opportunity to achieve multiple goals for environmental protection, restoration, public access and water-related development. The PSNERP analysis is at a very large scale and does not address conditions that may be present for any given location.

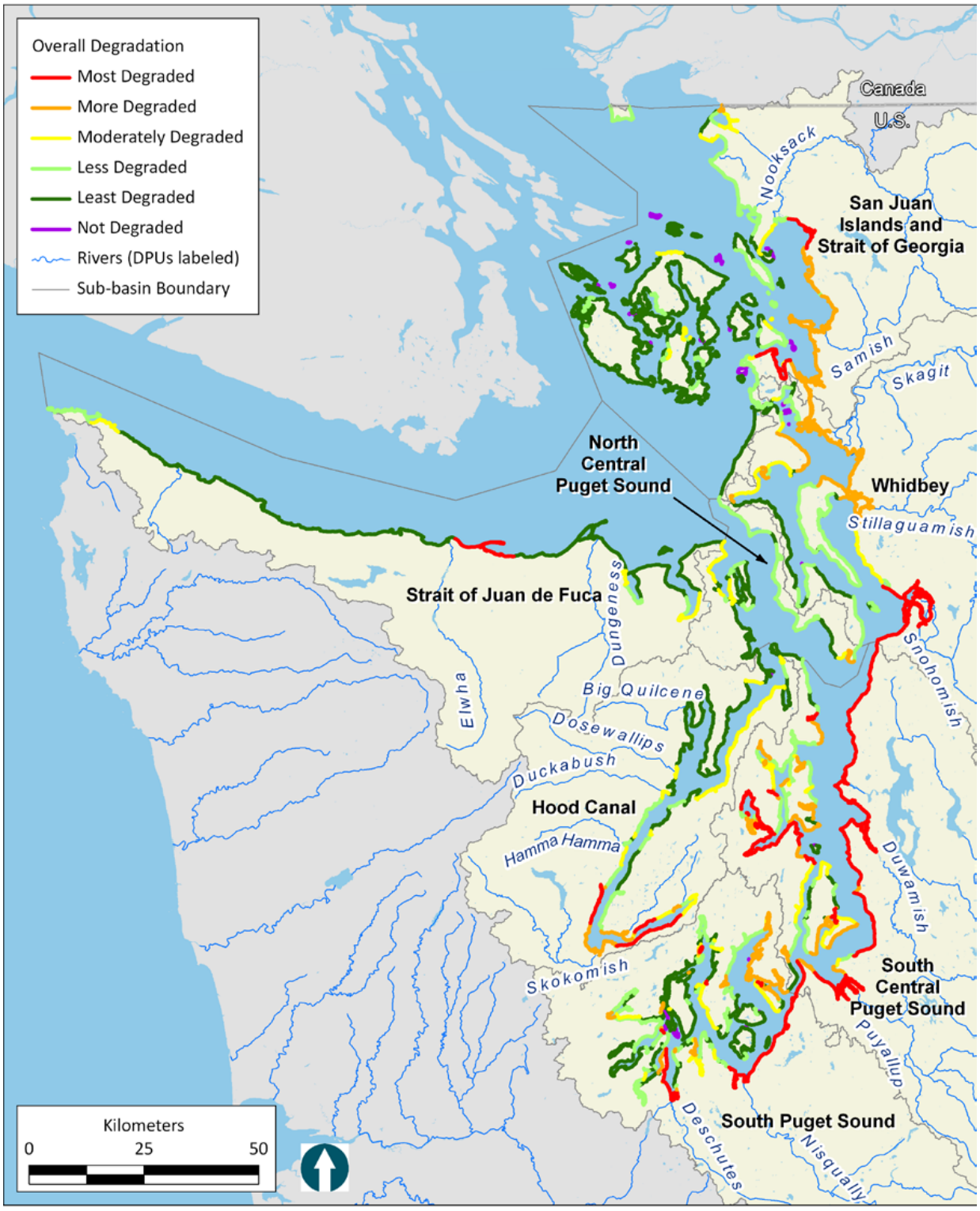


Figure 3-5. Relative degradation of Strait of Juan de Fuca nearshore reaches in terms of nearshore processes (Schlenger et al. 2010)

3.2 *Establishing a Baseline to Measure and Track Marine Ecological Functions*

To comply with the Shoreline Management Act, the County must demonstrate that the updated SMP achieves "no net loss" of shoreline ecological functions compared to the baseline conditions described in this report. Ecology explains the concept of no net loss as follows: *Over time, the existing condition of shoreline ecological functions should remain the same as the SMP is implemented*[1]. In other words, no net loss means that as shoreline development occurs, ecological functions are not diminished.

Ecological functions are dependent on the structure of the shoreline, which is shaped by ecosystem processes (such as erosion and deposition of sediment), which are affected to greater or lesser degrees by the actions people take on the shoreline. This basic model applies to a wide range of actions—many different ecological functions are linked to human actions and therefore to SMP decision. In this way, SMP decisions can lead to increases or decreases in ecological functions over time (Figure 3-6).

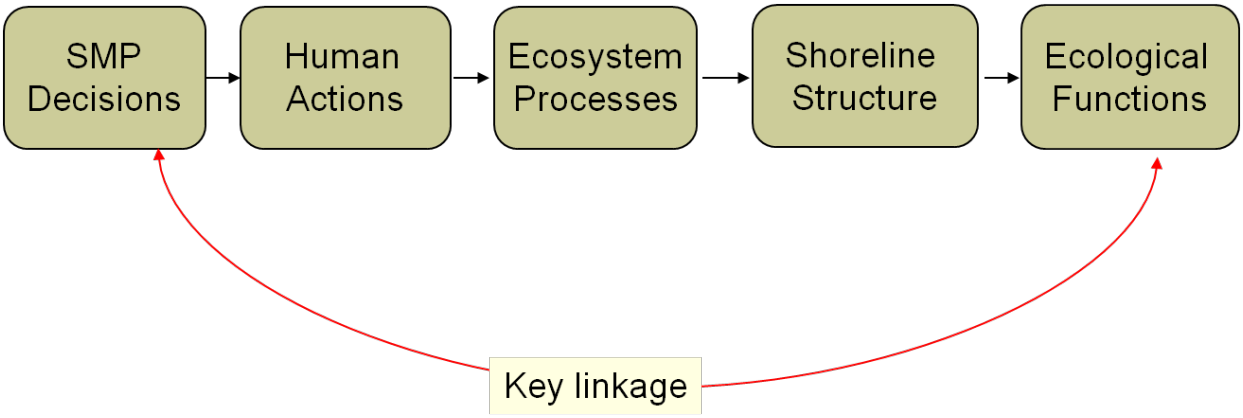


Figure 3-6. Relationship between human actions and shoreline ecological functions in the context of shoreline master programs

As an example, an SMP can regulate when and where bulkheads and other forms of shoreline stabilization are allowed. The construction of bulkheads can, in turn, have direct effects on sediment supply processes, which can affect beach substrates and profile, which can impact the suitability of the beach for forage fish spawning (Figure 3-7).

Figure 3-7. Relationship between shoreline stabilization regulations and forage fish functions

[1] See http://www.ecy.wa.gov/programs/sea/shorelines/smp/handbook/Chapter4.pdf

In order to document existing functions and track changes that occur over time, a set of measurable **indicators** is needed to help determine if ecological functions are increasing increased, decreased, or remaining the same. The set of indicators must be specific enough to be tallied in a reliable and systematic way and data must be available through existing sources. Table 3-3 contains a set of suggested indicators that could be used to assess ecological function of Clallam County marine shorelines along the Strait of Juan de Fuca. Measuring these indicators over time would provide an indication of whether, how and to what degree shoreline conditions and functions are changing. The changes could then be reviewed in light of shoreline management decisions to determine if the shoreline master program is achieving no net loss. The Puget Sound Partnership has identified a similar set of indicators to determine how efforts to restore, protect and prevent pollution in Puget Sound are going (see http://www.psp.wa.gov/pm_dashboard.php for more information).

The text that follows describes current condition of each marine reach in terms of these indicators (along with some related pertinent information). Some of the indicators illustrate the intrinsic quality of the shoreline environment and other indicators are measures of the degree of shoreline alteration.

Table 3-3. Suggested indicators of marine shoreline ecological function that can be systematically tallied using existing data for Clallam County

Metrics that Indicate Shoreline Quality	Why Selected?
▪ Percent of shoreland area mapped as feeder bluff (Table 3-7) ▪ Percent of shoreland area mapped as landslide and erosion hazards (Table 3-8) ▪ Percent of aquatic area supporting submerged aquatic vegetation (kelp) (Table 3-12) ▪ Percent closed canopy forest within 200 feet of the ordinary high water line (Figure 3-14)	▪ Feeder bluffs play a critical role in sediment erosion and deposition and transport processes, which are key determinants of the health of marine beaches (Johannessen and MacLennan 2007). ▪ Landslides and erosion are natural shoreline processes that deposit sediment on marine beaches but create hazardous conditions for property owners. ▪ Kelp and other submerged aquatic plants provide food and refuge for a wide variety of invertebrates (e.g., sea urchins and abalone) and fishes (e.g., juvenile rockfishes and salmon) and orca whales (Mumford, 2007; Shaffer 2008). ▪ Marine riparian vegetation has a major influence on functions including habitat, water quality, organic and nutrient inputs and microclimate (Brennan and Culverwell 2004).
Metrics that Indicate Shoreline Alteration	**Why Selected?**
▪ Percent of shoreline classified as modified (Table 3-6) ▪ Percent of feeder bluffs with armoring (Table 3-9) ▪ Percent of hard armoring along shoreline (Figure 3-9) ▪ Number of overwater structures per mile of shore (Table 3-10) and number of overwater structures per mile of sediment transport zone (Table 3-11)	▪ Modified shores are missing important structural elements that provide habitat for various terrestrial and aquatic species. ▪ Armoring can cause loss of beach and backshore habitat which important areas for forage fish spawning. Armoring also affects movement of materials and organisms between the riparian and the aquatic zone or alter natural drainage patterns (Shipman et al., 2010; Hirschi et al. 2003). ▪ Overwater structures impact sediment transport process, solar incidence and exchange of aquatic organisms, which affects wood web functions, habitat availability and species distribution (Schlenger et al. 2010; Nightengale and Simenstad 2001)

3.2.1 Baseline Conditions Overview

Within Clallam County, the Strait of Juan de Fuca shoreline consists of 18 reaches, each composed of different shoretypes that reflect the underlying geology, degree of exposure to wind/waves, long-term patterns of sea level change, the ongoing redistribution of sediment by net shore-drift processes and the influence of freshwater systems including the Dungeness, Elwha, Lyre and other rivers. The reaches are numbered sequentially from east to west and do not include the incorporated areas or tribal lands of the Makah Indian Reservation (Figure 3-8). All marine shorelines inventoried in this chapter are "shorelines of statewide significance" (Strait of Juan de Fuca).

Figure 3-8. Inventory reaches along the Strait of Juan de Fuca numbered form east to west (MR= marine reach)

In general, the Strait of Juan de Fuca marine shoreline is characterized by considerable wave exposure and moderate tidal range (Shipman 2008). Physical conditions vary dramatically from east to west. The bluffs along the eastern Strait of Juan de Fuca are composed mainly of glacially derived deposits, while the western bluffs are predominantly bedrock. Large scale depositional landforms are common in east Clallam County, while depositional landforms in the western portion of the Strait tend to be more limited to river mouths.

The Puget Sound Nearshore Ecosystem Restoration Project (2009) delineated the shoreline into geomorphic units called shoreforms as a way to further describe and differentiate the physical characteristics that are present along the shoreline. In Clallam County, most of the marine shoreline falls into one of two shoreform categories: bluff backed beach and rocky platform, although all 11 shoreform types are present to some degree (Table 3-4, see Map 1 in Appendix A).

Table 3-4. Breakdown of shoreform categories on the Strait of Juan de Fuca shoreline in Clallam County as a percent of shoreline length (Source: PSNERP 2009)

Shoreform Category	Percent of the Juan de Fuca Shoreline
Artificial	2.1%
Barrier Beach	19.4%
Barrier Estuary	6.6%
Barrier Lagoon	2.7%
Bluffed-Backed Beach	31.1%
Closed Lagoon Marsh	0.6%
Delta	7.4%
Open Coastal Inlet	0.7%
Pocket Beach	3.4%
Plunging Rocky Shoreline	0.2%
Rocky Platform	25.8%
Total	**100.0%**

This geomorphic context has a strong influence on shoreline management since the ecological processes, potential risks (such as landslides and erosion) and ecological functions will vary depending on the shoreform. As a result, strategies for addressing land use, public access and ecological protection will be different for a barrier beach (such as Gibson Spit) than for a rocky platform (such as Tongue Point), river delta (Dungeness river mouth) or bluff.

To further delineate differences in the physical character of the marine shore and assess bluff erosion characteristics, Coastal Geological Services (CGS) examined the marine shoreline of the Strait of Juan de Fuca in Clallam County (east of the Makah Indian Reservation) and classified it into one of 7 different shoretypes based on the criteria in Table 3-5 (see Map 1 in Appendix A):

Feeder Bluff Exceptional (FBE) – Applied to rapidly receding bluff segments with the highest volume sediment input areas per lineal foot. This classification was more common in the study area than in other Puget Sound region areas.

Feeder Bluff (FB) – Areas of substantial sediment input into the net shore-drift system. Feeder bluff segments have periodic sediment input with a longer recurrence interval as compared to feeder bluff exceptional segments.

Feeder Bluff (FB-TS) – Coastal bluffs/sea cliffs that are actively receding and have a history of erosion/landslides but are primarily found within areas mapped as bedrock. These areas function as bedrock sediment sources (typically marine sedimentary units such as sandstone and conglomerate). These bluffs likely recede/erode at a slower rate than typical feeder bluffs and therefore are distinctively different from the

unconsolidated, glacially deposited bluffs that the term feeder bluffs typically represents. Feeder bluff–talus units provide beach sediment in the form of shallow landslides and/or large deep-seated landslides that deliver soil and large woody debris with boulders, cobbles, sand and gravel (often via sandstone and conglomerate talus with soil) to beaches.

Transport Zone (TZ) – Areas that did not appear to be contributing appreciable amounts of sediment to the net shore-drift system, nor showed evidence of past long-term accretion.

Accretion Shoreform (AS) – Areas that are currently depositional or were depositional in the past.

Modified – Areas that have been bulkheaded or otherwise altered to a state where the natural geomorphic character of the shore is largely concealed by the modification such that the bank no longer provides sediment input to the beach system.

No Appreciable Drift (NAD) – Areas where there was no appreciable net volume of littoral sediment transport was occurring due a lack of adequate wave energy for littoral transport to occur, or along bedrock shores with an insufficient volume of sediment in transport.

Table 3-5. Strait of Juan de Fuca shoretype mapping and criteria for Clallam County (CGS 2011)

Shoretype	Criteria		Photo Example
	Presence of (priority in order):	Absence of:	
Feeder Bluff Exceptional (FBE)	1. Bluff/ bank 2. Recent landslide scarps 3. Bluff toe erosion 4. Abundant sand/gravel in bluff 5. Colluvium/ slide debris 6. Primarily unvegetated or vegetated slumps 7. Trees across beach 8. Boulder/ cobble lag 9. Steep bluff (relative	1. Shoreline bulkhead/ fill 2. Backshore 3. Old/ rotten logs 4. Coniferous bluff vegetation 5. Bulkhead	 South of Dungeness River (Reach 4)

Shoretype	Criteria		Photo Example
	Presence of (priority in order):	**Absence of:**	
	alongshore)		
Feeder Bluff (FB)	1. Bluff/ bank 2. Past landslide scarps 3. Intermittent toe erosion 4. Moderate sand/gravel in bluff 5. Intermittent colluvium 6. Minimal vegetation 7. Trees across beach 8. Boulder/ cobble lag 9. Steep bluff (relative alongshore)	1. Shoreline bulkhead/fill 2. Backshore 3. Old/rotten logs 4. Coniferous bluff vegetation 5. Bulkhead	 Northwest Sequim Bay (Reach 3)
Feeder Bluff –Talus (FBT)	1. Bluff/ bank 2. Past landslide scarps, mapped landslides 3. Bedrock with particle size relevant to beach material, bedding or jointing conducive to breaking and abrasion 3. Intermittent toe erosion 5. Intermittent colluvium 6. Minimal vegetation on bluff face	1. Shoreline bulkhead/fill 2. Backshore 3. Old/rotten logs 4. Basalt 5. Bulkhead	 East of Salt Creek (Reach 9)

Shoretype	Criteria		Photo Example
	Presence of (priority in order):	**Absence of:**	
	7. Trees across beach 8. Boulder/ cobble lag 9. Steep bluff (relative alongshore)		
Transport Zone (TZ)	1. Coniferous bluff vegetation 2. Apparent relative bluff stability 3. Gentle slope bluff (relative alongshore) 4. Unbulkheaded transport zone adjacent	1. Visible landslide scarps 2. Toe erosion 3. Backshore & backshore vegetation 4. Old/rotten logs 5. Colluvium 6. Trees across beach 7. Bulkhead	 Harrison Beach (Reach 10)
Modified (M)	1. Bluff/bank 2. Shoreline bulkhead (mostly intact) 3. Substantial shoreline fill	1. Backshore & backshore vegetation 2. Lagoon/wetland /marsh behind berm 3. Backshore "platform" 4. Old/rotten logs 5. Fine, well sorted sediment (relative alongshore)	 West of Hoko River (Reach 17)

Shoretype	Criteria		Photo Example
	Presence of (priority in order):	**Absence of:**	
Accretion Shoreform (AS)	1. Backshore & backshore vegetation 2.Lagoon/wetland /marsh behind berm 3. Backshore "platform" 4. Old/rotten logs 5. Fine, well-sorted sediment (relative alongshore)	1. Bluff/bank in backshore 2. Toe erosion at bank 3. Landslide scarps 4. Boulders on beachface 5. Bulkhead	 Dungeness Spit (Reach 5)

According to this assessment, roughly 28 percent of the marine shore is mapped as feeder bluff (FB, FBE or FB-T), 30 percent is accretion shoreform and the remainder is either classified as transport zone, no appreciable drift or modified shoreline (Table 3-6). Most of the feeder bluffs and feeder bluff exceptional areas are in eastern Clallam County east of Port Angeles, while the feeder bluff-talus areas occur west of Crescent Bay (Table 3-7). This suggest that bluff erosion rates in eastern Clallam County would be greater compared with the western Strait. Actual rates of erosion are unknown and are likely highly variable. Shipman (2004) citing data from Galster and Schwartz (1990) reported that erosion rates for bluffs west of Port Angeles were as much as one meter per year before the shoreline was armored. Preliminary data from a Jamestown S'Klallam Tribe study on the 8.5 mile-long segment of the shoreline west of Dungeness Spit indicates that average erosion rates range from 0.15 to 3.28 feet per year during the time period from 1956-2010. The largest amount of bluff retreat measured for the 2-year period of 2008 to 2010 was 26.4 feet at a site in Monterra. This assessment is still in progress (Personal communication from Randy Johnson to Andrea MacLennan, May 9 2011).

Table 3-6. Strait of Juan de Fuca shoretype mapping and criteria for Clallam County (CGS 2011)

Marine Shoretype	Percent of Shoreline
Accretion Shoreform	30.5%
Transport Zone	19.2%
No Appreciable Drift	12.7%
Feeder Bluff - exceptional	10.3%
Feeder Bluff	9.2%
Feeder Bluff-talus	8.1%
Modified	10.0%

Table 3-7. Percent of each reach mapped as feeder bluff along the Strait of Juan de Fuca in Clallam County (data from CGS 2011)

Marine Reach		Feeder Bluff Area as a Percent of Reach Length		
	Reach Miles (approx)	Feeder Bluff - Exceptional	Feeder Bluff	Feeder Bluff - Talus
1– Diamond Point	12.5	14%	30%	0%
2 – Sequim Bay	8.2	0%	28%	0%
3 – Gibson Spit	6.1	28%	10%	0%
4 – Kulakala Point	7.9	0%	6%	0%
5 – Dungeness Spit	15.7	0%	0%	0%
6 – Green Point	10.4	63%	8%	0%
7 – Angeles Point	7.3	3%	22%	1%
8 – Observatory Point	4.9	0%	0%	0%
9 – Crescent Bay / Low Point	10.7	0%	4%	35%

Marine Reach		Feeder Bluff Area as a Percent of Reach Length		
	Reach Miles (approx)	Feeder Bluff - Exceptional	Feeder Bluff	Feeder Bluff - Talus
10 – Twin Rivers	7.4	7%	7%	68%
11 – Deep Creek	5.3	0%	0%	47%
12 – Pysht River	2.4	0%	0%	4%
13 – Pillar Point	2.1	0%	0%	63%
14 – Slip Point	6.8	0%	0%	0%
15 – Clallam Bay	5.7	0%	0%	0%
16 – Sekiu River /Kaydaka	3.6	0%	0%	14%
17 – Shipwreck Point	6.9	0%	0%	0%
18 – Rasmussen /Bullman Creek	4.6	0%	0%	0%

The presence of feeder bluffs is an important indicator of the value of the reach in terms of supporting nearshore processes and it also an indicator of the suitability of the shore for human development. The Washington Department of Natural resources has mapped a substantial portion of the Strait of Juan de Fuca shoreline as a landslide and / or erosion hazard area (Table 3-8, see Map 2 in Appendix A) suggesting that large segments of the marine shore are potentially dangerous places to live. Some of these areas are already partially developed with single family homes. Additional development in these erosion or landslide hazard areas could put more people at risk.

Table 3-8. Percent of each reach mapped as landslide and erosion hazard along the Strait of Juan de Fuca in Clallam County (data from WDNR 2007)

Marine Reach	Reach Miles (approx)	Landslide and Erosion Hazard Areas as Percent of Reach Length
1 – Diamond Point	12.5	62%
2 – Sequim Bay	8.2	11%
3 – Gibson Spit	6.1	5%

Marine Reach	Reach Miles (approx)	Landslide and Erosion Hazard Areas as Percent of Reach Length
4 – Kulakala Point	7.9	3%
5 – Dungeness Spit	15.7	7%
6 – Green Point	10.4	61%
7 – Angeles Point	7.3	26%
8 – Observatory Point	4.9	8%
9 – Crescent Bay / Low Point	10.7	54%
10 – Twin Rivers	7.4	68%
11 – Deep Creek	5.3	66%
12 – Pysht River	2.4	27%
13 – Pillar Point	2.1	96%
14 – Slip Point	6.8	90%
15 – Clallam Bay	5.7	27%
16 – Sekiu River /Kaydaka	3.6	67%
17 – Shipwreck Point	6.9	11%
18 – Rasmussen /Bullman Creek	4.6	37%

A majority of the landslide- and erosion-prone land is high bluff and not conducive to traditional forms of shoreline stabilization (such as concrete bulkheads). Bulkheads are sometimes used to reduce bluff toe erosion but that approach has not been widely used in Clallam County, as bluff toe armoring is generally ineffective in the high-energy Strait of Juan de Fuca shoreline environment. Overall, only about 8% of the marine shoreline in unincorporated Clallam County is armored (Figure 3-9, see Map 6 in Appendix A). Currently, very little of the armoring occurs in areas that are mapped as feeder buffs (Table 3-9), with the exception of some feeder bluff shorelines in Sequim Bay and the Gibson Spit vicinity. The few reaches that are more heavily armored tend to be low bank accretion shores or bays such as Sequim Bay and Clallam Bay. In those places, the armoring is typically intended to prevent waves from overtopping, reduce flooding, minimize storm damage, retain fill, support marina development and/or protect pier abutments, outfalls and transportation/utility infrastructure.

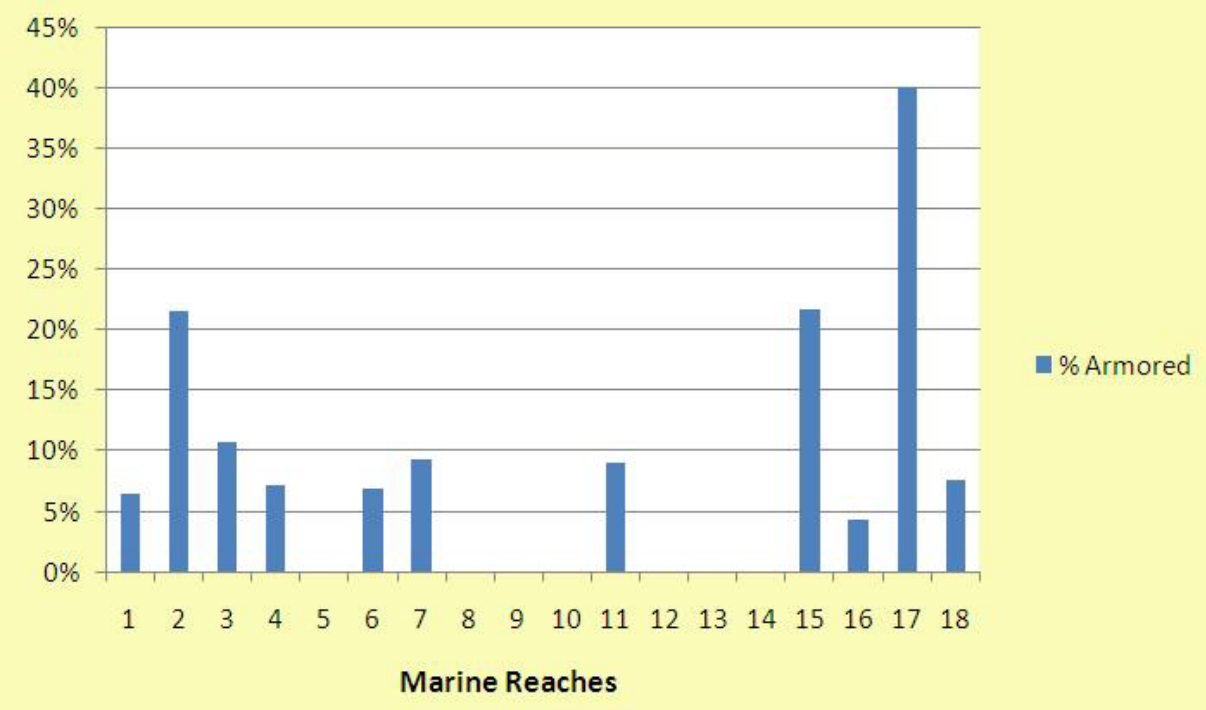


Figure 3-9. Percent of each reach with hard armoring along the Strait of Juan de Fuca in Clallam County (data from point PSNERP 2009, Battelle 2008)

Table 3-9. Reaches where armoring occurs at the base of mapped feeder bluffs along the Strait of Juan de Fuca in Clallam County

Reach ID	Length Feeder Bluff w/ Armor (Miles)	Total Feeder Bluff Length (Miles)	Reach Length (Miles)	Percent of Feeder Bluff that is Armored
2 – Sequim Bay	0.17	1.4	8.2	12.1%
3 – Gibson Spit	0.05	1.1	6.1	4.6%
Grand Total	0.22			

NOTE: Reaches 2 and 3 are the only reaches that have feeder bluffs with armoring

Minimizing, and in some cases prohibiting, new shoreline armoring is one of the ways that Clallam County can protect and maintain shoreline ecological functions. Bulkheads and other forms of hard shoreline armoring can have adverse effects on nearshore process, structure and function—and the effects can vary depending on where and how the bulkheads are constructed (MacDonald et al. 1994). On bluff backed beaches and low bank features (such as spits) armoring cuts off the sediment supply which can lead to beach starvation potential loss of fragile low bank features.

Regardless of where they are constructed, hard structures also tend to reflect wave energy back onto the beach, causing scour and coarsening of the beach over time as sand and gravel are washed way. This can lead to shifts in composition of beach fauna. Bulkheads also alter the movement of juvenile fish, moving them further offshore. Bulkhead installation weakens the linkage between the upland area and the marine environment, especially when riparian vegetation is removed. The loss of riparian vegetation reduces leaf litter and insect inputs to nearshore food webs, destabilizes shorelines and causes desiccation of intertidal habitat. Bulkheads can also displace or eliminate habitat for a number of important species such as rock sole and surf smelt (Table 3-10) (Williams and Thom 2001). Often the effect of building a bulkhead is not just confined to the footprint of the structure, but extends down-drift affecting adjacent properties within the drift cell (Johannessen and MacLennan 2007; Shipman et al. 2010; Williams and Thom 2001). The impacts can be cumulative, particularly as they affect net shore-drift sediment supplies and beach substrate.

Table 3-10. Effects of hard armoring on some marine species (from Thom et al. 1994)

	Armoring Effects [a]						
Resource Species	**Armoring-related Habitat Shift**	**Loss of Spawning Habitat**	**Loss of Shoreline Riparian Vegetation**	**Loss of Wetland Vegetation**	**Loss of Large Organic Debris**	**Changes in Food Resources**	**Loss of Migratory Corridors**
Surf Smelt	●	●	●		⊕		
Pacific Sand Lance	●	●	●		⊕		
Rock Sole	●	●	●		⊕		
Juvenile Salmonids	●		●	●	●	●	●
Pacific Herring	⊕	⊕					
Hardshell Clams	●	⊕				●	
Geoduck	○						
Oysters	○	○				○	
Dungeness Crab	⊕	⊕				⊕	
Sea Cucumber	○					○	
Sea Urchins	○					○	

[a] Filled circles represent well documented evidence of negative effects, cross-filled circles represent high potential for negative effects but not documented, and open circles indicate some potential for longterm effects but not documented.

The same factors that make much of the marine shoreline prone to erosion and landslides (namely wind and wave exposure) also make it largely unsuitable for moorage (such as docks, piers and marinas) and other types of overwater structures (OWS). Overwater structures can have a number of adverse effects on marine shore functions (Williams and Thom 2001). For example, structures alter wave energy and sediment transport dynamics, changing substrate size and stability, which in turn can affect benthic animal communities and forage fish spawning. The close placement of pilings can diminish wave energy, causing finer sediments to fall out of suspension where they normally would remain in transport. Reduced wave energy associated

with pilings can also prevent transport of larger sediments that require higher wave energy for transport. Overwater structures also reduce light levels, which affects photosynthesis and therefore growth and reproduction of phytoplankton and submerged aquatic vegetation such as eelgrass. Fish migrating along the shoreline alter their behavior when they encounter docks, sometimes dispersing or changing direction (Nightingale and Simenstad 2001).

There are relatively few overwater structures along the Strait and most occur in bays and other sheltered areas (Figure 3-10, see Map 6 in Appendix A). Because the majority of these structures are not in sediment transport zones, they generally do not have a major effect on net shore-drift (Table 3-11). On the other hand, these structures create shade that can limit or reduce the suitability of aquatic areas for eelgrass and kelp. Minimizing the number and extent of overwater structures in transport zones and in areas that support submerged aquatic vegetation will help ensure no net loss of ecological functions.

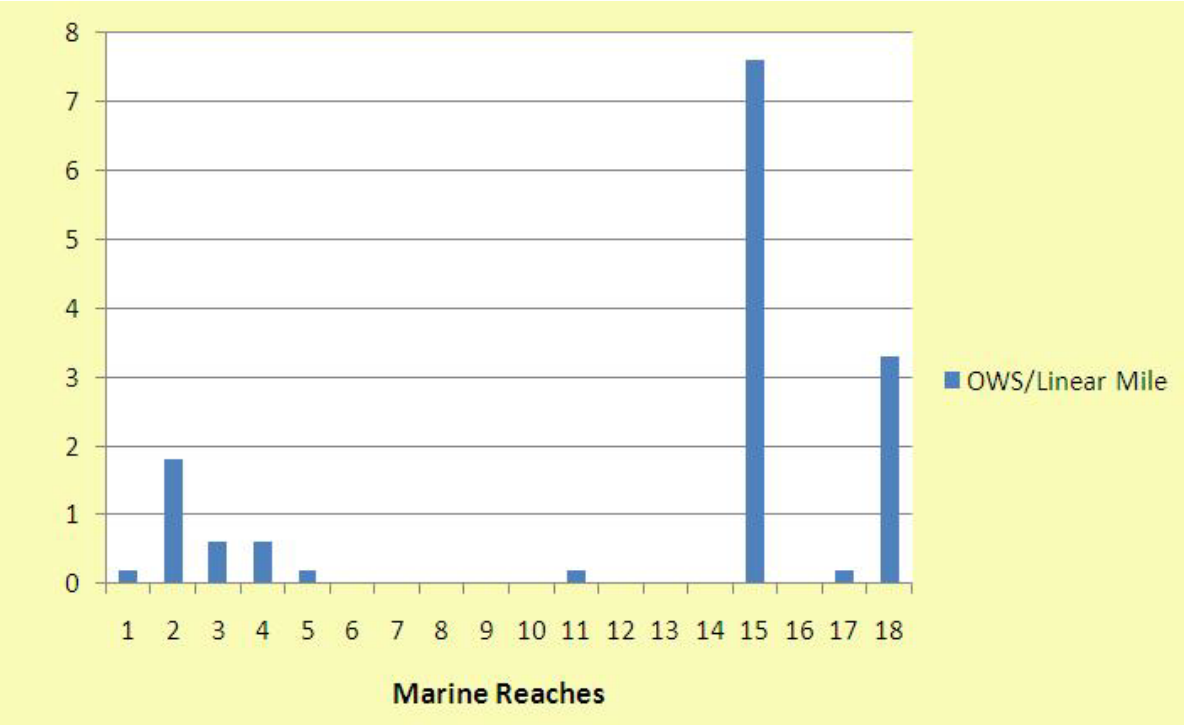


Figure 3-10. Number of overwater structures per mile of reach along the Strait of Juan de Fuca in Clallam County (data from PSNERP 2009)

Table 3-11. Reaches where overwater structures occur within sediment transport zones along the Strait of Juan de Fuca in Clallam County (data from PSNERP 2009 and CGS 2011)

Marine Reach	# OWS	Total Miles of Transport Zone	# OWS/ Miles of Transport Zone
1 – Diamond Point	2	9.2	0.2
2 – Sequim Bay	15	6.2	2.4
3 – Gibson Spit	4	3.5	1.1
4 – Kulakala Point	4	6.6	0.6
5 – Dungeness Spit	2	12.1	0.2
6 – Green Point	0	9.7	0
7 – Angeles Point	0	6.3	0
8 – Observatory Point	0	0	0
9 – Crescent Bay / Low Point	0	9	0
10 – Twin Rivers	0	6.8	0
11 – Deep Creek	1	4.7	0.2
12 – Pysht River	0	2	0
13 – Pillar Point	0	0.6	0
14 – Slip Point	0	0	0
15 – Clallam Bay	16	2.1	7.6
16 – Sekiu River /Kaydaka	0	2.5	0
17 – Shipwreck Point	1	4.9	0.2
18 – Rasmussen /Bullman Creek	3	0.9	3.3

The relative lack of shoreline armoring and overwater structures on the Strait of Juan de Fuca indicates that the Strait has likely retained its value and function for many of the aquatic organisms that rely on healthy nearshore systems. Overstory kelp (e.g., bull kelp) and eelgrass

are among the most important plant species in the nearshore as they serve as underwater meadows and forests for aquatic organisms (These aquatic plants are relatively abundant along the Strait occurring as continuous communities or in patches in places such as Freshwater Bay, Dungeness Bay, Crescent Bay and some areas just west of the Twin Rivers (WDNR 2007, Marine Resources Consultants 2006, Shaffer 1991). Table 3-12 shows the abundance of kelp within each reach (see Map 3 in Appendix A).

Table 3-12. Kelp abundance per mile of reach along the Strait of Juan de Fuca in Clallam County (data from WDNR 2004)

Marine Reach	Acres of Kelp	Total Aquatic Area of Reach (acres)	Percent
1 – Diamond Point	92	1295	7%
2 – Sequim Bay	0	843	0%
3 – Gibson Spit	0	577	0%
4 – Kulakala Point	5	845	1%
5 – Dungeness Spit	234	1622	14%
6 – Green Point	492	1336	37%
7 – Angeles Point	507	833	61%
8 – Observatory Point	237	524	45%
9 – Crescent Bay / Low Point	467	1113	42%
10 – Twin Rivers	451	860	53%
11 – Deep Creek	219	590	37%
12 – Pysht River	1	239	0%
13 – Pillar Point	141	261	54%
14 – Slip Point	461	809	57%
15 – Clallam Bay	222	390	57%
16 – Sekiu River /Kaydaka	290	454	64%
17 – Shipwreck Point	444	737	60%
18 – Rasmussen /Bullman Creek	435	546	80%

Kelp and eelgrass species occur primarily in the shallow subtidal areas, although some plants can be found low on the shore (Figure 3-11). Kelp prefer hard substrate in shallow water and can grow where pilings and other artificial surfaces exist (Mumford 2007). Eelgrass thrives in softer substrates (such as mud to clean sand) and can grow from the mid to upper intertidal zone down to the shallow subtidal area to the depth of light penetration. Humans use kelp as a source of micronutrients and as a stabilizing agent in foods, paints and inks (Mumford 2007).

Figure 3-11. Kelp on Bullman Beach (Photo by A. MacLennan)

Kelp and eelgrass are vulnerable to physical disturbance (from boat propellers for example), toxins and other stressors. Overwater structures such as piers, docks and moored boats (such as at marinas) can reduce amount of light available to theses plants (Nightingale and Simenstad 2001; Williams and Thom 2001). Plants can also be stressed from changes in salinity, temperature and / or oxygen levels. Sedimentation from upland runoff can cause smothering and light blockage (Mumford 2007).

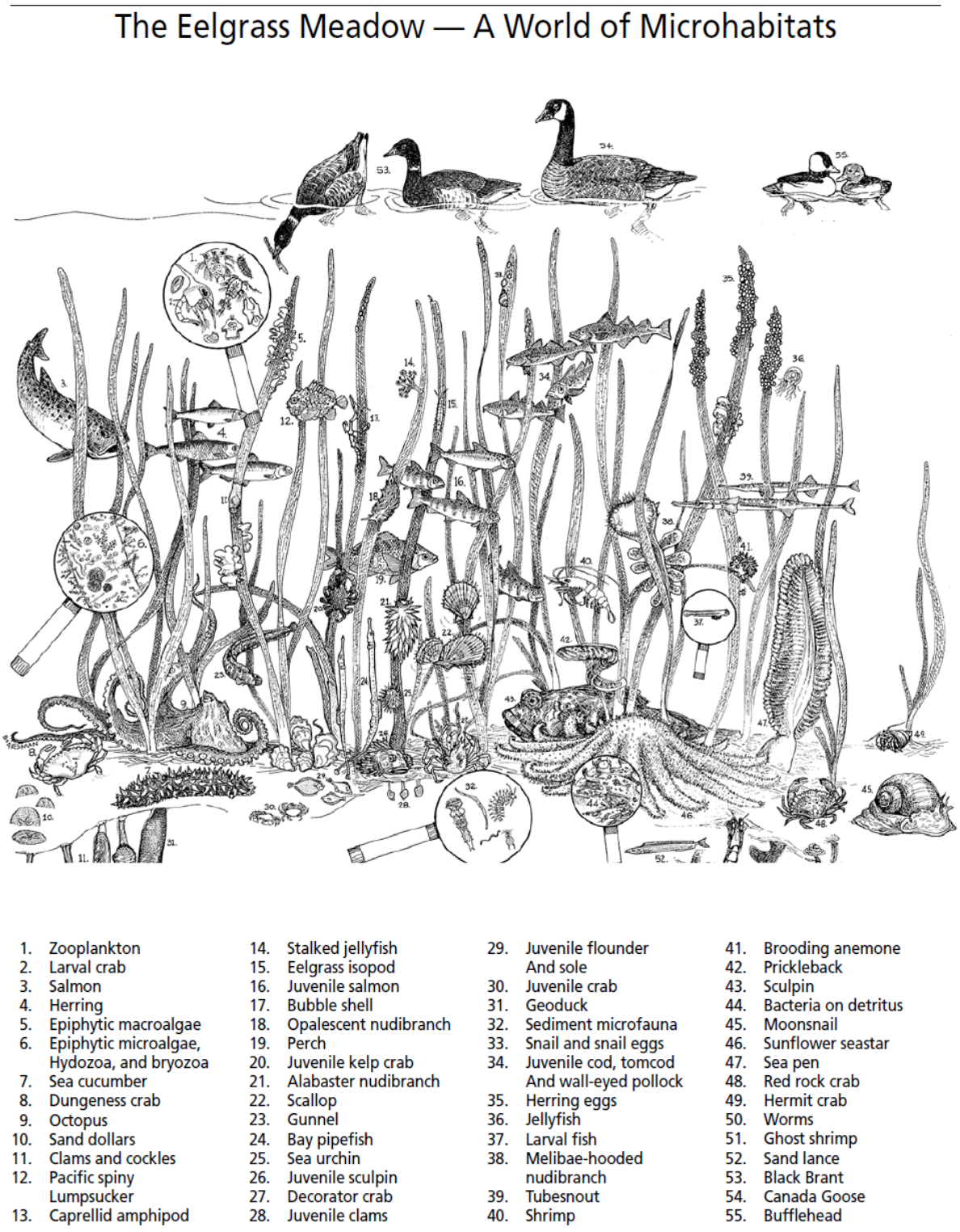


Figure 3-12. Illustration of the importance of eelgrass meadows as microhabitat for numerous species (from Port Townsend Marine Science Center; used with permission)

Healthy, sustainable marine ecosystems require well established riparian vegetation in addition to productive aquatic plant communities (Figure 3-13). There is a growing body of evidence to suggest that marine riparian systems play a key role in supporting marine biota and the integrity of the nearshore environment (Brennan and Culverwell 2004; Desbonnet et al. 1994). Some of the key functions provided by marine riparian vegetation include: soil and slope stability, sediment control, wildlife habitat (for example perching, nesting, cover and breeding for various species), water quality enhancement, nutrient and prey input from overhanging vegetation, shade to control temperature on beach spawning substrates; and large woody debris input (which provides roosting, nesting, foraging, spawning and attachment substrate for invertebrates and plants. Woody debris can also serve to stabilize beaches and backshore areas (Penttila 2000; Brennan et al. 2009).

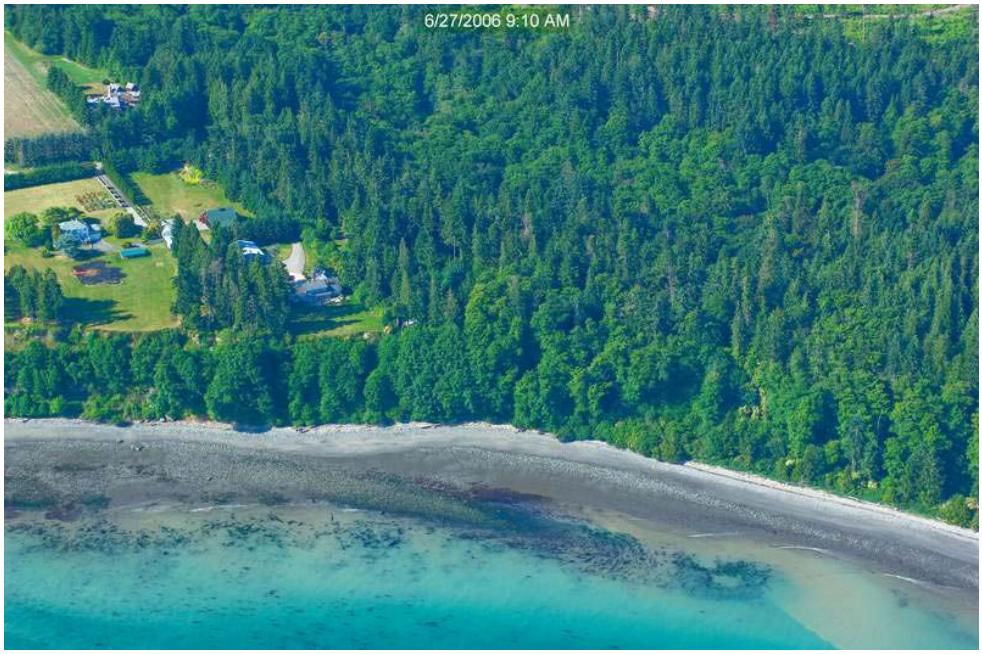


Figure 3-13. Healthy stands of marine riparian vegetation, such as this area just east of Green Point, perform important functions related to wildlife habitat, water quality, slope stability and food web support (photo: Ecology)

To help inform effective management of riparian vegetation in Clallam County, the Point No Point Treaty Council conducted a detailed assessment of riparian cover along Clallam County's marine and freshwater shorelines, mapping vegetation composition/ canopy cover within 200 feet of the ordinary high water line of the marine shoreline (Figure 3-14). Some reaches (mostly in western Clallam County where commercial forestry is the dominant land use) are almost totally forested, while other reaches (between Sequim and Port Angeles, for example) lack well developed marine riparian communities. Because vegetation plays such an essential role in performing so many ecological functions, maintenance of forest cover and revegetating areas that have lost forest cover should be important goals of the SMP update.

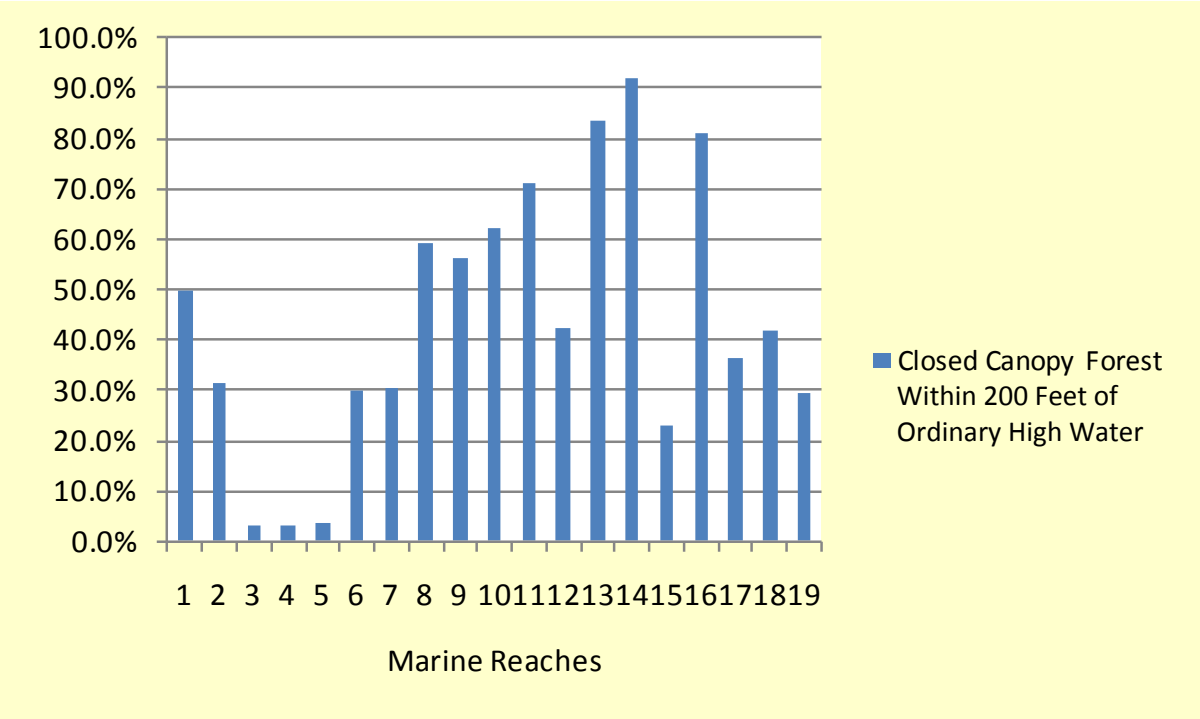


Figure 3-14. Percent of each marine reach with closed canopy forest cover along the Strait of Juan de Fuca in Clallam County (data from Point No Point Treaty Council 2011)

3.2.2 Potential Effects of Future Development and Baseline Conditions

This section describes some of the ways that future development could impact the baseline conditions. This analysis builds of the land use assessment presented in Chapter 2 and considers effects of future buildout on three specific attributes: forest cover, feeder bluffs and the suitability of Clallam County beaches for forage fish spawning.

In most cases, development of vacant or undeveloped lands requires some clearing of vegetation. The effects of the clearing activity are typically most pronounced when the vegetation being cleared is closed canopy or mature forest within 200 feet or less of the ordinary high water line. Some reaches of the Clallam County marine shore (mainly west of Twin Rivers) could experience substantial loss of forest cover because there are extensive areas of developable land with closed canopy forest (Table 3-13). Limits on vegetation clearing in affected areas could help to minimize loss of ecological functions.

Table 3-13. Developable Lands (Vacant Parcels) that have Closed Canopy Forest along the Strait of Juan de Fuca in Clallam County

Marine Reach	Vacant Parcel Area with Closed Canopy Forest (Acres)	Total Reach Area (land only)	Percent of Reach Area
1– Diamond Point	25.9	268.2	9.7%
2 – Sequim Bay	24.5	254.8	9.6%

Marine Reach	Vacant Parcel Area with Closed Canopy Forest (Acres)	Total Reach Area (land only)	Percent of Reach Area
3 – Gibson Spit	16.0	616.7	2.6%
4 – Kulakala Point	20.5	920.1	2.2%
5 – Dungeness Spit	4.2	248.8	1.7%
6 – Green Point	26.2	280.1	9.3%
7 – Angeles Point	53.7	322.1	16.7%
8 – Observatory Point	4.3	107.3	4.0%
9 – Crescent Bay / Low Point	50.0	252.7	19.8%
10 – Twin Rivers	69.4	175.0	39.7%
11 – Deep Creek	87.1	127.4	68.4%
12 – Pysht River	21.5	65.7	32.7%
13 – Pillar Point	25.8	48.6	53.0%
14 – Slip Point	132.6	154.7	85.7%
15 – Clallam Bay	5.4	96.1	5.6%
16 – Sekiu River /Kaydaka	51.0	93.4	54.6%
17 – Shipwreck Point	24.4	156.9	15.5%
18 – Rasmussen /Bullman Creek	42.3	119.2	35.5%
Grand Total	684.9		

The potential for new development to occur on or adjacent to feeder bluffs varies per reach. (Table 3-14, see Maps 1 & 5 in Appendix A). Reaches where there are a substantial number of vacant lots on or adjacent to feeder bluffs are Gibson Spit, Green Point, Twin Rivers, Deep Creek and Pillar Point. To minimize loss of shoreline ecological functions, development in and around these lots should be designed so as not to interfere with normal bluff erosion process. Also, given that these same areas are also prone to erosion and landslides, limits on new development would also have benefits to human health and safety.

Table 3-14. Length and Percent of Developable Lands (Vacant Parcels) that also have Feeder Bluffs along the Strait of Juan de Fuca in Clallam County

Marine Reach ID	Length of Feeder Bluff along Vacant Parcels (Miles)	Total Reach Length (Miles)	% of Reach with Feeder Bluffs along Vacant Parcels
1– Diamond Point	1.0	12.5	8.2%
2 – Sequim Bay	0.2	8.2	2.4%
3 – Gibson Spit	0.7	6.1	11.5%
4 – Kulakala Point	0.0	7.9	0.3%
5 – Dungeness Spit	0.0	15.7	0.0%
6 – Green Point	2.1	11.4	18.5%
7 – Angeles Point	0.8	7.3	10.6%
8 – Observatory Point	0.0	4.9	0.0%
9 – Crescent Bay / Low Point	0.8	10.7	7.8%
10 – Twin Rivers	2.7	7.4	36.0%
11 – Deep Creek	0.7	5.3	14.1%
12 – Pysht River	0.0	2.4	1.9%
13 – Pillar Point	0.3	2.1	14.0%
14 – Slip Point	0.0	6.8	0.0%
15 – Clallam Bay	0.0	5.7	0.0%
16 – Sekiu River /Kaydaka	0.2	3.6	6.6%
17 – Shipwreck Point	0.0	6.9	0.0%
18 – Rasmussen /Bullman Creek	0.0	4.6	0.0%
Grand Total	**9.8**	**131.3**	**7.4%**

The potential that development of vacant lots will impact beaches that provide suitable forage fish spawning habitat varies by reach (Table 3-15, see Maps 3 & 5 in Appendix A). The risks to forage fish spawning potential are greatest near Diamond Point, Gibson Spit, Dungeness Spit, Angeles Point and most areas west of the Twin Rivers. In these areas special care should be given to minimize construction of new bulkheads and maintain riparian vegetation to ensure forage fish functions.

Table 3-15. Length and Percent of Developable Lands (Vacant Parcels) in areas that provide suitable forage fish spawning habitat along the Strait of Juan de Fuca in Clallam County

	Forage Fish Suitability Class (data from Anchor Environmental and Marine Resources Committee 2002)					
Marine Reach	**Very Low**	**Low**	**Moderate**	**High**	**Very High**	**Grand Total**
1– Diamond Point	0.0%	1.4%	0.0%	11.2%	6.6%	19.2%
2 – Sequim Bay	0.0%	0.0%	0.0%	8.9%	1.0%	10.0%
3 – Gibson Spit	0.0%	0.8%	3.1%	14.2%	16.5%	34.6%
4 – Kulakala Point	0.0%	0.0%	10.7%	0.3%	0.0%	10.9%
5 – Dungeness Spit	0.0%	6.6%	2.4%	9.4%	22.9%	41.2%
6 – Green Point	0.0%	1.8%	11.1%	0.0%	0.2%	13.0%
7 – Angeles Point	0.0%	7.2%	13.3%	11.2%	0.0%	31.6%
8 – Observatory Point	0.0%	0.0%	1.9%	0.0%	0.0%	1.9%
9 – Crescent Bay / Low Point	0.0%	3.8%	7.2%	5.0%	0.0%	16.0%
10 – Twin Rivers	0.0%	0.0%	0.0%	23.0%	0.0%	23.0%
11 – Deep Creek	3.8%	0.0%	20.5%	9.4%	0.0%	33.7%
12 – Pysht River	0.0%	0.0%	30.4%	0.0%	0.0%	30.4%
13 – Pillar Point	0.0%	0.0%	25.2%	0.0%	0.0%	25.2%
14 – Slip Point	0.0%	0.0%	70.9%	0.0%	0.0%	70.9%
15 – Clallam Bay	7.3%	10.4%	20.7%	0.0%	0.0%	38.5%
16 – Sekiu River /Kaydaka	4.0%	56.4%	0.7%	0.0%	0.0%	61.1%
17 – Shipwreck Point	0.0%	25.6%	12.2%	0.0%	0.0%	37.8%
18 – Rasmussen /Bullman Creek	7.0%	5.2%	57.9%	0.0%	0.0%	70.1%

3.3 *Summary of Baseline Conditions and Initial Management Considerations for the Strait of Juan de Fuca Marine Shore*

The Strait of Juan de Fuca is an important transport zone for the entire Puget Sound region. People use the marine corridor along Clallam County for commercial and recreational ship traffic and the Strait is a transport zone for sediment, salt and freshwater and migrating species of fish and wildlife, including Endangered Species Act-listed stocks of Chinook salmon.

The baseline analysis of the marine shorelines in Clallam County indicates that the Strait of Juan de Fuca is in relatively good condition compared to other portions of Puget Sound, but there are local pockets of degradation and shoreline modification that provide opportunities for restoration, clean-up and other forms of stewardship. Several river mouths along the Strait shoreline have been modified by roads, levees and structures and many of these have been are slated for restoration. Kelp forests and eelgrass meadows are prevalent along the Strait, serving as feeding and rearing areas for many resident and migratory species. Shoreline riparian vegetation is fairly intact in the forested areas west of Port Angeles, but bluff and low bank areas near the east end of the County have been cleared and are more developed. Bald eagles use a substantial percentage of the land along the Strait as foraging, perching and nesting habitat.

Physically, the shorelines along the Strait are on the move as feeder bluffs are continually eroding to form beaches and sustain sand spits. Outside of incorporated cities, only a small percentage of Clallam County marine shoreline is armored and most of the armoring that is present does not directly impede sediment delivery from feeder bluffs. Only 12.7% percent of the Strait of Juan de Fuca shorelines in Clallam County have no appreciable amount of net shore-drift because they are composed of erosion resistant rock or are located in sheltered bays. Relatively few overwater structures are located in Clallam County, but they are generally concentrated in sheltered bays and the cumulative effects on shading and forage fish spawning will need to be considered in shoreline management strategies.

3.3.1 Key Management Considerations

The issues that appear to be the most pertinent for Clallam County to consider along the Strait of Juan de Fuca include residential use (particularly in the east end of the County) and shoreline vegetation management. Commercial forestry is the second most dominant land use, especially on the western reaches; however, forest practices are generally not regulated by the Shoreline Management Act. Unincorporated portions of Clallam County marine shorelines have little commercial, industrial, or port use and these uses are not included in the key management considerations.

These findings are presented as general considerations that will require further exploration and discussion with stakeholders including citizens, shoreline property owners, County staff, elected officials, neighboring jurisdictions and the Department of Ecology. This is not an exhaustive list of issues and it is not intended to limit the focus of the SMP update as there are other issues including other types of uses or modifications that the State shoreline guidelines require to be addressed.

1. New residential development in and around feeder bluffs, landslide hazard areas and erosion hazard areas

    - Protect natural sediment processes and maintain human health and safety by ensuring that new structures are set back an adequate distance from feeder bluffs and other erosion or landslide-prone areas. Setback considerations should take into account the life of the structure (generally defined as 100 years), expected erosion for that duration and effects on neighboring or down-drift properties. Setting structures back from the shoreline can also reduce the need (and associated cost) of future, potential shoreline stabilization measures along eroding shorelines.

- Avoid the acceleration of erosion processes in and near erosion/ landslide -prone areas by preserving forest cover along marine shorelines. Limitations on the removal of forest cover also help maintain shoreline habitat for many wildlife species and the formation of nearshore habitat for aquatic species. The management of forest cover along shorelines also necessitates consideration of connectivity to adjacent upland forests for birds and other species that move between terrestrial and marine environments.

- Reduce risk factors that can cause slope instability by designing and managing runoff from new developments in ways that minimize soil saturation.

- Provide incentives and flexible regulatory/permitting procedures to allow relocation of existing homes in rapidly eroding or other potential dangerous areas to safer areas of the property.

2. New residential development on low bank accretion shores:

    - Set structures back from the shoreline to decrease the potential risks of coastal flooding and tsunami damage and minimize the need (and associated landowner costs) for hard shoreline armoring. Effects of armoring on down-drift properties should be fully evaluated before new bulkheads are allowed to prevent impacts to neighbors and shoreline processes.

    - Locate and design new shore stabilization to avoid impacts on forage fish spawning habitats.

    - Use “soft armoring” techniques to protect existing structures. These generally have less negative impact to shoreline processes, forage fish spawning and salmon rearing habitat than traditional “hard armoring” methods (such as rock/concrete bulkheads).

    - Protect embayment and lagoon habitats from further encroachment by development. These areas provide habitat for a diversity of species and perform flood storage and water quality functions. Compared to some shoreforms, lagoons and coastal embayments have been disproportionally affected by shoreline development throughout the Puget Sound / Strait of Juan de Fuca system so protection of the remaining areas is a high priority for regional resource managers.

    - Location, design and operation of residential septic systems remains an ongoing challenge so as not to degrade water quality or cause the closure of shellfish beds for recreational and commercial harvest.

3. New in-water and overwater structures such as docks, piers, marinas (marine shorelines):

    - Limit of the proliferation of new in-water or overwater structures (such as docks) to prevent impacts on submerged aquatic vegetation, sediment transport and aquatic fish species. Where structures are allowed, the number, design and location should incorporate considerations of sediment transport zones, shading of aquatic vegetation and the effect on spawning habitat for forage fish species.

- Public access should be located, designed and managed to avoid sensitive habitats such as forage fish spawning beaches or areas that could be unsafe due to slope instability or other factors.

4. MARINE REACH INVENTORY

This chapter describes the marine shoreline reaches that are within the jurisdiction of the County's SMP (in WRIAs 18, 19, and a portion of 17, excluding incorporated areas and the Makah Reservation) (see Figure 3-7 for the reach locations). Reaches are described in terms of their physical attributes, ecological condition, and human environment / land use characteristics. Maps are provided in Appendix A.

Based upon available County-wide data sources, key physical, ecological, and land use characteristics for each reach are detailed on "reach sheets," located at the end of this section. A description of the available data sources, including data limitations, is presented in the "reach sheet explainer" following this chapter.

The reach descriptions below contain a summary of the data presented within the reach sheets and additional pertinent information, including potential future land use impacts to shoreline processes and management issues and opportunities.

4.1 *Reach 1: Diamond Point (Maps 1a to 6a in Appendix A)*

The "Diamond Point" reach contains 12.5 miles of marine shoreline, which extends along Miller Peninsula from the Clallam/Jefferson county line to the northwest corner of Sequim Bay (approximately one mile south of Travis Spit). The reach contains shoreline along Discovery Bay, the Strait of Juan de Fuca, and Sequim Bay. The reach also contains the mouth of Eagle Creek (Eagle Creek is not a shoreline of the state, except where it enters the Strait of Juan de Fuca). Jefferson County has designated the majority of the adjacent Discovery Bay shorelands as either Natural or Conservancy. The aquatic area is designated Priority Aquatic. These designations provide the highest levels of ecological protection available under the Jefferson County shoreline master program.

4.1.1 Summary of Baseline Conditions

The predominant shoreform of Miller Peninsula is bluff backed beach. Over half of the shoreline consists of feeder bluffs, except for the Thompson Spit, Diamond Point, and Travis Spit vicinities. The feeder bluffs, combined with net shore-drift, supply the sands, gravels and cobbles that maintain barrier beaches at the spits and Diamond Point. A majority of the bluffs are considered to be unstable and some areas show evidence of recent slides—particularly on the shoreline west of Diamond Point. The shorelines along Diamond Point, Thompson Spit, Paradise Cove Spit, and Travis Spit are within a tsunami hazard zone and the FEMA coastal 100-year floodplain.

Forage fish species such as surf smelt and sand lance spawn in the upper intertidal gravel and gravel-sand beaches of Discovery Bay and Sequim Bay (Figure 4-1). Eelgrass is mapped throughout a majority of the reach, and patches of kelp are mapped along the Strait. The marine shores in this area, and in particular the Discovery Bay and Sequim Bay shorelines, are prime habitat for juvenile salmonids, which use the shallow nearshore waters for migration and rearing. The Jamestown S'Klallam Tribe and Clallam County (2004) identified the nearshore areas between Sequim Bay on the east and Morse Creek on the west as being of particular importance

to Dungeness River salmon stocks. Lagoon/coastal embayment wetland habitat is present at Diamond Point, Thompson Spit, and Paradise Cove. Travis Spit and adjacent shorelines provides habitat for shorebirds and waterfowl, and contains a haulout area for marine mammals. Eagle Creek provides habitat for coho salmon and cutthroat trout.

Most of the tidelands within the reach are publicly owned. Some public tidelands areas near Paradise Cove are leased for aquaculture, and some commercial geoduck beds are present throughout the reach, including the northeastern portion of Sequim Bay. Recreational shellfish harvesting is available on almost the entire north shore of Miller Peninsula, and south of Diamond Point on Discovery Bay. Discovery Bay was closed to shellfish harvesting in 2007 because of elevated fecal coliform levels, but has since reopened. The source of the bacteria is not known, but according to the WRIA 17 Watershed Management Plan several drains near Diamond Point carry pollution into Discovery Bay (Cascadia Consulting Group 2003). The reach has no other documented water quality impairments.

Sections of the shoreline (6% of reach total) have been armored, presumably to protect adjacent residences. The armoring occurs along Diamond Point and Paradise Cove, which are accretion shoreforms. Approximately 3 docks are located in the Diamond

Figure 4-1. Forage fish eggs on gravelly beach substrate

Point vicinity, but no other overwater structures are present within the reach. Neither the docks nor the armoring occur along feeder bluffs or in transport zones. A few small segments of bulkhead occur in areas that support sand lance spawning and eelgrass.

Half of the shoreland area within the reach is heavily forested, which provides habitat for a diversity of wildlife species and helps stabilize erosive bluffs. Outside of the shoreland zone, the majority of Miller Peninsula upland area is forested.

Land use along the shoreline is primarily undeveloped open space, with pockets of residential development. This is consistent with the zoning which is either R5 or open space. The densest concentration of residential development is located in the Diamond Point vicinity, with more sparse development in the Travis Spit vicinity and northeast Sequim Bay. The north, central portion of the reach is the undeveloped Miller Peninsula State Park, managed by Washington State Parks.

More than half of the land in shoreline jurisdiction in this reach is publicly owned. A majority of the adjacent tidelands are also mapped as publicly owned. The uplands are accessible to the public; however, there are limited opportunities to access water from the uplands because of the presence of steep, unstable bluffs. Public shorelines in the northern portion of the reach can be accessed via a trail from Panorama Vista County Park. The shoreline along Discovery Bay can be accessed at one location, via an informal trail at within the site of the future Miller Peninsula State Park.

4.1.2 Future Land Use and Potential Effects on Shoreline Ecology

There are a substantial number of undeveloped and underdeveloped parcels on this reach. Under current zoning regulations, approximately one-third of the shoreland area has potential for new residential development. The developable land is generally located along bluffs in the eastern and western portions of the reach, in areas that are mainly forested. Vacant parcels in the along Discovery Bay feeder bluffs are mostly 1- to 5-acre lots that cannot be subdivided under current zoning regulations. The lots are rectangular in size with narrow water frontages (approximately 150 feet). Development in these lots could result in relatively dense shoreline development as well as removal of forest cover near the erosive feeder bluffs in this area. Vegetation removal along bluffs tends to accelerate erosion, which can put adjacent homes and other structures at risk.

The Washington State Parks Commission has put plans for development of Miller Peninsula State Park on hold due to budgetary constraints (WSP, 2011). The development would likely increase managed public access to the area, which would be a benefit to the community, but could lead to adverse effects on the quality of the nearshore environment if not properly designed and managed. Clearing, grading, impervious surface and shoreline modification could reduce the amount or quality of the forested habitat or create other adverse impacts on shoreline ecology. State park planners have mapped sensitive ecological features, opportunities and constraints for consideration in the initial planning stages.

The residential land on Diamond Point has already been platted into small (approximately quarter-acre) parcels, and most of the homes are built within 50 feet of the ordinary high water line. Infill development on scattered vacant parcels could occur in the future. Few of the homes in this reach have a dock or other overwater structure since most of this reach is subjected to the strong wind and wave conditions that are prevalent along the Strait. There is some potential for new dock construction on the Discovery Bay shoreline since it is somewhat more protected

(from wind and waves), but the absence of docks along the Bay suggests that conditions are generally unsuitable for docks.

Diamond Point landowners whose homes are close to the shore may seek to construct bulkheads or other shoreline armoring structures to protect their property from storm activity or changes in sea level, particularly on parcels bordering the Strait. An increase in armoring and/or overwater structures in the area may adversely impact sediment delivery and transport processes which could impact submerged aquatic vegetation communities and/or forage fish spawning habitat, which would in turn reduce the quality/suitability of this reach for salmonid rearing and migration. The nature and degree of the impact would depend on the type of armoring and its location relative to the ordinary high water line among other factors.

There is a significant amount of undeveloped land in the Travis Spit vicinity, some of which are large parcels that may be subdivided into 5-acre lots under current zoning regulations. Similar to the southwestern portion of the reach, many parcels are rectangular in shape with water frontage widths averaging 150 feet. Potential shoreline impacts resulting from development on these parcels are similar to those described on the Discovery Bay shoreline. An area near Travis Spit is mapped as a waterfowl concentration area, and changes in the development density in this vicinity could reduce the quality or suitability of the habitat for waterfowl species.

4.1.3 Management Issues and Opportunities

This reach has significant feeder bluffs and transport zones that are mostly intact/uninterrupted, so sediment processes are in relatively good condition. There are few shoreline modifications (such as armoring and overwater structures) and significant amounts of high quality terrestrial (forest) and submerged aquatic vegetation. Protecting these natural shoreline attributes and habitat-forming processes is key to maintaining the overall ecological health of the reach, and minimizing loss of barrier beach habitat. Compared to some shoreforms, lagoons and coastal embayments have been disproportionally affected by shoreline development throughout the Puget Sound / Strait of Juan de Fuca system so protection of the remaining areas is a high priority for regional resource managers.

In addition to their extremely high value as fish and wildlife habitat, Travis Spit and Paradise Cove Spit help protect Sequim Bay's shorelines from wave energy and erosion. Limiting or preventing the construction of bulkheads within their drift cells will help protect these valuable features by preserving their sediment supplies.

Over half of the shoreline in this reach is publicly owned; however, direct water access is generally not feasible because of the steep, erodible bluffs. Opportunities for increased public access, trails, and shoreline viewing areas are available at the undeveloped Miller Peninsula State Park. The northern shoreline of Travis Spit is publicly owned, but there are no adjacent public parcels.

Key management considerations for this reach include:

- Bluffs / highly erosion-prone areas: Protection of feeder bluffs and sediment processes are critical concerns. Bluffs will continues to naturally erode / retreat, so homes and other structures must be set back a sufficient distance (from the edge of the bluff) to minimize

risk and avoid the need for harmful stabilization measures. Vegetation should be maintained to stabilize slopes and runoff needs to be managed so that it does not destabilize slopes. Shoreline property owners should be aware of the substantial risks to property and human safety resulting from developing land near unstable feeder bluffs.

- Low bank areas: Potential risks of coastal flooding and tsunami damage, sediment transport, and fisheries habitat should be considered when siting new or modifying existing structures. Construction of bullheads where they do not now exist should be discouraged in favor of more environmentally protective strategies. Protection of embayment and lagoon habitats at Diamond Point and Paradise Cove is critical.

- Future development of Miller Peninsula State Park should be managed and located to minimize habitat fragmentation and avoid intensive public use/access in ecologically and geologically sensitive areas.

- Existing public access sites should be managed to avoid impacts to shorelines, adjacent residences, and habitats.

4.2 *Reach 2: Sequim Bay (Maps 1a to 6a in Appendix A)*

The "Sequim Bay" reach contains 8.2 miles of marine shoreline which extends from the northeast corner of the bay (approximately one mile south of Travis Spit) to just south of the John Wayne Marina. The reach also contains the mouths of Jimmycomelately and Dean creeks (these streams are not shorelines of the state, except where they enter Sequim Bay). Areas within the S'Klallam Reservation are part of this reach, but the reach excludes shoreline within City of Sequim jurisdiction.

4.2.1 Summary of Baseline Conditions

The predominant shoreform of Sequim Bay is bluff backed beach, and approximately one-third of the total reach shoreline is classified as feeder bluffs. The feeder bluffs, combined with net shore-drift within the reach, supply the sand, gravel, and cobble that maintain the barrier beaches present at several locations within the reach. Bluffs within the reach are generally stable, and the relatively sheltered position of Sequim Bay means there is less exposure to winds and waves compared with other areas along the Strait. However, some unstable bluffs areas are located in the western portion of Sequim Bay.

Approximately one-third of the shoreland area within the reach is heavily forested, which provides habitat for a diversity of wildlife species. The dense forest cover also helps stabilize the bluffs within the reach. Outside of the shoreland zone, the majority of the surrounding land is forested. However, portions have been cleared for residential development, agriculture, and other uses.

Wetlands occur near the mouth of Jimmycomelately Creek, and there have been ongoing restoration efforts to improve salmonid habitat within the creek and its estuary. The wetlands provide important habitat for shorebirds, waterfowl and other species. Eelgrass is mapped throughout almost all of the reach. Forage fish species, such as herring and sand lance, spawn on eelgrass and in the upper intertidal gravel and gravel-sand beaches of the bay. The presence of

aquatic vegetation and forage fish makes the Sequim Bay shoreline prime feeding grounds for juvenile salmonids and other species, which use the shallow nearshore waters for migration and rearing. In addition, coho salmon, chum salmon, winter steelhead, and resident cutthroat trout are mapped in several of the streams draining to the bay. As noted above, the nearshore habitats in this area are noted as being of particular important to Dungeness River salmon stocks.

Several patches of armoring are present along the reach shoreline; approximately 20% of the shoreline within the reach has been armored, or otherwise modified. Approximately 15 overwater structures (docks and piers) are mapped in the southern and western portions of the reach. Many mooring buoys are also present within the reach. The location of the armoring, overwater structures and fill coincides with the mapped forage fish habitat. Most of Sequim Bay is in a tsunami hazard zone and FEMA coastal and stream (Jimmycomelately Creek) 100-year floodplains.

Some of the tidelands within the reach are public (managed by DNR), but most of the tideland areas are privately owned. Of the public tidelands, some portions are leased for aquaculture. Sequim Bay State Park is a popular recreational shellfish harvesting area, and a commercial oyster farm (operated by the Jamestown S'Klallam Tribe) is located at the bay head. Hardshell clam, geoduck, and pandalid shrimp are also mapped within the bay. Dungeness crab are assumed to be present, as well.

There are no impaired water quality listings for the marine waters of Sequim Bay; however, the State lists Sequim Bay as a "water of concern" for low dissolved oxygen levels. The portion of Jimmycomelately Creek within the reach has State impaired water quality listings for fecal coliform and low dissolved oxygen levels. The Streamkeepers have listed Jimmycomelately water quality as "impaired" for both B-IBI and WQI. Increasing fecal coliform levels in the creek has a variety of negative human health and ecological impacts, including affecting the safety of shellfish harvesting on the bay shorelines.

The dominant land use along the Sequim Bay shoreline is moderate- to low-density residential development (occurring throughout the reach), with other significant land uses being open space and timber harvest. The Jamestown S'Klallam Tribe offices and tribal commercial facilities are located at the bay head. Over 90% of the shoreland area is privately owned. Several roads are located within the shoreland area including portions of Highway 101, Old Blyn Highway, and West Sequim Bay Road. The Olympic Discovery Trail runs along the southern end of Sequim Bay with public access and parking near the mouths of Jimmycomelately and Dean Creeks.

Portions of the lower Sequim Bay estuary and the mouths of Jimmycomelately and Dean Creeks have been restored in the last 10 years by the County, Jamestown S'Klallam Tribe, and Clallam Conservation District, with state, federal and private partners. Restoration activities included the removal of a log dump and access road in the estuary, removal of a trailer park and other structures in the shorelands, re-routing of the mouth of Jimmycomelately Creek, re-vegetation of shorelands, and other activities to improve ecosystem function.

Approximately 15% of the shoreline in the reach is publicly owned, the majority of which is accessible from land. Publically owned shoreline is located on the west shore of Sequim Bay, and can be directly accessed from Sequim Bay State Park.

4.2.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, approximately half of the shoreland area within the reach has potential for new development. The undeveloped land within SMP jurisdiction is distributed fairly evenly throughout the reach, along both bluff and barrier beach shoreforms. Most of the vacant parcels are between one to two acres in size, and cannot be subdivided under current zoning regulations. There are a few larger parcels (10 to 20 acres) that can be subdivided into five-acre lots.

Most of the undeveloped lots are rectangular in size, with narrow water frontages (approximately 75 feet). Development in these lots could result in relatively dense shoreline development, which would likely require reductions in the amount of forest cover. Vegetation removal along the erosive feeder bluffs in the reach could accelerate erosion, which puts adjacent homes and other structures at risk. Removal of forest cover also reduces cover, nesting/breeding, and foraging habitat for a large number of birds and other wildlife.

Sequim Bay landowners whose homes are close to the shore along barrier beaches may seek to construct bulkheads or other shoreline armoring structures to protect their property from wind and wave action. In addition, given the prevalence of docks in the bay, landowners without docks may wish to build them. An increase in shoreline armoring and/or overwater structures in the area may adversely impact aquatic vegetation communities and forage fish spawning habitat, which would in turn reduce the suitability of this reach to continue to provide high-quality salmonid rearing habitat.

4.2.3 Management Issues and Opportunities

As stated above, the nearshore environment of Sequim Bay provides vital salmon rearing and migration habitat, as well as shellfish habitat. While a significant amount of shoreline armoring is present in the bay, the majority of the shoreline is unaltered which allows natural sediment movement and beach forming processes. Protecting these natural qualities of the nearshore environment is crucial to maintaining the overall ecological health of the reach, and protecting beachfront properties from erosion. In addition, protecting the remaining forest cover in the reach is important for maintaining wildlife habitat in the area, as well as protecting properties from accelerated bluff erosion. Other special management considerations in this reach include:

- Protection of water quality from non-point sources in the watershed, shoreline septic systems, and boater operations.

- Effects of shoreline armoring and overwater structures on forage fish spawning areas, salmon rearing, and aquatic vegetation. Limits on the length, location and design of new overwater structures (such as docks) would help to prevent impacts on eelgrass, kelp and other forms of aquatic life. Docks “shade out” submerged aquatic vegetation, which decreases herring spawning and salmon rearing habitat.

- Continued work on protection and restoration of estuarine wetland habitats since these areas provide habitat for a diversity of species and perform flood storage and water quality functions.

- Given the relatively sheltered position of Sequim Bay, "soft armoring" techniques (such as log placement) should be strongly preferred over traditional "hard armoring" methods (such as rock/concrete bulkheads).

4.3 *Reach 3: Gibson Spit (Maps 1a to 6a in Appendix A)*

The "Gibson Spit" reach contains 6.1 miles of marine shoreline, which extends from north of the John Wayne Marina in Sequim Bay to just north of Graysmarsh (Gierin Creek mouth) along the Strait of Juan de Fuca. The reach excludes shorelines within City of Sequim jurisdiction. The reach contains Sequim Bay and the estuaries of Bell and Gierin creeks (Bell and Gierin Creeks are not shorelines of the state, except where they enter the Strait of Juan de Fuca).

4.3.1 Summary of Baseline Conditions

Shoreforms in the reach consist of bluff backed beach, barrier beach, and barrier estuary, with a lesser amount of Dungeness River delta shore at the northern end of the reach. From the north, net shore-drift is generally southward along feeder bluffs, which supplies the sand, gravel, and cobble that maintains barrier beach at Gibson Spit, at the north end of Washington Harbor. A second, northward drift cell originates at the John Wayne Marina, which supports a second barrier beach (South Spit) that encloses the harbor from the south.

Several relatively short feeder bluff segments, located in the central portion of the reach north of Washington Harbor, are identified as landslide hazard areas. Graysmarsh (Gierin Creek estuary), Gibson Spit, Washington Harbor, and the southern portion of the reach (Sequim Bay) are in a tsunami hazard zone and the FEMA coastal and/or stream 100-year floodplain.

Within 300 feet of the shore, approximately 12% of the shoreland area is heavily forested, and another 71% consists of natural shrub and herbaceous habitat. These diverse vegetation communities provide habitat for a variety of wildlife species. The majority of the landslide hazard areas within the reach are forested, which helps stabilize the slopes. Outside of the shoreland zone, the majority of the surrounding land is agricultural, but some forest land is present in the Gierin and Bell creek vicinities.

Washington Harbor, also known as the Bell Creek estuary, is the largest tidal wetland complex in the vicinity of Sequim Bay. Most of the historic mudflat, tidal marsh, and barrier beach (Gibson Spit) remain. However, a road, which provides maintenance access and protection for the City of Sequim's sewer outfall, and dikes have degraded ecosystem processes including tidal hydrology, sediment supply, and tidal channel formation. This areas is identified as a high priority site for restoration and plans are underway to remove the stressors that are degrading the habitat.

Approximately three-quarters of the shoreland zone with the reach is wetland habitat. These wetlands provide important habitat for salmon, shorebirds and waterfowl. Peregrine falcon and bald eagle habitat is also mapped throughout the reach. The northern portion of the reach, near Graysmarsh, provides habitat for harbor seal (including a haulout area) and Taylor's checkerspot butterfly. Graysmarsh, a paleo-mouth of the Dungeness River, was historically a saltwater marsh complex and a tidal barrier was installed in the early 20th century near the mouth of Gierin Creek. The marsh is currently managed as freshwater habitat by the Graysmarsh landowner. (Personal communication, R. Johnson).

Patches of eelgrass and kelp are present along a majority of the reach, and the shoreline in the Washington Harbor vicinity provides forage fish (sand lance) spawning habitat. The marine shores in the area, and in particular the southern portion of the reach (Sequim Bay and Gibson Spit), provide important feeding grounds for juvenile salmonids, which use the shallow nearshore waters for migration and rearing. Gierin and Bell creeks within the reach provide habitat for coho salmon, bull trout, steelhead, and resident cutthroat trout.

Four segments (15% total) of this reach are armored including a small portion of the feeder bluff exceptional southeast of Graysmarsh. There are partial tidal barriers at Graysmarsh, at the mouth of Bell Creek and within the embayment at Washington Harbor (Figure 4-2). Other shoreline modifications include fill and/or overwater structures, most of which appear to be in the divergence zone of the drift cell. Approximately one-acre of nearshore fill occurs within the sediment transport zone near the county park end of Port Williams Road and may be disrupting transport toward the Spit. There are also numerous overwater structures identified within Graysmarsh. These appear to be part of a trail or boardwalk system crossing channels and other open water areas within the marsh itself.

Figure 4-2. View of the partial tidal barrier within Washington Harbor; the road/ dike contains a sewer outfall pipe

There are no impaired water quality listings for the marine waters within the reach; however, the portion of Bell Creek within the reach has State impaired water quality listings for dissolved

oxygen, fecal coliform, and biological impairment. The Streamkeepers have listed the water quality of the creek as "impaired" for B-IBI and "highly impaired" for WQI.

Land use in the northern portion of the reach (Gibson Spit and northward) is primarily forestry and agriculture, with minimal shoreline development. Most of the reach is zoned for agricultural residential, except for the spit which is rural low zoning. South of Gibson Spit, moderate- to high-density residential development is present along Sequim Bay. The shorelands on this reach are almost all in private ownership with the exception of Marlyn Nelson County Park at the end of Port Williams Road. The park provides public access to the shoreline for recreational activities, including shellfish harvesting

4.3.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, over three-quarters of the shoreland area has potential for new residential development. The undeveloped and underdeveloped parcels within SMP jurisdiction are distributed fairly evenly through the reach. In the southern portion of the reach, bordering Sequim Bay, are several one to two acres parcels that are occupied, but could be further subdivided. The majority of the subdivided lots would likely be well landward of the shore, outside of SMP jurisdiction. The majority of the shoreline in this developed area is already armored. Two docks are present in this developed area, and given the prevalence of docks in Sequim Bay, landowners without docks may seek to build them. An increase in overwater structures in the area may adversely impact aquatic vegetation communities, forage fish spawning habitat, and salmonid rearing and migration, which could in turn reduce the suitability of the habitat for other species.

North of Gibson Spit, undeveloped parcels are larger (20 acres average) and are currently working timber and agricultural lands with little to no existing residential development along the shoreline. Under current zoning regulations, parcels in this area cannot be subdivided into lots less than 5 acres, so the potential for dense shoreline development in this area is unlikely. Additionally, the significant extent of wetland habitat at Graysmarsh likely precludes intensive development in the area. However, even low-density development near the marsh or along the feeder bluffs in the area could degrade the habitat quality or disrupt the delivery of sediment to the nearshore environment.

4.3.3 Management Issues and Opportunities

With the exception of the armored areas in Sequim Bay, the shoreline of the Gibson Spit reach is generally unaltered, so nearshore processes are in relatively good condition. The mostly unarmored feeder bluffs in the central portion of the reach, combined with net shore-drift, allow the natural beach formation processes that maintain Gibson Spit/Washington Harbor. Protecting the natural condition of these bluffs, along with the remaining riparian forest cover in the reach, is key to maintaining the overall ecological health of the reach and minimizing loss of barrier beach habitat. Protection and restoration of the Bell Creek estuary has been identified as a high priority nearshore restoration project.

Because most of the shoreline is privately owned, there are relatively few opportunities for increasing public access in this reach. Acquisition of land near Gibson Spit could be beneficial but would require willing sellers.

As compared to the reaches to the east, there is relatively low development potential within this reach. However, additional development along the shoreline will likely occur in the future.

Key management considerations for this reach include:

- Maintaining the sediment delivery and transport process in the adjoining up-drift reaches to ensure the sustainability of Gibson Spit.

- Restoring sediment and tidal processes by removing or modifying the dike within Washington Harbor would improve this significant tidal wetland complex.

4.4 *Reach 4: Kulakala Point (Maps 1a to 6a in Appendix A)*

The "Kulakala Point" reach contains 7.9 miles of marine shoreline, which extends from north of Graysmarsh (Gierin Creek mouth) to just east of the landward end of Dungeness Spit. The reach contains Dungeness Bay, Cline Spit, and Dungeness Harbor. The reach includes the Dungeness River delta (a shoreline of the state), and the mouth of Cassalery Creek. The creek is not a shoreline of the state, except where it enters the Strait of Juan de Fuca.

4.4.1 Summary of Baseline Conditions

The reach predominantly consists of delta shoreform associated with the Dungeness River, with barrier beach at Cline Spit and bluff backed beach along Dungeness Harbor. Cline Spit is maintained by the sand, gravel, and cobble that drifts eastward from the feeder bluffs at Dungeness Harbor, and westward along the Dungeness River delta. The western side of Cline Spit is armored, and several residential properties along Three Crabs Road are protected by bulkheads and other types of armoring. Complete and partial tidal barriers (levees) are located at the Dungeness River mouth. Pockets of nearshore fill and/or structures (e.g., docks and bridges) at the end of Crays Road, at Cline Spit, and near Three Crabs Road, and a concrete flume at the mouth of Cooper Creek, cover portions of the beach and may impede sediment transport processes.

Portions of the feeder bluff area along Dungeness Harbor are landslide hazard areas. Development along the bluffs has removed much of the natural vegetation, which makes the bluffs more susceptible to slides. East of Cline Spit, the extensively developed shoreline along Three Crabs Road is composed of low-bank delta and barrier beach shoreforms, which are in tsunami hazard zones and FEMA coastal and/or stream 100-year floodplains.

Within 300 feet of the shore, approximately half of the shoreland area contains forest and natural shrub and herbaceous vegetation. However, much of the vegetation directly bordering the shoreline has been removed to accommodate dense shoreline development, particularly along Three Crabs Road, Seashore Lane, Jamestown Road, and the south shore of Dungeness Harbor. Outside of the shoreland zone, the surrounding land consists of residential development and agriculture.

The naturally vegetated areas that remain in the reach, located primarily in the Dungeness River delta and its associated wetlands and Dungeness Bay, provide important habitat for a large diversity of fish and wildlife species. Wildlife species and assemblages that utilize this habitat

include waterfowl, peregrine falcon, bald eagle, and harlequin duck. In addition, Taylor's checkerspot butterfly habitat is present at the south end of the reach, near Graysmarsh.

Eelgrass is mapped throughout a majority of the reach, and a few patches of kelp are mapped southeast of the Dungeness River. Forage fish (sand lance, herring, and smelt) spawn in the upper intertidal gravel and gravel-sand beaches along the Dungeness Harbor shoreline. The marine shoreline within the reach, and in particular the Harbor shoreline, is prime feeding grounds for juvenile salmonids, which use the shallow nearshore waters for migration and rearing. The Dungeness River and the other streams (including Cooper and Cassalery creeks) within the reach provide habitat for a variety of fish species, including bull trout; resident cutthroat trout; and coho, pink, chum, and chinook salmon.

The portion of Cassalery Creek within the reach has State impaired water quality listings for dissolved oxygen, fecal coliform, and biological impairment. In addition, Cline Ditch is listed for fecal coliform; Cooper Creek for dissolved oxygen and fecal coliform; Meadowbrook Creek for dissolved oxygen, fecal coliform, and pH; and Meadowbrook Slough for pH. Dungeness River water quality within the reach is listed by the Streamkeepers as "impaired" for B-IBI and "compromised" for WQI.

Portions of Dungeness Bay were closed to shellfish harvest following the failure of water quality monitoring stations in 1997-1998. Several studies were conducted in the ensuing decade to track the sources of fecal coliform contamination, including intensive sampling of freshwater sources, preparation of freshwater and marine Total Maximum Daily Loading reports, a circulation study of the bay, and a microbial source tracking analysis by the Battelle Marine Lab. The source tracking study documented the presence of typical sources of fecal coliform in the bay, such as livestock and human waste from failing septic systems, but substantial input came from avian species, wildlife (particularly raccoons), pet waste, and a few exotic mammal species, e.g. yaks and bison. Following several watershed projects to remove animal access, septic remediation, and other actions, portions of the bay were conditionally re-approved for shellfish harvest in April, 2011.

Some of the tidelands within the reach are public, but most of the tideland areas are privately owned. Of the public tidelands, some portions are leased for aquaculture. Some commercial geoduck beds are located on bedlands within the reach. Dungeness Bay is an important location for recreational crab and clams harvest, and is a commercial crab harvesting area. The bay also contains has two commercial shellfish farms, and several tribes have treaty rights to harvest shellfish in the bay. Recreational shellfish harvesting occurs in the Cline Spit vicinity.

Land use in the shoreland zone consists primarily of open space, residential development, and agricultural lands. This is fairly consistent with current zoning which includes rural low and rural moderate, rural neighborhood conservation and agricultural residential. The open space land is concentrated around the Dungeness River, and the residential development is located near the shoreline on the south shore of Dungeness Harbor, Three Crabs Road, Seashore Lane, and Jamestown Road

Nearly all the shorelands in the reach are privately owned. Of the shoreline itself, approximately one-third is in public ownership, of which the majority of accessible from land. Public shoreline

can be accessed at the end of Wilcox Road, the east end of Jamestown Road, and from Pioneer Memorial Park and Cline Spit County Park, where there is a public boat launch. Recent acquisitions by WDFW have increased public access near the mouth of the Dungeness River at River's End Road.

The shoreline along Jamestown Road contains several parcels owned by the Jamestown S'Klallam Tribe or tribal citizens, as this was the historic site of the Jamestown Tribal community in 1874. Tribal access to the shoreline is utilized for ceremonial, recreational, and resource harvest purposes at this location, including the annual welcome ceremony for tribal canoe journeys.

4.4.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, over half of the shoreland area in the reach has potential for new development, although the presence of wetland habitat in the Dungeness delta likely precludes development in some areas. In the eastern portion of the reach, along Three Crabs Road, Seashore Lane, and Jamestown Road, most of the land area has already been platted into small (approximately quarter-acre) lots, or very narrow 5-acre lots with moderate-to-densely developed water frontages. The majority of these lots have homes, most of which are within 20 to 60 feet of the ordinary high water line and within the FEMA-mapped coastal floodplain. Infill development on the remaining vacant parcels will likely occur in the future.

Few of the residences in the Three Crabs Road/ Seashore Lane low bank area are protected by armoring. Property owners in the area may seek to construct bulkheads or other shoreline armoring structures to protect their property in response to changes in sea level or storm activity. An increase in armoring could adversely impact aquatic vegetation communities and forage fish spawning habitat, which would in turn reduce the quality/suitability of this reach for salmonid rearing. An increase in armoring could also impede net shore-drift, which would likely result in beach loss along the east side of Cline Spit. The area is generally unsuitable for docks, as most of the area is subjected to the strong wind and wave conditions that are prevalent along the Strait of Juan de Fuca.

There are several large undeveloped parcels adjacent to the Dungeness River mouth that are owned or managed by WDFW, the North Olympic Land Trust, and Dungeness Farms (private) for fish and wildlife conservation purposes. There are also several small (approximately 0.5 acre) undeveloped parcels in the area, particularly along Rivers End Road. Several of the parcels along Rivers End Road have been acquired by Clallam County, WDFW, and the Jamestown S'Klallam Tribe for salmon restoration purposes as part of a larger project to remove houses within the flood plain, remove or set back levees, and restore the lower Dungeness River delta/estuary.

Along the Dungeness Harbor bluffs west of Cline Spit, most of the shorelands have already been subdivided (0.5 to 2 acre parcels) and developed with homes. Under current zoning regulations, some of the parcels could be further subdivided. The areas close to the water are generally already developed; therefore, the majority of future development in the area would take place away from the shore, outside of SMP jurisdiction. However, increased development in the area would likely impact the remaining forest cover, which could destabilize the erosive feeder bluffs and fragment wildlife habitat.

An increase in overwater structures in the area would likely impact aquatic vegetation communities and forage fish spawning habitat, which would in turn reduce the suitability of this reach to continue to provide high-quality salmonid rearing habitat.

4.4.3 Management Issues and Opportunities

As stated above, the nearshore environment and shorelands within the reach provide important fish and wildlife habitat for a variety of species. In particular, the Dungeness River delta, Dungeness Bay, and Dungeness Harbor provide vital rearing habitat for juvenile salmonids. Major restoration activities including dike removal and setback are planned in the lower Dungeness River delta area. Several private parcels remain in the lower river delta area that are at risk of flood hazard from river or coastal flood events. Development or structural modification of these parcels will need to incorporate safety considerations as well as impacts to ecological functions. While some shoreline armoring is present in the reach, the majority of the shoreline is unaltered which allows natural sediment movement and other beach forming processes. The potential increase in shoreline armoring along the low bank shores in the Three Crabs Road vicinity and/or along the Dungeness Harbor shoreline have the potential to disrupt the natural beach maintenance processes and ecological health of the reach.

Most of the activities to maintain or upgrade water quality are outside of SMP shorelands, but septic design and operation along marine shorelines is an ongoing issue, as is pet waste management on publicly-accessible beaches.

Key management considerations for this reach are:

- In the low bank areas in the Three Crabs Road vicinity, set new structures back from the shoreline (if possible) to decrease the potential risks of coastal flooding and tsunami damage, and minimize the need for shoreline armoring. For protection of existing structures, the use of "soft armoring" techniques (such as log placement) should be preferred over traditional "hard armoring" methods (such as rock/concrete bulkheads). Removing or setting back levees on the Dungeness River has the potential to improve natural river and nearshore process and enhance fish and wildlife habitat.

- In order to protect natural sediment movement processes, as well as human health and safety, new structures should be set back an adequate distance from erosion-prone areas, such as the feeder bluffs along the south shore of Dungeness Harbor.

4.5 *Reach 5: Dungeness Spit (Maps 1a to 6a in Appendix A)*

The "Dungeness Spit" reach contains 15.7 miles of marine shoreline. The reach includes the entire spit, including Graveyard Spit, and a small portion of the landward end of the spit. Nearly the entire reach is within the Dungeness National Wildlife Refuge.

4.5.1 Summary of Baseline Conditions

Dungeness Spit is the longest natural sand spit in the United States. Eastward net shore-drift along the feeder bluffs to the west (Reach 6) supplies the sand, gravel, and cobble that maintains the spit. The eastern, leeward portion of the spit exhibits westward drift, which maintains Graveyard Spit. There are no identified shoreline modifications within the reach

Almost the entirety of Dungeness Spit, and all of Graveyard Spit, are contained within the Dungeness National Wildlife Refuge. The refuge protects a wide array of wildlife species and habitat assemblages and provides recreational opportunities for thousands of visitors each year. The spit and adjacent waters support an abundance of shorebirds, marine birds (such as Caspian terns and black brant), raptors (peregrine falcon and bald eagle), fish and marine mammals (including harbor seal several haulout areas).

The majority of the shoreland area in the reach contains natural shrub and herbaceous vegetation. WDNR ShoreZone data shows patches of eelgrass within Dungeness Harbor but no eelgrass on the outer shore of the spit. However, surveys by Norris and Fraser (2007) found eelgrass patches (approximately 29 acres total) along the northern, outer shoreline of the spit. Norris and Fraser (2009) also found eelgrass patches within Dungeness Harbor (178 acres total), and Dungeness Bay (185 acres total).

Patches of kelp are mapped on the outside of the spit. Forage fish (sand lance, herring, and smelt) spawn in the upper intertidal gravel and gravel-sand beaches along the Dungeness Harbor shoreline. The marine shoreline within the reach, and in particular the harbor shoreline, is prime feeding grounds for juvenile salmonids, which use the shallow nearshore waters for migration and rearing. Nearshore habitats along this reach and reaches to the east are considered critical to the health of Dungeness River salmon stocks (Jamestown S'Klallam Tribe and Clallam County 2004).

The majority of the shorelands within the reach are in public ownership (Dungeness National Wildlife Refuge), and the tidelands around the spit are also publically owned. Dungeness crab, hardshell clam, oyster beds, and red sea urchin are mapped throughout the reach. Some commercial geoduck beds are located offshore.

Dungeness Spit beaches and trail systems can be accessed from the Dungeness Recreation Area, located at the north end of Kitchen-Dick Road. For the purposes of wildlife protection, portions of Graveyard Spit and Dungeness Spit are closed to public entry. There is some private land located along Dungeness Harbor, east of where Dungeness Spit connects to land. Most of these private parcels are already developed with single-family homes, set back approximately 300 feet from the shoreline. Natural vegetation has been cleared around the homes, but forest cover remains along the shoreline.

4.5.2 Future Land Use, Potential Effects on Shoreline Ecology, and Management Issues

Given that the majority of the reach is a publicly owned national wildlife refuge the threat of future development is very low. The few privately owned parcels in this reach land cannot be subdivided under current zoning regulations. The existing homes are located more than 300 feet back from the shoreline; therefore, there is a low chance of future armoring.

There are no overwater structures mapped within the reach and new structures are not likely to proliferate given the existing land use/land ownership patterns. The key management considerations for this reach include preserving the existing forest cover within the reach and maintaining the sediment delivery and transport process in the adjoining up-drift reaches to ensure the sustainability of the Spit.

Extensive public use of the shoreline at the top and bottom of the feeder bluffs immediately west of Dungeness Spit occurs because of public access and trails at the Dungeness Recreation Area. These areas have been subject to erosion and trail areas have recently been moved. Future public access and parking at this location will need to consider human safety as well as the impact to the bluffs.

4.6 *Reach 6: Green Point (Maps 1a to 6a in Appendix A)*

The "Green Point" reach contains 11.4 miles of marine shoreline, which extends along the Strait of Juan de Fuca from just west of Dungeness Spit to the Port Angeles city limits. The reach also contains the mouths of McDonald, Siebert, Morse, and Lees creeks. McDonald and Morse Creeks are shorelines of the state. The other streams that intersect this reach are not shorelines of the state, except where they enter the Strait of Juan de Fuca. The western end of this reach (west of Morse Creek) is within the Port Angeles urban growth area and may eventually be annexed by the City. According to the City's draft shoreline master program, this area would have a dual/parallel designation of Urban Conservancy Recreation along the water and Shoreline Residential inland if it were annexed.

4.6.1 Summary of Baseline Conditions

The predominant shoretype in the reach is bluff backed beach, with smaller portions of barrier beach and barrier estuary. Over 70% of this reach is mapped as feeder bluff or feeder bluff exceptional (Figure 4-3). Starting from a small region of no appreciable drift near the mouth of Lees Creek, net shore-drift is eastward along the feeder bluffs, transporting sand, gravel, and cobble that maintains Dungeness Spit. These feeder bluffs are subject to the high wind and wave energy. There is very minimal armoring within this drift cell, which allows unimpeded drift and natural beach building processes to occur to occur along Dungeness Spit. The area just west of Green Point is a landslide hazard area. Recent landslides have been mapped along the feeder bluffs within the reach, and many homes along the edge of the bluffs could be at risk. A second drift cell flows west from Lees Creek towards Port Angeles. The shoreline within this drift cell is heavily modified with armoring that protects the Olympic Discovery Trail, and contains an area of nearshore fill. There are no overwater structures identified within the reach.

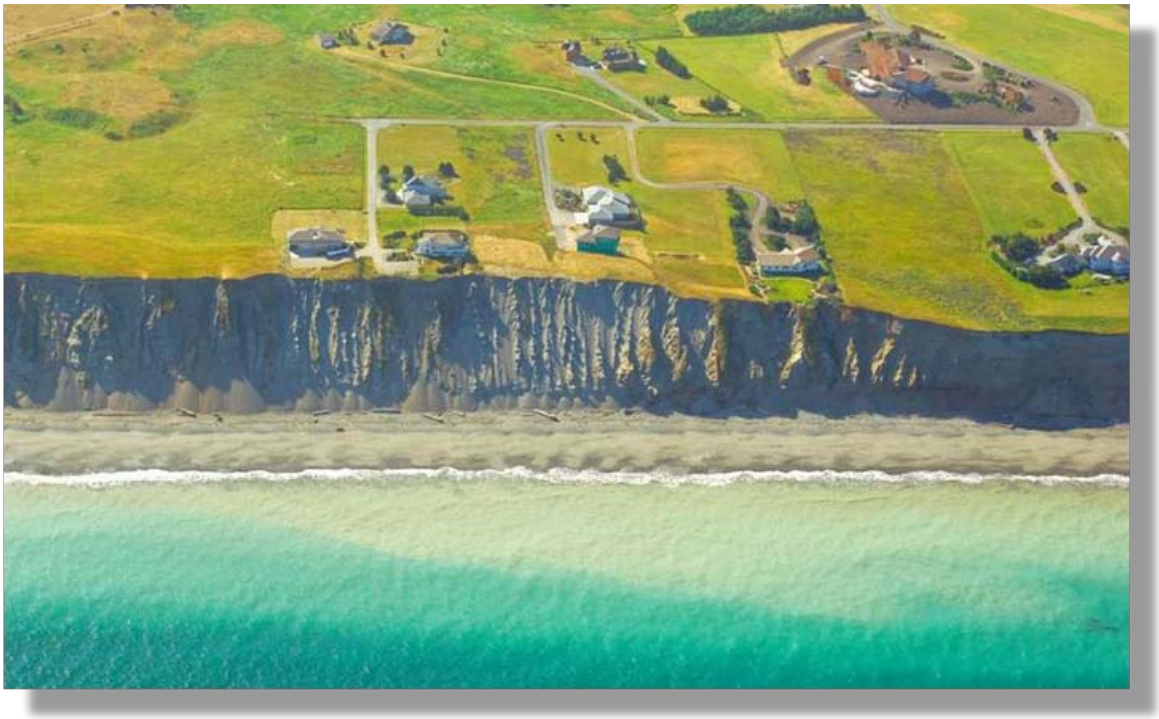


Figure 4-3. Segment of exceptional feeder bluff west of Dungeness Spit lacking native riparian forest cover. Note proximity of existing homes to edge of retreating bluffs (Photo: Ecology Coastal Atlas)

The mouths of Morse and McDonald Creek are in tsunami hazard areas and mapped FEMA 100-year floodplains (coastal and stream).There is limited development adjacent to the McDonald Creek mouth; however, dense residential development is located near the Morse Creek mouth, and many of these homes are within the floodplain and/or channel migration zone of the creek (Figure 4-4). The mouth of Siebert Creek has been the focus of a coordinated program by the North Olympic Land Trust and other organizations to acquire conservation easements.

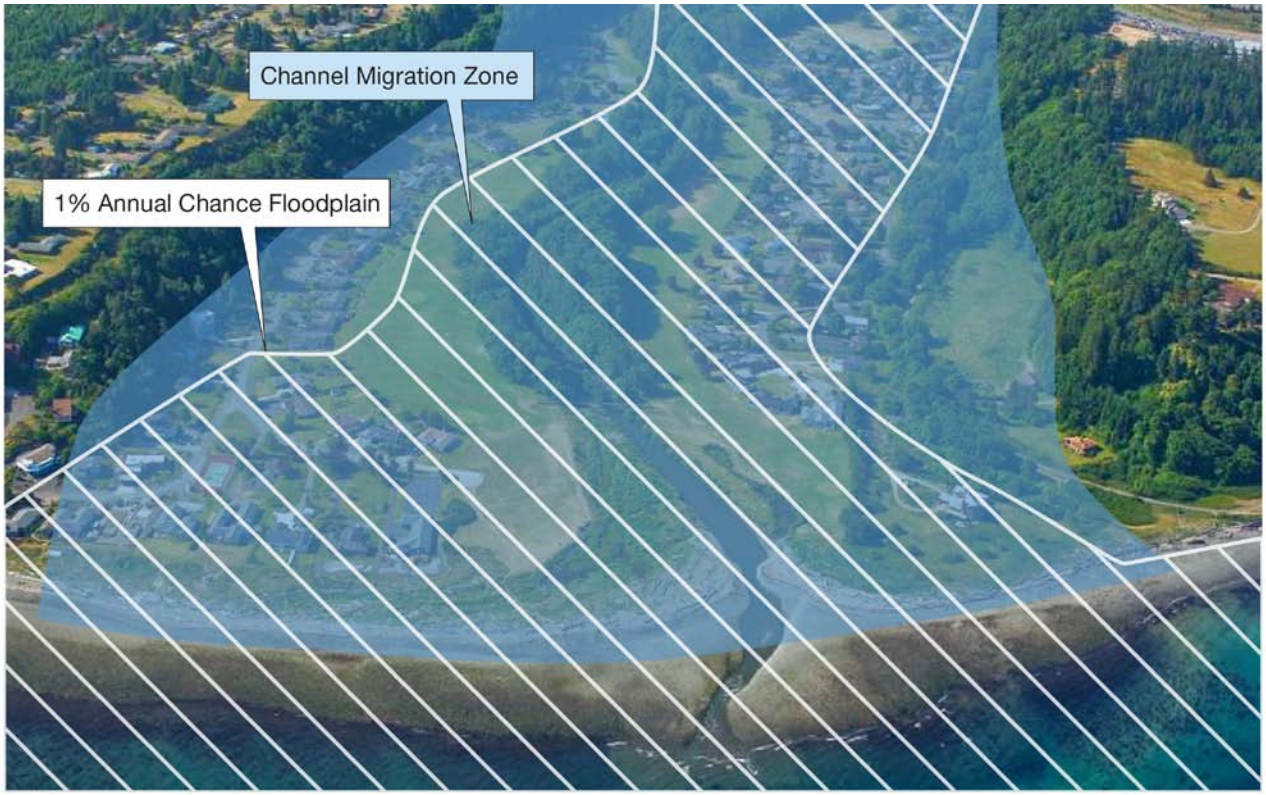


Figure 4-4. Development at the mouth of Morse Creek with the mapped floodplain and channel migration zone. (Photo: Ecology Coastal Atlas)

Approximately one-third of the shoreland area in the Green Point reach is forested, and another third contains natural shrub and herbaceous vegetation. Forest cover is generally absent in the heavily developed areas. The forest cover that remains in the reach helps stabilize the erosive bluffs, and provides habitat for a diversity of wildlife species. Wetland areas associated with the mouth of Morse Creek provide important habitat for waterfowl and other wildlife, and a gray whale feeding area is identified near the mouth of Siebert Creek. The reach also provides habitat for bald eagle and peregrine falcon.

WDNR ShoreZone data shows patches of eelgrass directly east of Green Point. This is generally consistent with a survey by Norris and Fraser (2007), which found eelgrass patches (approximately 74 acres) located primarily east of the point.

Patches of kelp are mapped throughout the reach, and patches of smelt spawning habitat are mapped east of Morse Creek. No smelt habitat areas are located in the armored shoreline areas west of the creek. The marine shores in the area, and in particular the unarmored areas east of Morse Creek, provide feeding grounds for juvenile salmonids, which use the shallow nearshore waters for migration and rearing. The streams within the reach provide habitat for resident cutthroat, rainbow, and bull trout; steelhead; and coho, chinook, chum, and pink salmon.

Tideland ownership throughout the reach is mixed, private and public. Abalone and red sea urchin are mapped throughout a majority of the reach. Some commercial geoduck beds are located on bedlands within the reach.

The portion of Lees Creek within the reach has a State impaired water quality listing for dissolved oxygen. The water quality of Morse and McDonald Creeks is listed by the Streamkeepers as "compromised" for B-IBI and "healthy" for WQI.

Land ownership within the reach is 93% private and 7% public. The primary land use within the reach is residential development, with lesser amounts of open space, commercial timber land, agriculture, and vacant land. The existing land uses do not align fully with the existing zoning as none of the reach is zoned for Commercial Forestry or agriculture. Most of the land is zoned for residential development (mostly R5 or rural character conservation with a few pockets of R1 near Kitchen-Dick Road and near Morse Creek).

Over 10% of the shoreline in the reach is publicly owned and accessible by land. Public shoreline in the eastern portion of the reach can be accessed from the Dungeness Recreation Area (via trails), and shoreline in the western portion can be accessed via the Olympic Discovery Trail.

4.6.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, approximately 40% of the shoreland area has potential for new residential development. The undeveloped and underdeveloped land within SMP jurisdiction is distributed fairly evenly throughout the reach. Much of the vacant land within the reach has already been subdivided into 1 to 3 acre lots. These lots are rectangular in size with narrow water frontages; varying from approximately 75 to 150 feet. In addition, there are several larger parcels (approximately 20 acres in area) that could be subdivided into 3 or 5 acre lots. Development in these lots could result considerable clearing/loss of forest cover, increased stormwater runoff, and other changes that could exacerbate landslide and erosion hazards and diminish ecological functions.

4.6.3 Management Issues and Opportunities

The Green Point reach has potential for substantial new residential development in the future, which is a potential management concern considering the highly erosive feeder bluffs and the importance of these bluffs to down-drift shores. Development that involves vegetation removal or increased rates of stormwater runoff could accelerate erosion and potentially put homes and other structures at risk. Given the height, steepness, and sediment composition of these bluffs, as well as their exposure to wind and wave energy on the Strait of Juan de Fuca, it is unlikely that shoreline armoring along the toe of the bluffs would effectively protect homes or other structures. The majority of the shoreline in this reach is unaltered; attempts to armor these shorelines could impede natural sediment recruitment and net shore-drift, thus putting Dungeness Spit at significant risk.

There is limited opportunity for increased public shoreline access within this reach given the topography and sensitivity of the bluffs. All of the publicly owned shoreline is already accessible.

Key management considerations for this reach are:

- Protection of feeder bluffs and sediment processes are critical concerns. Bluffs will continues to naturally erode / retreat, so homes and other structures must be set back a sufficient distance (from the edge of the bluff) to account for the potentially rapid rate of erosion, minimize risk and avoid the need for harmful stabilization measures. Vegetation should be maintained to stabilize slopes and runoff needs to be managed so that it does not destabilize slopes. Shoreline property owners should be aware of the substantial risks to property and human safety resulting from developing land near unstable feeder bluffs.

- Regulations should be streamlined to allow landowners whose homes are close to the edge of the bluff to move structures back from the shoreline, if feasible.

- Removal of forest cover, which generally results in accelerated erosion, should be limited in and near erosion-prone areas. Preserving forest cover also helps maintain wildlife species and diversity in developing areas.

4.7 *Reach 7: Angeles Point (Maps 1b to 6b in Appendix A)*

The "Angeles Point" reach contains 7.3 miles of marine shoreline, which extends from the western Port Angeles city limits to just south of Observatory Point. The reach contains Freshwater Bay, the estuary of the Elwha River (a shoreline of statewide significance) and the mouth of Colville Creek (a shoreline of the state).

4.7.1 Summary of Baseline Conditions

Shoretypes within the reach are primarily bluff backed beach and Elwha River delta shores. Net shore-drift within the reach is entirely eastward, originating along the west shore of Freshwater Bay. Approximately one-third of the shoreline consists of feeder bluffs, while the rest is accretion shoreforms and transport zones. Levee sections are mapped near the Elwha River mouth and sections of shoreline armoring (less than 10% of reach total) are mapped at the western end of the reach.. Baseline conditions in this reach include the presence of two dams in the Elwha River (described further in freshwater sections) that block sediment transport from the Elwha River and migration of several species of fish. As the dams are dismantled from 2011 to 2014, baseline conditions will change.

The feeder bluffs within the reach, located east of Angeles Point and within Freshwater Bay, are mapped as unstable, but no recent slides are identified. The Freshwater Bay and Angeles Point shorelines are mostly within the tsunami hazard zone and FEMA coastal and/or river 100-year floodplains. With the exception of Angeles Point and an area just to the west of the Elwha River mouth, there is limited existing development within these identified hazard areas.

Within 300 feet of the shore, more than half of the shoreland area contains forest cover, and another quarter is natural shrub and herbaceous vegetation. These vegetation communities, along with the wetland habitat at the Elwha River estuary, provide habitat for a diversity of species. Designated priority habitats within the reach include bald eagle, harlequin duck (at the Elwha River estuary), and common loon (at west end of reach) (Figure 4-5). Outside of the shoreland

zone, the majority of the surrounding land is forested, although some low-density residential development is present.

WDNR ShoreZone data shows patches of eelgrass present throughout a majority of the reach, from Angeles Point to Observatory Point. However, a survey by Norris and Fraser (2007) found three eelgrass patches within Freshwater Bay (approximately 60 acres total), and none east of the Elwha River mouth.

Continuous kelp stands are present from Port Angeles City limits to Observatory Point. A patch of forage fish (smelt) spawning habitat is located east of the Elwha River. Freshwater Bay provides habitat for crab and shellfish, and recreational shellfish harvesting and crabbing is available at the County Park. The entire reach provides habitat for abalone.

Figure 4-5. Common loon, one of several priority species to occur in Freshwater Bay

Tideland ownership throughout the reach is mixed: public and private. Commercial geoduck beds are located offshore in Freshwater Bay.

The marine shores in the area provide feedings grounds for juvenile salmonids, which use the shallow nearshore waters for migration and rearing. In particular, the Elwha nearshore is very important habitat for fish including federally listed salmonids, including Columbia River and Klamath River Chinook stocks (Shaffer et al., 2008; Shaffer, Crain, and Kassler, 2008). The Elwha River and Colville Creek within the reach provide habitat for steelhead; resident cutthroat and bull trout; and coho, chinook, chum, pink, and sockeye salmon.

The portion of the Elwha River within the reach has a State impaired water quality listing for temperature. Elwha water quality is listed by the Streamkeepers as "compromised" for WQI. Coville Creek is listed as "healthy" for WQI.

Land ownership within the reach is 58% private, 18% public, and 24% tribal. The majority of the private and tribal-owned land is used for residential development, with some agriculture land present. The publicly owned land includes DNR forest land and park land. Public shoreline near the Elwha River mouth can be accessed directly from the north end of Elwha Dike Road, where limited public parking is available. Shoreline at the western end of the reach (Freshwater Bay) can be accessed directly from Freshwater Bay County Park.

4.7.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, approximately two-thirds of the shoreland area has potential for new residential development. The undeveloped land within SMP jurisdiction is distributed fairly evenly throughout the reach. Privately owned parcels in the eastern portion of the reach, east of the Lower Elwha Klallam Tribe Reservation, have already been subdivided into approximately 2 acre lots. These lots are rectangular in size with narrow water frontages; varying from approximately 100 feet in width. Development of these lots could reduce forest cover and result in relatively dense shoreline development along the bluff shoreline in the area. Vegetation removal along the bluffs could degrade wildlife habitat and further destabilize the bluffs.

To the west of the reservation, along the eastern shore of Freshwater Bay, is a densely developed residential area with approximately 1-acre parcel sizes. Most of the parcels along this barrier beach shoreline have been developed, although some infill development will likely occur in the future. No armoring is located along the shoreline in this location; landowners whose homes are close to the shore may seek to construct bulkheads or other shoreline structures to protect their homes from wind and wave action. If that occurs it could adversely impact sediment delivery and transport processes, reduce productivity of the submerged aquatic vegetation communities, and reduce the quality of the nearshore aquatic habitat for fish and wildlife.

Parcel sizes in the western portion of the reach are generally between 5 to 10 acres in area, but under current zoning regulations, could be subdivided into 2 acre lots and become more intensively developed. The privately owned land near the center of the Freshwater Bay shoreline is currently used for timber production. However, current zoning regulations allow these parcels to be subdivided. The effects of timber harvest and / or residential development would be similar for this reach as for other reaches.

4.7.3 Management Issues and Opportunities

The Angeles Point reach contains the mouth of the Elwha River and is likely to experience dramatic changes in sediment transport following dam removal from 2011 to 2014. Restoration planners do not plan to use artificial means to move the large volume of sediment coming from behind the dams, and expect natural sediment transport processes to move it through the river mouth and nearshore over time. Management strategies in this reach will need to consider the potential for change for several years and minimize disruption of net shore-drift and habitat formation processes as the river delta and estuary system resets.

Most of the shoreline in this reach is publicly owned; however, there is limited direct public water access in the reach because most of the adjacent shoreland parcels are privately owned. In many areas, water access is generally not feasible because of the steep, erodible bluffs. An opportunity for public access is the DNR-managed parcel near the center of the Freshwater Bay.

4.8 *Reach 8: Observatory Point (Maps 1b to 6b in Appendix A)*

The "Observatory Point" reach contains 4.9 miles of marine shoreline, which extends from Observatory Point to Tongue Point, along the Strait of Juan de Fuca.

4.8.1 Summary of Baseline Conditions

Virtually the entire shoreline of this reach consists of rocky platform shore. The rocky shoreline is relatively stable compared to most of the reaches to the east; minimal landslide or erosion hazards are mapped within the reach. There are no identified shorelines modifications (such as armoring or docks) identified within the reach. There is no appreciable net shore-drift along this reach.

The majority of the shoreland area is forest habitat, with a lesser portion of natural shrub and herbaceous vegetation. Less than one-tenth of the riparian vegetation has been altered. The majority of land surrounding the shoreland area is also forested and zoned for commercial foresty. The large expanses of riparian forest within the reach provide important habitat for a variety of wildlife species, including bald eagle and harlequin duck.

Thehe rocky shoreline provides important habitat for harbor seal; several marine mammal haulout areas are mapped within the reach. Abalone, Dungeness crab, and red sea urchin are mapped along almost the entire reach. Both eelgrass patches and continuous kelp stands are mapped along approximately half of the shoreline. The bedrock composition of the nearshore substrate makes the area unsuitable for forage fish spawning habitat, but the large expanses of submerged aquatic vegetation make the nearshore area important habitat for marine species, including juvenile salmonids. The undeveloped condition of the shoreline with forest habitat also provides important sources for cover and food production for migrating juvenile salmon. In particular, the Salt Creek nearshore provides highly functioning habitat for a number of critical species, including federally listed salmon (Shaffer and Ritchie, 2008a).

Private development within the reach is limited to moderate-density residential development in the east third of the reach, where the zoning is rural low mixed. Parcel sizes range from approximately 3 to 5 acres, and most homes are set back over 200 feet from the shoreline. A significant amount of forest coverage remains on the developed parcels.

At the western end of the reach, surrounding Tongue Point, is the Salt Creek Recreation Area, one of the County's premier marine parks. Bordering the park to the east is the Striped Peak Recreation Area, managed by DNR. The Striped Peak area is accessed via a trail from the Salt Creek Park. Over half of the shoreline in this reach is publicly owned, and can be accessed from these recreation areas (Figure 4-6). Most of the tideland areas within the reach are publically owned.

4.8.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, only 6% of the reach has potential for new residential development. Potential development would consist of residential infill adjacent to existing developed parcels. The undeveloped parcels range from 3 to 5 acres in area, and cannot be further subdivided. As a result, this area is not as likely to experience shoreline development impacts as other reaches to the east.

4.8.3 Management Issues and Opportunities

The developed parcels within the reach have retained a substantial degree of forest cover, and the homes are generally set back a significant distance from the shoreline. In order to minimize impacts to shoreline processes and ecology, future development should encourage similar design and stewardship.

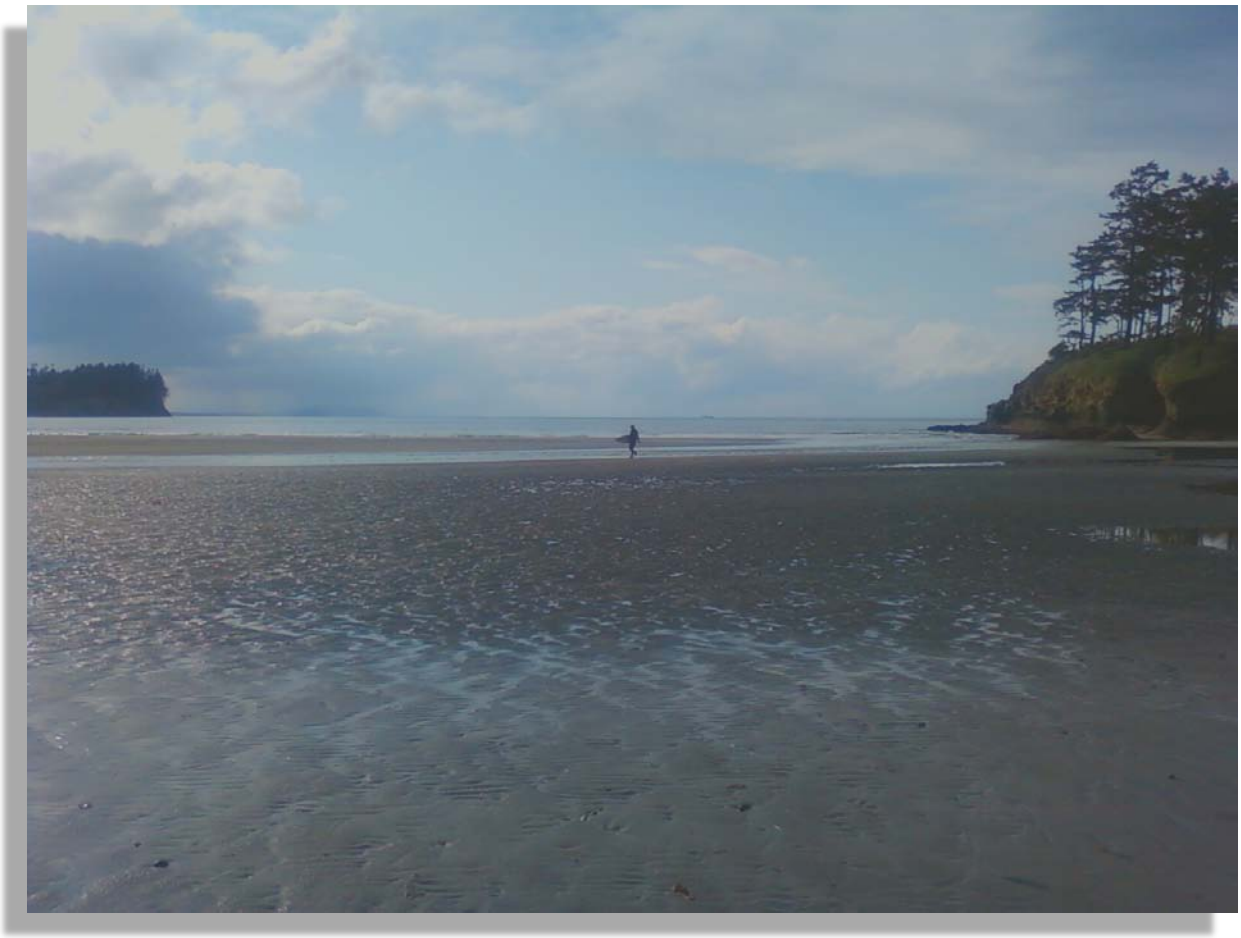


Figure 4-6. Surfer at Salt Creek Recreation Area, Crescent Beach

4.9 *Reach 9: Crescent Bay-Low Point (Maps 1b to 6b in Appendix A)*

The "Crescent Bay-Low Point" reach contains 10.7 miles of marine shoreline, which extends from the east end of Crescent Bay to approximately 2 miles west of Low Point. The reach contains shoreline along Crescent Bay, the mouths of Salt, Whiskey, and Murdock creeks, and the Lyre River estuary. Salt Creek and the Lyre River are shorelines of the state. The other streams in the reach are not shorelines of the state, except where they enter the Strait of Juan de Fuca.

4.9.1 Summary of Baseline Conditions

Net shore-drift is generally eastward along the reach. The western half of the reach generally consists of feeder bluffs, which supply the sand, gravel, and cobble to sustain the beaches of Crescent Bay. The feeder bluffs near the center of the reach are composed of talus, which erode much slower than the unconsolidated glacial deposits that make up the feeder bluffs in the western portion of the reach. There are no identified shoreline modifications mapped within the reach. Several of the feeder bluffs areas are considered unstable, with recent slides identified adjacent to Agate Bay. Most of Crescent Bay, Agate Bay, and Low Point are in tsunami hazard zones and FEMA 100-year floodplains (coastal and stream).

Just over half of the shoreland area contains forest vegetation, and the majority of the land that borders the shoreland zone is also forested. Less than 10% of the shoreland area consists of wetland habitat that is concentrated along the river mouths, primarily in the Salt Creek estuary. These forest and wetland areas provide habitat for a wide variety of wildlife species, including bald eagle. Priority harbor seal habitat and a marine mammal haulout area are mapped at Low Point. In addition, a gray whale feeding area is located at Crescent Bay.

WDNR ShoreZone data shows patches of eelgrass from the western end of Crescent Bay to Tongue Point. A survey by Norris and Fraser (2009) also found eelgrass patches in Crescent Bay (approximately 31 acres total), which are located primarily in the western portion of the bay.

Kelp is mapped throughout almost half of the reach, but is somewhat sparse in Crescent Bay. Patches of forage fish (smelt) spawning habitat are located east of the Whiskey Creek mouth, and west of the Lyre River estuary. As a result, the nearshore area of the reach is used by many species for feeding, migration and rearing. The nearshore areas and streams within the reach provide habitat for a variety of salmonid and trout species, including steelhead, resident cutthroat trout, and coho and chum salmon.

There are no State impaired water quality listings within the reach. However, Streamkeepers has listed Whiskey Creek water quality as "impaired" for WQI, and the Lyre River is listed as "impaired" for B-IBI but "healthy" for WQI. Salt Creek is listed as "compromised" for both B-IBI and WQI.

A breakwater, associated with a boat ramp, is located at the Whiskey Creek Campground. The breakwater is the only mapped shoreline modification within the reach.

Land uses and ownership within the shoreland area vary throughout the reach. The eastern end of Crescent Bay is within the Salt Creek Recreation Area. The remainder of Crescent Bay is a privately owned campground (the Crescent Beach and RV Park) zoned Tourist Rural and Parks and Recreation. Lands from the west end of Crescent Bay to the mouth of Whiskey Creek are DNR-managed commercial forest lands. The land at the west end of the reach is also publicly owned commercial forest land. The remaining land within this reach is zoned Commercial Forest Residential or Residential (R5). Parcels vary in area, with an average size of approximately 5 acres.

Although slightly more than half of the shoreline in this reach is publicly owned, only a small portion of this can be easily accessed from land (from the Salt Creek Restoration Area).

Approximately one-third of the shoreline is privately owned, but accessible only to customers of the Crescent Beach and RV Park, Whiskey Creek Campground, and Lyre River Campground. Tideland ownership within the reach is mixed: public and private.

4.9.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, almost three-quarters of the shoreland area has potential for new development. There are several undeveloped parcels located near the east shore of Crescent Bay; however, the presence of wetland habitat in the area likely precludes development. Parcel sizes, shapes, and zoning categories vary widely in the remaining privately-owned, developable land within the reach. Many of the parcels are large (> 10 acre), and could be subdivided into lots from 2 to 20 acres in size, depending upon the specific zoning category.

4.9.3 Management Issues and Opportunities

The majority of the privately owned land within the reach is undeveloped and forested. There are no identified shoreline modifications within the reach, so sediment and habitat-forming processes are in good condition. Protecting these natural shoreline attributes is crucial key to maintaining the overall ecological health of the reach.

This reach has a substantial amount of publicly owned shoreline, but a minimal portion of this can be accessed by the public. Opportunities for increased access are available through the DNR-managed land within the reach.

Key management considerations for this reach are:

- New structures should be set back an adequate distance from erosion-prone areas, such as feeder bluffs. Moving development away from bluffs helps protect structures from landslides, and allow natural sediment transport processes to continue and avoid the need for harmful forms of shoreline stabilization in the future.

- In low bank areas, set structures back from the shoreline to decrease the potential risks of coast flooding and tsunami damage, and minimize the need for shoreline armoring. Armoring degrades nearshore habitat (such as forage fish spawning and salmon rearing areas), and can impede natural sediment flow/beach maintenance processes.

- Removal of forest cover, which generally results in accelerated erosion, should be limited in and near erosion-prone areas. Preserving forest cover also helps maintain wildlife species and diversity in developing areas

- Increase access to publicly owned shorelines, so the public can use and enjoy the high-quality shoreline areas within this reach.

4.10 *Reach 10: Twin Rivers (Maps 1b to 6b in Appendix A)*

The “Twin Rivers” reach contains 7.4 miles of marine shoreline, which extends along the Strait of Juan de Fuca from approximately 2 miles west of Low Point to approximately 1 mile east of the mouth of Deep Creek. The reach includes the mouths of the East and West Twin Rivers, which are shorelines of the state.

4.10.1 Summary of Baseline Conditions

The predominant shoretype within the reach is rocky platform shores, with small portions of barrier beach and bluff-backed beach located at the Twin River mouths. Over three-quarters of the shoreline consists of feeder bluffs, but the majority of these bluffs are composed of talus, which erode more slowly than the unconsolidated glacial deposits that make up the most feeder bluffs along the eastern shore of the Strait of Juan de Fuca. Net shore-drift is entirely eastward through the reach. However, a large, manmade obstruction to littoral drift (referred to as a mole) occurs in the western portion of the reach, which bisects drift into two separately functioning cells (Figure 4-7). The mole is associated with a mine (now closed) at the adjacent bluff. There are no other shoreline modifications mapped within the reach.

Figure 4-7. Retailed fill ("mole") extending into the nearshore zone just west of West Twin River.

The area around the mouths of the Twin Rivers is in a Tsunami hazard zone, and the FEMA coastal 100-year floodplain. Some unstable bluff areas are present within the reach, with recent slides mapped near the eastern end of the reach.

Over half of the shoreland area of the reach consists of forest habitat, with most of the remaining area being natural shrub and herbaceous habitat. In addition, most of the land surrounding the shorelands is forested. These large, continuous tracts of forest land provide important habitat for a variety of species, including bald eagle. The forest cover also helps stabilize the erosive bluffs in the area.

The rocky shoreline within the reach provides important habitat for harbor seal, and several marine mammal haulout areas are mapped within the reach. Two patches of smelt spawning habitat are located on the beach habitat near the mouths of the Twin Rivers. Patchy eelgrass meadows are located in the eastern half of the reach, and continuous kelp stands are located throughout the nearly the entire reach. As a result, the nearshore areas of the reach are important feeding grounds for marine wildlife including juvenile salmonids, which use the shallow nearshore waters for migration and rearing. In particular, the nearshore habitat adjacent to the Twin Rivers is very important habitat for steelhead, trout, and forage fish (Shaffer and Ritchie, 2008).

The Twin Rivers provide habitat for steelhead, resident cutthroat trout, and coho and chum salmon. The Twin Rivers have no impaired water quality listings by the state. However, within the reach boundary, Streamkeepers lists the water quality of the East Twin River as "impaired" for WQI, and the West Twin River is listed as "compromised" for B-IBI but "healthy" for WQI.

Most of the land within the shoreland area is privately owned and zoned for Commercial Forestry. Some DNR-managed forest land is located in the eastern portion of the reach. The shorelands within the reach are largely undeveloped.

Almost the entire shoreline length in this reach is publicly owned, but only a small portion of this is accessible from land. Shoreline area near the Twin Rivers is informally accessible from Highway 112; however, there are no dedicated parking areas available. The tideland areas within the reach are mostly publically owned.

4.10.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, approximately one-third of the shoreland area has potential for new development. However, most of this land is zoned for Commercial Forestry, and unlikely to be intensively developed. Zoning regulations allow single-family dwellings on Commercial Forest-zoned land, but at a maximum density of one dwelling per 80 acres. Therefore, the development potential within the shoreland area is minimal.

4.10.3 Management Issues and Opportunities

Because of the overall lack of development along the shorelands, sediment processes and habitat conditions within the reach are in good condition. An exception is the area of nearshore fill (mole) that bisects a drift cell. State and federal agencies have identified removal of this fill as a nearshore restoration priority.

The majority of the shoreline in this reach is publicly owned, but generally inaccessible from land. Substantial opportunities for increased access are available through the DNR-managed land within the reach. In addition, public access to the Twin Rivers mouths could be improved.

Given that most of the privately owned land is zoned for Commercial Forestry and unlikely to be intensively developed, the risk of degradation of ecological function resulting from development is minimal.

4.11 *Reach 11: Deep Creek (Maps 1c to 6c in Appendix A)*

The "Deep Creek" reach contains 5.3 miles of marine shoreline, which extends along the Strait of Juan de Fuca from approximately 1 mile east of the mouth of Deep Creek to approximately one-third of a mile east of the mouth of Butler Creek. The reach includes the mouths of Deep, Joe, and Jim Creeks. Deep Creek is a shoreline of the state. Joe and Jim Creeks are not shorelines of the state, except where they enter the Strait of Juan de Fuca.

4.11.1 Summary of Baseline Conditions

The eastern half of the reach is composed of bluff backed beach while the western half is rocky platform shores, with a small barrier beach area at the mouth of Deep Creek. Approximately half of the reach is composed of talus feeder bluffs, which erode much slower than the unconsolidated glacial deposits. Net shore-drift along the reach is entirely eastward; however, a large obstruction (the Silver King Resort breakwater) is located at the mouth of Jim Creek. Nearshore fill, armoring, and 3 overwater structures are located in the resort vicinity. The remainder of the reach has no identified shoreline modifications.

Most of the shoreline areas in the Jim and Deep Creeks vicinity are in a tsumami hazard zone and FEMA 100-year floodplains (coastal and stream). Some unstable bluff areas are present within the reach, with recent slides mapped directly west of Deep Creek.

Approximately three-quarters of the shoreland area of the reach consists of forest habitat. In addition, most of the land surrounding the shorelands is forested. These large, continuous tracts of forest land provide important habitat for a variety of species, including bald eagle. The forest cover also helps stabilize the erosive bluffs in the area.

The shoreline within the reach provides important habitat for harbor seal, and several marine mammal haulout areas occur within the reach. Almost the entire shoreline is mapped as Dungeness crab and sea urchin habitat. Two patches of smelt spawning habitat are located at the eastern and western ends of the reach. Patchy kelp stands are located throughout nearly the entire reach, with continuous stands west of the Silver King Resort. The nearshore areas of the reach are important migration and rearing habitats for juvenile salmonids and other species.

Jim and Deep Creeks provide habitat for resident cutthroat; steelhead; and coho, chinook, and chum salmon. The portion of Deep Creek within the reach has State impaired water quality listings for dissolved oxygen and temperature. Deep Creek water quality is listed by Streamkeepers as "healthy" for WQI.

Land ownership within the reach is 100% private. Land usage within the shoreland is Commercial Forestry, with the exception of the Silver King Resort area, which is zoned Rural Neighborhood Commercial. Over two-thirds of the shoreline in this reach is publicly owned; however, none of this area is accessible from land. The remainder of the reach shoreline is privately owned, but can be accessed by Silver King owners and guests. The tideland areas within the reach are mostly publically owned.

4.11.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, almost the entire shoreland area has potential for new development. However, most of this land is zoned for Commercial Forestry, and unlikely to be intensively developed. Zoning regulations allow single-family dwellings on Commercial Forest-zoned land, but at a maximum density of one dwelling per 80 acres. Therefore, the development potential within the shoreland area is minimal.

Because 100% of the shorelands are privately owned, without the acquisition of public access easements there is limited potential for increasing shoreline public access within the reach.

4.11.3 Management Issues and Opportunities

Because of the overall lack of development along the shorelands, sediment processes and habitat conditions within the reach are generally in good condition. However, the breakwater at the Silver King Resort impedes natural sediment flow processes in the area.

Given that most of the privately owned land is zoned for Commercial Forestry and unlikely to be intensively developed, the risk of degradation to ecological function resulting from development is minimal.

4.12 *Reach 12: Pysht River (Maps 1c to 6c in Appendix A)*

The "Pysht River" reach contains 2.4 miles of marine shoreline, which extends along the Strait of Juan de Fuca from approximately one-third of a mile east of the Butler Creek mouth, to just south of Pillar Point. The reach includes the mouth of Butler Creek and the Pysht River estuary. The Pysht River is a shoreline of the state. Butler Creek is not a shoreline of the state, except where it enters the Strait of Juan de Fuca.

4.12.1 Summary of Baseline Conditions

The most abundant shoretype in the reach is barrier estuary, associated with the mouth of the Pysht River. A south-trending drift cell, originating at Pillar Point, supplies the sand, gravel, and cobble that forms barrier beach north of the Pysht River mouth. This drift cell converges with a westward drift cell at the Pysht River estuary. Rocky platform shores comprise the eastern portion of the shoreline. Tidal barriers (levees) are located at the mouth of the river.

Some of the bluff areas in the northern and southeastern portion of the reach are unstable, but no recent landslides are identified. Nearly all of the Pysht River estuary area is in a tsunami hazard zone and FEMA coastal and/or river floodplains.

More than half of the shoreland area of the reach is mapped as forest habitat, and most of the remainder of the shorelands (Pysht River estuary) contain natural shrub and herbaceous vegetation. In addition, most of the land surrounding the shorelands is forested. These large, continuous tracts of forest land provide important habitat for a variety of species, and help stabilize the erosive bluffs in the area.

The Pysht estuary is one of the largest estuarine complexes on the Olympic Peninsula and provides important habitat for waterfowl and other wetland-dependent species, as well as steelhead and several salmon species (Todd et al., 2006 in Shaffer et al., 2008). The river itself

provides habitat for steelhead; resident cutthroat trout; and coho, chinook, and chum salmon. Pysht River water quality is listed by Streamkeepers as "compromised" for B-IBI. In addition, the portion of the Strait of Juan de Fuca within the reach has a State impaired water quality listing for fecal coliform.

The rocky shores at the eastern end of the reach are designated priority habitat for harbor seal. A patch of forage fish (sand lance) spawning habitat is located in the northern portion of the reach. The nearshore and estuarine areas of the reach are important feeding grounds for juvenile salmonids, which use the shallow nearshore waters for migration and rearing.

The lower Pysht river area was historically used extensively for commercial logging operations that resulted in significant diking, channelizing, and filling of the estuary and lower river (Todd et al., 2006 in Shaffer et al., 2008). Logging operations in the estuary ended in 1974, but many of the remnant structures remain.

Land ownership within the reach is 100% private. Land use in the reach is primarily timber land, with a small amount of low-density residential and open space. The entire reach is zoned Commercial Forest. Approximately 5% of the shoreline is publicly owned, and can be directly accessed at Pillar Point County Park (located at Butler Cove). Recreational crabbing is available at the park. The tideland areas within the reach are mostly privately owned.

4.12.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, almost the entire shoreland area has potential for new development. However, most of this land is zoned for Commercial Forestry, and is unlikely to be intensively developed. Zoning regulations allow single-family dwellings on Commercial Forest-zoned land, but at a maximum density of one dwelling per 80 acres. Therefore, the development potential within the shoreland area is minimal.

Because over 95% of the shorelands are privately owned, without the acquisition of public access easements there is limited potential for increasing shoreline public access within the reach.

4.12.3 Management Issues and Opportunities

Because of the overall lack of development along the shoreline, sediment processes and habitat conditions within the reach are in very good condition. However, because of the ecological value of the estuary and the presence of historic modifications in the lower river, the Pysht estuary is a high-priority restoration area (Shaffer et al., 2008).

Given that most of the privately owned land is zoned for Commercial Forestry and is unlikely to be intensively developed, the risk of degradation to ecological function resulting from development is minimal.

4.13 *Reach 13: Pillar Point (Maps 1c to 6c in Appendix A)*

The "Pillar Point" reach contains 2.1 miles of marine shoreline, which extends along the Strait of Juan de Fuca from just south of Pillar Point to approximately a mile and a half west of the point.

4.13.1 Summary of Baseline Conditions

Almost the entire shoreline of the reach consists of bedrock shores, with rocky platforms comprising the eastern half and a broad pocket beach in the western half. Feeder bluff talus shoreforms back the pocket beach. The reach consists of two short drift cells, which converge at the pocket beach area. However, bedrock shores and deep water preclude sandy beach development in the area. There is no appreciable drift along the rocky platform area. There are no identified shoreline modifications within the reach.

Many of the bluff areas within the reach are unstable, with recent slides mapped in the northwestern portion of the reach. A portion of Pillar Point and the pocket beach area in the western portion of the reach is in a tsunami hazard zone and the FEMA coastal 100-year floodplain.

Almost the entire shoreland area contains forest habitat, and the surrounding land is also forested. The large expanses of forest within the reach provide important habitat for a variety of wildlife species, including bald eagle. In addition, the rocky shoreline provides important habitat for harbor seal; two marine mammal haulout areas are mapped within the reach.

Kelp (both continuous and patchy stands) are mapped throughout the reach. The bedrock composition of the nearshore substrate makes the area unsuitable for forage fish spawning habitat, but the undeveloped condition of the shoreline and large expanses of submerged aquatic vegetation make the nearshore area important habitat for marine species, including juvenile salmonids.

Land ownership within the reach is almost entirely private, and use is primarily timber, with a smaller amount of low-density residential located in the eastern portion of the reach, adjacent to Pillar Point. Approximately three-quarters of the shoreline is publicly owned; however, none of the area can be accessed from land. Tideland ownership in the reach is mixed: public and private.

4.13.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, more than half of the shoreland area has potential for new development. However, almost all of this land is zoned for Commercial Forestry, and unlikely to be intensively developed. Zoning regulations allow single-family dwellings on Commercial Forest-zoned land, but at a maximum density of one dwelling per 80 acres. Therefore, the development potential within the shoreland area is minimal.

Because over 95% of the shorelands are privately owned and there are no public roads in the vicinity, there is limited potential for increasing shoreline public access within the reach.

4.13.3 Management Issues and Opportunities

Because of the overall lack of development along the shoreline, sediment processes and habitat conditions within the reach are in very good condition. Given that nearly all of the shoreland area is zoned for Commercial Forestry and unlikely to be intensively developed, the risk of degradation to ecological function resulting from development is minimal.

4.14 *Reach 14: Slip Point (Maps 1c to 6c in Appendix A)*

The "Slip Point" reach contains 6.8 miles of marine shoreline, which extends along the Strait of Juan de Fuca from approximately a mile and a half west of Pillar Point to Slip Point.

4.14.1 Summary of Baseline Conditions

Bedrock rocky platform shores comprise the entire shoreline within the reach, and there is no appreciable net shore-drift along the shores. There are no identified shoreline modifications within the reach. Many of the slopes along the shoreline are unstable; however, no recent slides are identified. Most of the shoreline near Slip Point is in a tsunami hazard zone and the FEMA coastal 100-year floodplain.

Almost the entire shoreland area contains forest habitat, and the surrounding land is also forested. The large expanses of forest within the reach provide important habitat for a variety of wildlife species, including bald eagle. The forest cover also helps stabilize the unstable slopes within the reach. The rocky shoreline provides important habitat for harbor seal; several marine mammal haulout areas are mapped within the reach.

Continuous kelp stands are mapped throughout the reach. The bedrock composition of the nearshore substrate makes the area unsuitable for forage fish spawning habitat, but the undeveloped condition of the shoreline and large expanses of submerged aquatic vegetation make the nearshore area important habitat for marine species, including juvenile salmonids.

Almost the entire shoreland area is privately-owned timber land. Nearly the entire shoreline is publicly owned; however, none of the area can be accessed from land. Tideland areas within the reach are publically owned.

4.14.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, more than 90% of the shoreland area has potential for new development. However, all of this land is zoned for Commercial Forestry, and unlikely to be intensively developed. Zoning regulations allow single-family dwellings on Commercial Forest-zoned land, but at a maximum density of one dwelling per 80 acres. Therefore, the development potential within the shoreland area is minimal.

Because almost all of the shoreland area within the reach is privately owned and there are no public roads in the vicinity, there is limited potential for increasing shoreline public access within the reach.

4.14.3 Management Issues and Opportunities

Because of the overall lack of development along the shoreline, habitat conditions within the reach are in very good condition. Given that nearly all of the shoreland area is zoned for Commercial Forestry and unlikely to be intensively developed, the risk of degradation to ecological function resulting from development is minimal.

4.15 *Reach 15: Clallam Bay (Maps 1c to 6c in Appendix A)*

The "Clallam Bay" reach contains 5.7 miles of marine shorelines which extends along Clallam Bay from Slip Point to Sekiu Point, within the Clallam Bay Sekiu urban growth area. The reach also contains the Clallam River estuary and the mouth of Falls Creek. The Clallam River is a shoreline of the state. Falls Creek is not a shoreline of the state, except where it enters the Strait of Juan de Fuca.

4.15.1 Summary of Baseline Conditions

The eastern half of the shoreline in this reach consists of low beaches (barrier estuary and barrier beach), with bluff backed beach in the western portion. These beaches are maintained by two drifts cells (originating at the Clallam Bay headlands), which converge in the central portion of the bay near the mouth of the Clallam River. Some of the bluff areas within the reach are unstable, and recent slides are identified near the center of the reach. Most of the Clallam Bay shoreland area is within a tsunami hazard zone and FEMA coastal and/or river 100-year floodplain.

Almost one-quarter of the shoreline within the reach has been armored, or otherwise modified. Two marina breakwaters are located within the reach, near the center of the bay and at the west end. In addition, shoreline armoring is present along the shoreline near the west marina. There are several overwater structures (docks) at each of the marinas (Figure 4-8).

This is one of the more heavily developed reaches in western Clallam County so the shoreline vegetation has been significantly altered. Only about one-quarter of the shoreland area contains forest cover, with natural shrub and herbaceous vegetation located along the Clallam River. The remainder of the shorelands contains developed and lawn/landscaped area. The remaining forest cover provides habitat for many wildlife species, including bald eagle. Most of the land outside of the SMP jurisdiction is forested.

Wetland habitat is mapped within the Clallam River estuary, which provides important habitat for wetland-dependent species. Almost the entire shoreline provides habitat for abalone, Dungeness crab, and red sea urchin. Patchy kelp stands are present throughout the reach. Two patches of forage fish spawning are located in the reach; sand lance near the Clallam River mouth and smelt west of the marina in the central portion of the bay. The presence of submerged aquatic vegetation and forage fish habitat makes the Clallam Bay shoreline important feeding grounds for juvenile salmonids, which use the shallow nearshore waters for migration and rearing. However, nearshore habitat quality has been impacted by the shoreline modifications within the bay.

The Clallam River provides habitat for coho salmon, chum salmon, resident cutthroat trout, and steelhead. However, natural net shore-drift processes sometimes blocks fish access to the river mouth, particularly during periods of low river flows. Clallam River water quality has a State impaired water quality listing for temperature. Water quality of the river is listed by Streamkeepers as "impaired" for WQI.

Major land uses within the shoreland area include open space, roads, lodging, high-density residential, and commercial. Over 90% of the shoreland area is privately owned.

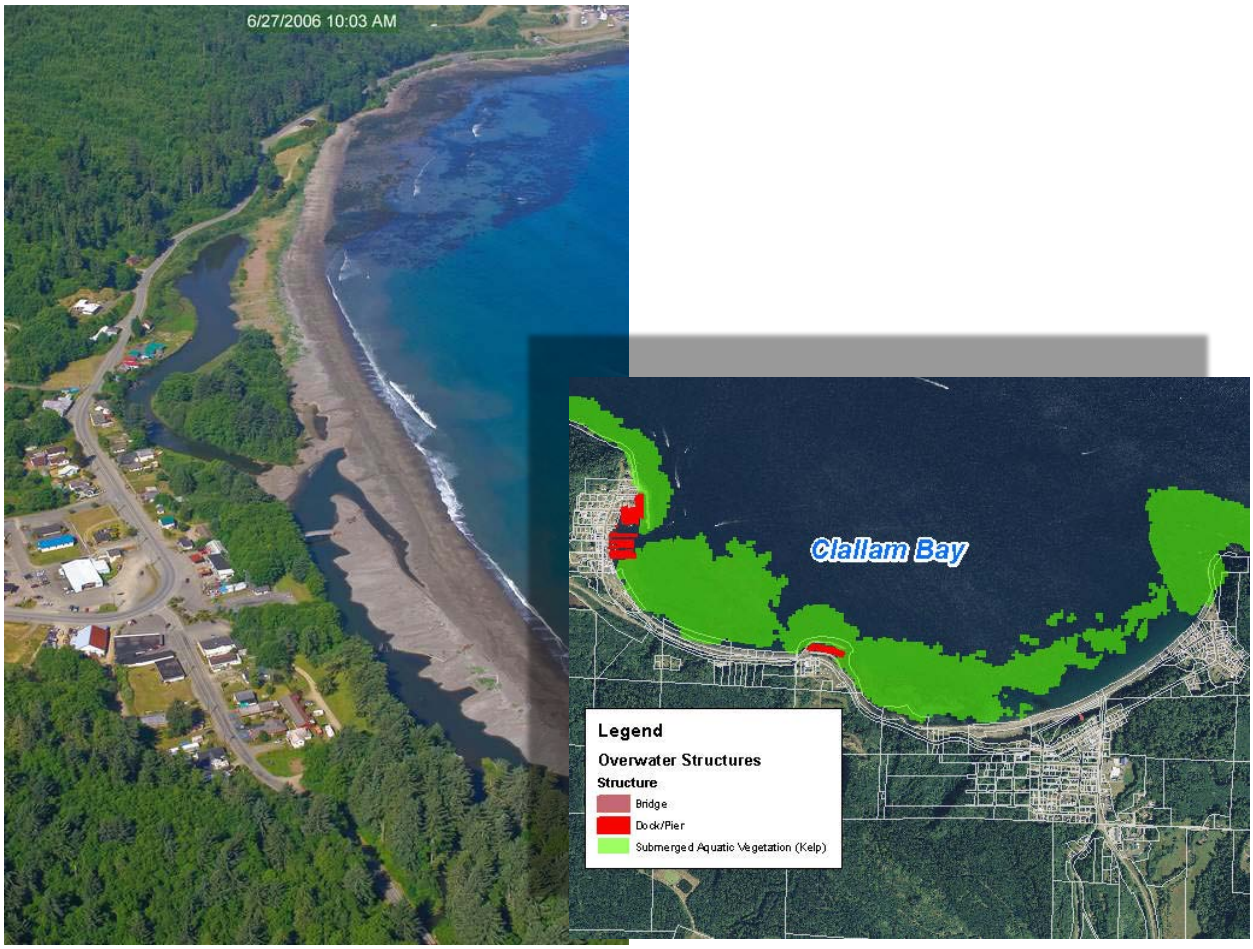


Figure 4-8. Clallam Bay shoreline showing overwater structures (shown in red) and kelp stands (shown in green on right photo) (Photo: Ecology Coastal Atlas)

Half of the shoreline in the bay is publicly owned and accessible from land. Public shoreline in the eastern portion of the reach is accessible from Clallam Bay Spit Community Beach County Park. Public shoreline near the western end of the reach is informally accessible from Highway 112. An additional quarter of the shoreline in the reach is not publicly owned, but can be accessed by patrons of the two marinas in the bay. Tideland areas within the reach are mostly privately owned.

4.15.2 Future Land Use and Potential Effects on Shoreline Ecology

Clallam Bay-Sekiu is an urban growth area and is expected to absorb additional growth. Under current zoning regulations, approximately half of the shoreland area within the reach has potential for new development. The vacant, developable land is primarily concentrated in the western two-thirds of the reach, and is zoned for commercial development or lodging. These undeveloped parcels are generally irregular in size and narrow in width, with wide water frontages. Most of these parcels are narrow in width and backed by Highway 112, so development within the parcels would occur in close proximity to the shoreline. Development in

these parcels may also necessitate installation of shoreline armoring to protect structures. An increase in shoreline armoring in these areas may adversely impact submerged aquatic plant communities and/ or forage fish spawning habitat, which would in turn reduce the suitability of this reach to continue to provide high-quality salmonid rearing habitat. Armoring may also impede natural sediment flow and beach maintenance processes.

Clallam Bay landowners along the low beach areas may seek to construct bulkheads or other shoreline armoring structures to protect their property from wind and wave action.

4.15.3 Management Issues and Opportunities

As stated above, the nearshore environment of Clallam Bay provides important salmon rearing habitat. While a significant amount of shoreline armoring is present in the reach, the majority of the shoreline is unaltered which allows natural sediment movement and beach forming processes. Protecting these natural qualities of the nearshore environment is crucial to maintain the overall ecological health of the reach, and protecting beachfront properties from beach erosion. In addition, protecting the remaining forest cover in the reach is important for maintaining wildlife habitat in the area, as well as protecting properties from accelerated erosion.

Key management recommendations for this reach are typical of other portions of the marine shoreline, including:

- Removal of forest cover, which generally results in accelerated erosion, should be limited in and near erosion-prone areas. Preserving forest cover also helps maintain wildlife species and diversity in developing areas.

- In low bank areas, set structures back from the shoreline (if possible) to decrease the potential risks of coast flooding and tsunami damage, and minimize the need for shoreline armoring. Armoring degrades nearshore habitat (such as forage fish spawning and salmon rearing areas), and can impede natural sediment flow/beach maintenance processes.

- For protection of existing structures, the use of "soft armoring" techniques (such as log placement) should be preferred over traditional "hard armoring" methods (such as rock/concrete bulkheads). As opposed to hard armoring, soft armoring generally has less negative impact on natural sediment movement and beach forming processes, as well as nearshore forage fish spawning and salmon rearing habitat.

4.16 *Reach 16: Sekiu-Kydaka Point (Maps 1c to 6c in Appendix A)*

The "Sekiu-Kydaka Point" reach contains 5.7 miles of marine shoreline, which extends along the Strait of Juan de Fuca from Sekiu Point to Kydaka Point. This reach includes a very small segment of the western Clallam Bay-Sekiu urban growth area.

4.16.1 Summary of Baseline Conditions

Rocky platform shores comprise over half of the shoreline within the reach, with bluff backed beach in the center of the reach. Two small pocket beaches are located in the western portion of the reach. Net shore-drift within the reach is entirely eastward. A small section of shoreline

armoring is located at the eastern end of the reach, near Sekiu. The remainder of the shoreline is unaltered (Figure 4-9).

Figure 4-9. Mussels and other fauna on the rocky beach west of Sekiu Point

Over half of the reach contains unstable bluff areas, with recent slides mapped southwest of Kydaka Point. Most of the northwest portion of the reach is in a tsunami hazard zone and the FEMA coastal 100-year floodplain.

Almost the entire shoreland area contains forest habitat, and the surrounding land is also forested. The large expanses of forest within the reach provide important habitat for a variety of wildlife species, including bald eagle. The shoreline in the eastern portion of the reach provides important habitat for harbor seal, and several marine mammal haulout areas are mapped within the reach.

Patches of kelp are mapped throughout the reach, and a patch of forage fish (smelt) spawning habitat is mapped at the east end of the reach. Red sea urchin is mapped throughout most of the reach, and patches of abalone, hardshell clam, and geoduck are also mapped. The prevalence of bedrock substrate in and along the shoreline makes most of the reach unsuitable for forage fish spawning habitat. Nevertheless, the undeveloped condition of the shoreline and large expanses of submerged aquatic vegetation make the nearshore area important habitat for marine species, including juvenile salmonids.

The eastern two-thirds of the reach is primarily privately owned timber land, with one publicly owned parcel (managed by State Parks) located near the center of the reach. Land use in the western third of the reach is moderate-density residential and vacant parcels.

More than three-quarters of the shoreline in the reach is publicly owned, but there are no available public access points from land. Tideland areas within the reach are mostly publically owned.

4.16.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, approximately two-thirds of the shoreland area has potential for new development. However, most of the land within the reach is zoned for Commercial Forestry, and unlikely to be intensively developed. Zoning regulations allow single-family dwellings on Commercial Forest-zoned land, but at a maximum density of one dwelling per 80 acres.

The western portion of the reach is zoned for very low density residential development (R20), and contains many vacant 1 to 2 acre lots. Some of these lots are have narrow water frontages (approximately 100 feet). Development in these lots could result in relatively dense shoreline development. In general, the shoreline in the Residential-zoned areas consists of stable, rocky platform shores. The shoreward ends of the lots lie within mapped tsunami and FEMA-mapped coastal floodplain areas. Development in these parcels would also likely remove forest cover with potential impacts to existing, high-quality wildlife habitat in the area.

4.16.3 Management Issues and Opportunities

Because of the overall lack of development along the shoreline, habitat conditions and sediment flow processes within the reach are in very good condition. The eastern two-thirds of the reach is zoned for Commercial Forestry unlikely to be intensively developed; therefore, the risk of degradation to ecological functions resulting from development in this area is minimal.

There is no land access to public shoreline within the reach. Access could be provided at the publicly owned, WSP-managed parcel near the center of the reach. However, direct access to the water in this area may be limited due to the high bluffs along the shoreline.

There is significant development potential on the residential lots in the western third of the reach. Given that the shoreline consists of stable, rocky shores, there is a low potential for shoreline armoring in the area.

Key management recommendations for this reach are:

- Removal of forest cover should be limited where possible. Preserving forest cover helps maintain wildlife species and diversity in development area.

- To protect property and human health and safety, structures should be built outside of tsunami and coastal floodplain hazard areas.

4.17 *Reach 17: Shipwreck Point (Maps 1c to 6c in Appendix A)*

The "Shipwreck Point" reach contains 6.9 miles of marine shoreline, which extends along the Strait of Juan de Fuca from Kydaka Point to the Jansen Creek mouth. The reach also contains portions of the Hoko and Sekiu River estuaries, and the mouths of Jansen and Olson Creeks. The Hoko and Sekiu rivers are shorelines of the state. Jansen and Olson Creeks are not shorelines of the state, except where they enter the Strait of Juan de Fuca.

4.17.1 Summary of Baseline Conditions

The majority of the shoreline consists of rocky platforms shores, with barrier beaches and barrier estuary located near the Hoko and Sekiu estuaries. A bluff backed beach is located between the estuaries, and a pocket beach is located in the western portion of the reach. Net shore-drift in the reach is entirely eastward. Nearly the entire eastern half of the reach is armored (50% of the total reach), which protects Highway 112. Some of the bluff areas within the reach are unstable, but there are no recent slides identified. Most of the shoreland area is within a tsunami hazard zone, and the estuaries and some of the low bank areas lie within FEMA-mapped coastal and stream 100-year floodplains.

Approximately one-third of the reach is heavily forested, with a lesser amount of natural shrub and herbaceous vegetation within the wetlands associated with the river estuaries. Natural vegetation cover within a third of the shoreland area has been altered by residential development and roads. Most of the land bordering the shorelands is forested. This forest land provides habitat for a wide variety of wildlife species, including bald eagle. The remaining forest cover also helps stabilize the erosive slopes in the area.

No forage fish spawning habitat is identified within the reach. Red sea urchin is mapped throughout almost the entire shoreline, with abalone mapped in the east and a patch of hardshell clam in the center. Continuous kelp stands are located along the shoreline in the western two-thirds of the reach, and patchy stands are located along the remainder of the reach. Patches of eelgrass are located along the west end of the reach. The presence of dense submerged aquatic vegetation make the shoreline an important habitat area for juvenile salmonids, which use the shallow nearshore waters for migration and rearing. The rocky shoreline near the center of the reach provides priority habitat for harbor seal, including two marina mammal haulout areas.

The streams within the reach provide habitat for resident cutthroat trout; steelhead; and coho, chinook, and chum salmon. The portion of the Sekiu River within the reach has a State impaired water quality listing for temperature. Hoko River water quality is listed by Streamkeepers as "compromised" for B-IBI but "healthy" for WQI. The Sekiu River is listed as "compromised" for B-IBI.

Almost half of the land use within the reach is timber, with other significant land uses being residential, open space, and roads. Moderate- to high-density residential subdivisions are located along the pocket beach near the center of the reach, on the landward side of Highway 112, and directly west of the Hoko River estuary. Most of the homes are set back more than 75 feet from the shoreline.

Over three-quarters of the shoreline within the reach is publicly owned, and accessible from land. Shoreline access in the western and eastern portion of the reach is informally available off of Highway 112. State Parks has recently acquired 850 acres near the Hoko estuary and extending up the river (Hoko River State Park); however, no formal parking or access areas have been established. Tideland ownership within the reach is mixed: public and private.

4.17.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, approximately one-third of the shoreland area has potential for new development. Most of the developable parcels are located in the narrow strip of land between Highway 112 and the shoreline. Approximately half of this area is zoned Commercial Forest (including all of the land west of the Sekiu River), while the other half is zoned for residential development (1 to 2 acre lots). Most of the undeveloped land is located within both tsunami and coastal floodplain hazard areas. Development on these lots could result in a significant risk to structures, as well as human health and safety.

Shoreland landowners whose homes are close to the shore along low beach areas may seek to construct bulkheads or other shoreline armoring structures to protect their property from wind and wave action (Figure 4-10). In addition, given the location of the underdeveloped properties, shoreline armoring may be necessary if future structures are built. An increase in shoreline armoring could negatively impact natural sediment transport and beach maintenance processes.

Figure 4-10. Riprap or" hard" shoreline armor and homes on the beach near the Hoko River (Photo by A. MacLennan

4.17.3 Management Issues and Opportunities

All of the publicly owned shoreline within the reach is accessible from land, but there are no formal parking areas available. The recently-acquired WSP land at the Hoko River mouth provides an excellent opportunity for increasing public access at the eastern end of the reach.

A significant portion of the shoreland area has potential for increased moderate-density residential development. Given the dimensions of the undeveloped parcels, and the location of Highway 112, most of the new residential development would occur very close to the shoreline, in tsunami and flood hazard areas.

Key management recommendations for this reach are:

- In low bank areas, set structures back from the shoreline (if possible) to decrease the potential risks of coastal flooding and tsunami damage, and minimize the future need for shoreline armoring.

- If shoreline protection is needed, the use of "soft armoring" techniques (such as log placement) should be preferred over traditional "hard armoring" methods (such as rock/concrete bulkheads).

- Minimize the removal of forest cover within the shorelands. Preserving forest cover helps stabilize erosion-prone areas, maintain wildlife species and diversity in developing areas.

- Increase access to publicly owned shorelines, so the public can use and enjoy the high-quality shoreline areas within this reach.

4.18 *Reach 18: Rasmussen (Bullman Creek) (Maps 1c to 6c in Appendix A)*

The "Rasmussen (Bullman Creek)" reach extends along the Strait of Juan de Fuca from just west of the mouth of Jansen Creek to the Makah Nation boundary. The reach also contains the mouths of Rasmussen/Bullman, and Snow Creeks. Bullman Creek is a shoreline of the state. The other streams within the reach are not shorelines of the state, except where they enter the Strait of Juan de Fuca.

4.18.1 Summary of Baseline Conditions

More than three-quarters of the reach consists ofrocky platform shores, with some intermittent pocket beaches. Most of the shoreline within the reach has no appreciable net shore-drift; however, eastward drift occurs along Bullman Beach and at the mouth of Rasmussen Creek. Two small segments of shoreline armoring (8% of reach total length) are mapped in the western portion of the reach, at Bullman Beach and the mouth of Snow Creek. In addition, there is one overwater structure (dock) mapped at Snow Creek.

Approximately one-third of the reach contains mapped unstable slopes, with recent slides in the southeast portion of the reach and west of Bullman Creek. Most of the land adjacent to the Snow and Bullman creek mouths is located within a tsunami hazard zone and FEMA coastal and/or stream 100-year floodplains.

Approximately half of the shoreland area within the reach is heavily forested, which helps stabilize erosive slopes and provides habitat for a diversity of wildlife species, including bald eagle. Natural shrub and herbaceous vegetation is present near the creek mouths. Vegetation in approximately a quarter of the reach has been altered by roads and development. Most of the shoreland area is bordered by forest land.

Continuous kelp stands and patchy eelgrass areas are present throughout a majority of the reach. A small patch of forage fish habitat (smelt) is present at the mouth of Bullman Creek. The presence of dense aquatic vegetation provides important nearshore habitat for marine species, including juvenile salmonids. Priority harbor seal habitat and a marine mammal haulout area is identified at the west end of the reach.

The streams within the reach provide habitat for steelhead, and coho, chinook, and chum salmon. The portions of Rasmussen and Snow creeks within the reach have State impaired water quality listings for temperature. Water quality within the streams is listed by the Streamkeepers as "compromised" for WQI.

The predominant land usage within the reach is timber, with residential, lodging, and open space land at the west end of the reach. A pocket of higher density residential development is located at

Bullman Beach, and most of the homes are fairly close to the shoreline (approximately 50 feet) (Figure 4-11). A few of the homes are protected by shoreline armoring. The entire residential area is within mapped tsunami and coastal floodplain hazard areas.

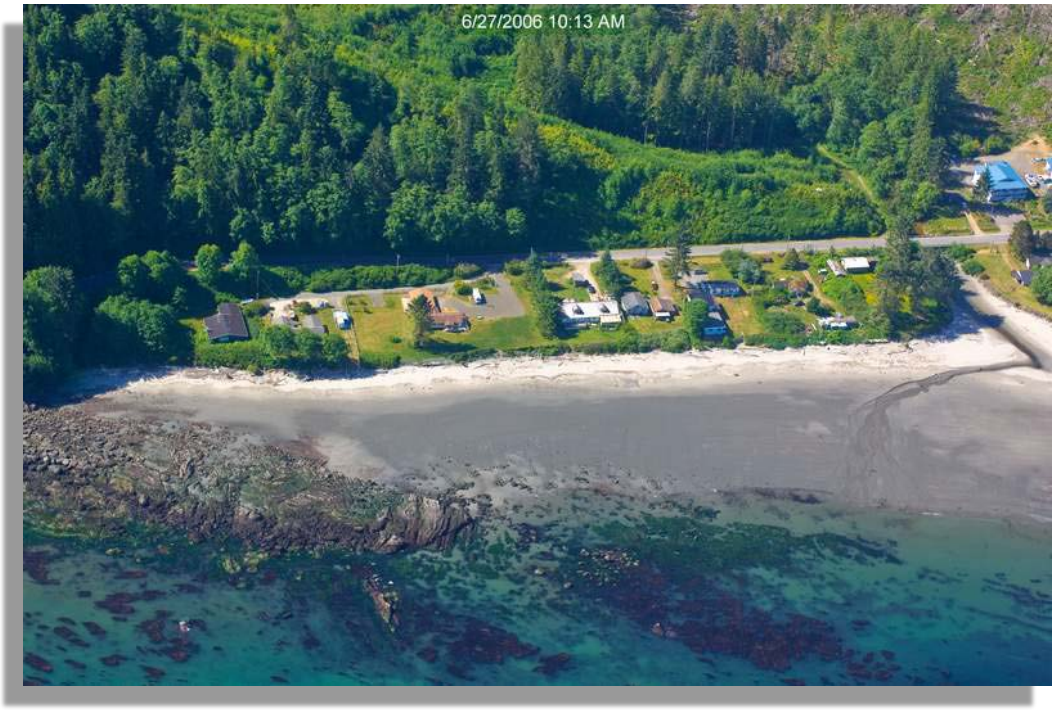


Figure 4-11. Pocket of residential development at Bullman Beach (Photo: Ecology Coastal Atlas)

Nearly the entire shoreline is publicly owned and accessible from land. Shoreline at the western end of the reach can be accessed from the Snow Creek boat launch. Other portions of the shoreline can be accessed informally from Highway 112. Tideland areas within the reach are mostly publically owned.

4.18.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, approximately one-third of the shoreland area has potential for new development. However, most of this area is zoned for Commercial Forestry, and unlikely to be intensively developed. Zoning regulations allow single-family dwellings on Commercial Forest-zoned land, but at a maximum density of one dwelling per 80 acres. With the exception of a few undeveloped lots, the residential-zoned land at Bullman Beach is already fully developed. As a result, the development potential within the shoreland area is minimal.

Bullman Beach landowners whose homes are close to the shore may seek to construct bulkheads or other shoreline armoring structures to protect their property from wind and wave action. An increase in shoreline armoring in the area may adversely impact aquatic vegetation communities and smelt spawning habitat, which would in turn reduce the suitability of the area to continue to provide high-quality salmonid rearing habitat.

4.18.3 Management Issues and Opportunities

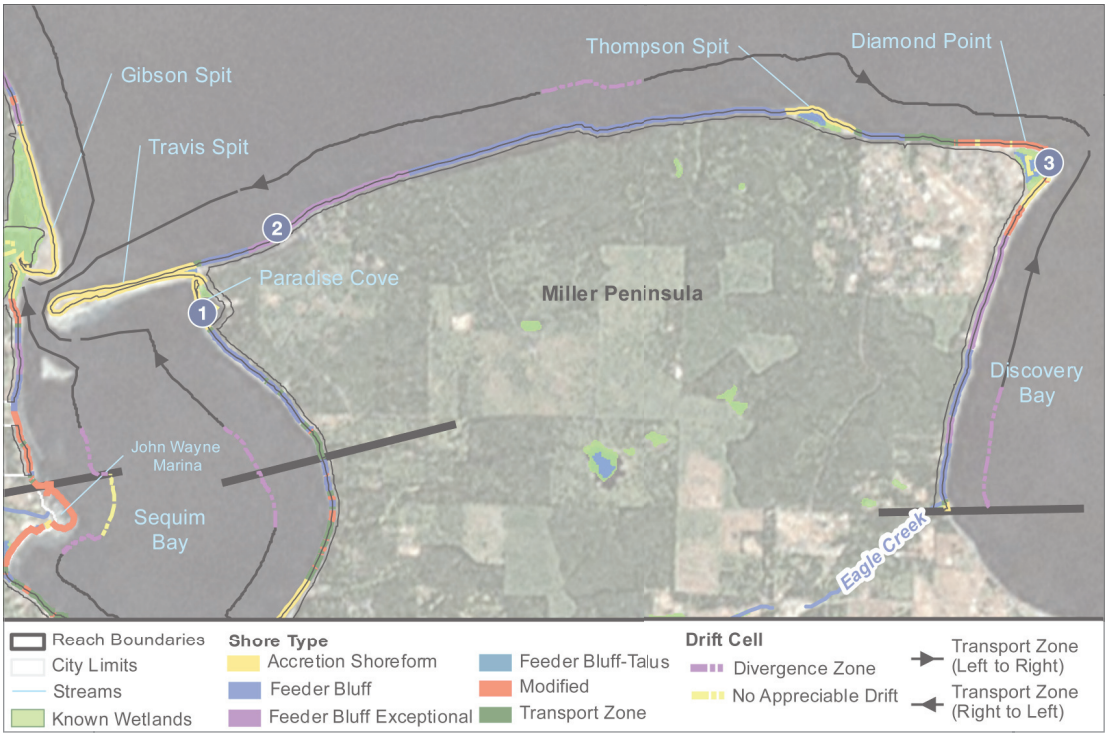
Development opportunities within the reach are limited. However, an increase in shoreline armoring may occur within the Bullman Beach area. Key management recommendations for this reach for the low bank areas include the use of "soft armoring" techniques where necessary, and setting structures back from the shoreline (if possible) to decrease the potential risks of coastal flooding and tsunami damage, and minimize the need for shoreline armoring.

Reach Sheet Data Descriptions and Sources

Marine Reach Sheet Explainer

REACH MAP

The reach maps show the physical features of each "reach" or inventory segment—there are 18 segments on the marine shore overall, excluding incorporated areas and the Makah Reservation. Geologic shore type and drift cell components are depicted to help illustrate the location of feeder bluffs, sediment transport zones, accretion shores and modified shores. The maps also show the direction of net shore-drift, divergent zones and areas of no appreciable drift. Shoreline oblique photos taken by Ecology in 2006 are provided to help orient the reader to key localities. The aerial photo base map is from 2009.



Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL

Shoreform and Shoretype

The shoreform and shoretype information describes the geologic characteristics of the shoreline as they relate to nearshore process such as the erosion, transport and accretion / deposition of sediment. The shoreform classifications were provided by the Puget Sound Nearshore Ecosystem Restoration Project (PSNERP). Categories include barrier beach, bluff-backed beach, barrier estuary, barrier lagoon, delta, closed lagoon marsh, open coastal inlet, pocket beach, rocky platform, plunging rocky shore and artificial. Shoretypes were determined by Coastal Geologic Services in 2011 using aerial photos and boat surveys. The shoretypes identify the feeder bluffs (sediment sources), transport zones, accretion shores and modified shores as defined in the report text.

Net Shore Drift

This dataset depicts littoral drift in Puget Sound. Each drift cell is described and mapped in terms of the direction of sediment transport, the location of divergent zones and areas where there is no appreciable drift. These data were provided by PSNERP (2009) and updated/refined by Coastal Geologic Services (2011).

Hazard Areas

This dataset contains information about geologic and coastal hazards, which include: areas of slope instability areas, landslide hazard areas, tsunami hazard areas, frequently flooded areas, and erosion hazard areas (Data sources: Clallam County; Ecology; FEMA; NRCS; and WDNR). In general, these data show where hazards are likely to occur or where they are known to have occurred. Some data are missing in undeveloped areas (such as commercial forest-zoned lands). Hazards may still be present in areas where none are mapped.

PSNERP Degradation Score

This score is an evaluation of the level of degradation (most degraded to least degraded) for each the following nearshore processes: sediment input, sediment transport, erosion/accretion, tidal flow, distributary channel formation, tidal channel formation, detritus import/export, freshwater input, physical disturbance, solar incidence. This is a relative analysis completed by PSNERP in 2009 which compares all the nearshore reaches of Puget Sound/ Strait of Juan de Fuca. The data are course-scale, and may not accurately represent conditions at a site- or parcel-scale.

Reach Sheet Data Descriptions and Sources — Marine Reach Sheet Explainer

ECOLOGY

Offshore Vegetation

Information on aquatic vegetation is from the Washington Department of Natural Resources Nearshore Habitat Program, which inventories and monitors seagrass and floating kelp beds as part of its program to track nearshore habitat health. The project is part of the Puget Sound Ambient Monitoring Program. Data collection and analysis are completed in collaboration with NOAA's Olympic Coast National Marine Sanctuary. The data were collected using video imagery, taken from a helicopter during low tides. The data are generally course-scale, and may not accurately represent conditions at a site- or parcel-scale. Some site-specific aquatic vegetation data, collected using underwater video technology, is available from the Clallam Marine Resources Committee and other organizations. However, these data are not described on the reach sheets as they are not available County-wide.

Onshore (Upland) Vegetation

This information describes the vegetation cover classification of uplands and shorelands within 300 feet of the ordinary high water line. The Point-No-Point Treaty Council (PNPTC) (2011) identified areas of closed canopy forest, other natural vegetation, non-forest (areas with human influence such as roads, agriculture, houses lawns, etc…), freshwater, and areas known to be off-shore. This analysis was performed using aerial photography, repeatability analyses, and some field surveys. The consultants further annotated the PNPTC data into more detailed categories, such as agriculture, lawn/landscaping, and natural herbaceous habitat, through air photo interpretation.

Habitats and Species

This describes the location of state-designated priority habitats and species in upland and aquatic areas as reported by the Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species Program and the Washington Department of Natural Resources (WDNR) Natural Heritage Program database. Priority habitat and forage fish spawning data are course-scale and based upon field biologist observations. More recent forage fish spawning habitat data is available from the Clallam Marine Resources Committee and other organizations. However, these data are not described on the reach sheets as they are not available County-wide.

Information on the approximate location and extent of known wetlands and streams is based on data from the US Fish and Wildlife Service (USFWS) and Clallam County wetland inventories and the WDNR and Clallam County stream inventories. Wetland data are somewhat course-scale, and often do not depict small wetlands, slope wetlands or wetlands in dense forest stands. A field wetland determination would be required to accurately determine the presence or absence of wetland habitat in a particular area.

Shellfish

The dataset depicts the locations of commercial shellfish beds and areas of recreational harvesting from WDFW (2010).

Water Quality

This dataset comes from the State of Washington's Water Quality Assessment (WQA) and list of impaired waterbodies. The State's WQA categories water quality into five categories, ranging from a Category I waterbodies which meets federal clean water standards to Category 5 waterbodies that are polluted and put on the EPA's impaired waterbodies (303(d)) list. Only Category 5 waterbodies are shown in the reach sheets. Data from Clallam County Streamkeepers monitoring (2010) is also reported. The Streamkeepers measured water quality using two different water quality indices: WQI and B-IBI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

These data describes the use and ownership (i.e., public, private, etc.) of lands immediately adjacent to the marine shoreline. Ownership information includes reservation lands, areas within Olympic National Park, publicly owned tidelands, protected lands, National Wildlife Refuges, and aquatic parcels. Data sources: Clallam County, 2009-2010; WSDOT, 2009; WDNR, 2011; PSNERP, 2009; NPS, 2007; USFWS, 2009.

Zoning and Parcel Data

These data depict Clallam County zoning categories and development potential of land parcels within the reach. Data source: Clallam County, 2009-2010. Based upon this data, a qualitative estimate (i.e. high, moderate, and low) of development potential within the reach is provided.

Public Access

These data identify the existing public access sites on the marine shoreline. Information was provided by the Washington Department of Ecology's Shoreline Public Access Project. The dataset also includes the location of the existing Olympic Discovery Trail (data sources: Ecology (2010) and Clallam County). Some locally known, unpublished public access areas may be absent from the data set. Public lands that are outside the jurisdiction of the shoreline master program are not included.

Impervious Surfaces

This dataset depicts estimated percentages of impervious surfaces (e.g., pavement, buildings, etc.) covering the land surface. Estimates are based on digital images (data source: NLCD, 2001). Smaller areas of impervious surface, particularly in areas with adjacent forest cover, may not be included in the data set.

Shoreline Modifications

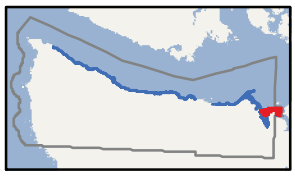
This dataset identifies locations of modifications to the shoreline environment including: bulkheads, jetties, docks, piers, marinas, buildings, tidal barriers, dams, bridges, stream crossings, and fish passage barriers. Data are from a variety of sources including: WDNR, 2001 and 2009; PSNERP, 2009; Battelle, 2008; and Clallam County, 2009.

Contaminated Sites

This dataset contains the locations of regulated hazardous materials facilities, spill sites, and cleanup projects. The list of regulated facilities as well as past and on-going cleanup projects is maintained and updated by the Washington Department of Ecology. Environmental compliance and cleanup status is also listed. Data source: Ecology, 2009.

Cultural and Archaeological Resources

This dataset contains known and recorded historic and prehistoric cultural and archaeological sites (Source: Washington State Department of Archaeology and Historic Preservation). Due to federal and state laws which preclude the release of site location information, only the number and type of cultural resources sites recorded within a reach are shown on the reach sheets.



REACH MR-1: Diamond Point

SHORELINE LENGTH
12.5 Miles

REACH AREA
268.16 Acres

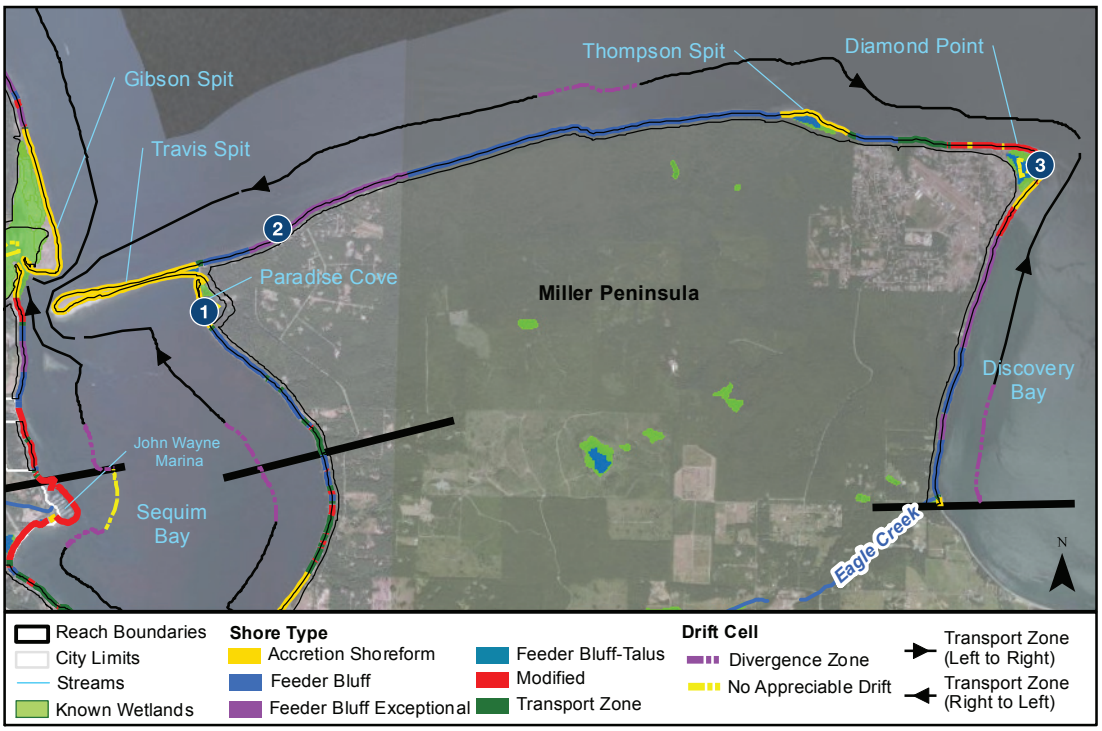
PSNERP PROCESS UNITS
SPU 1013 - 1017

REACH SUMMARY

The "Diamond Point" reach extends along Miller Peninsula, from the Clallam/Jefferson county line to the northwest corner of Sequim Bay. The reach borders Discovery Bay to the east, the Strait of Juan de Fuca to the north, and Sequim Bay to the west, and includes Diamond Point, Thompson Spit, Travis Spit, and Paradise Cove. Over half of the reach consists of feeder bluffs, which are erosion hazard areas. Minimal shoreline armoring and overwater structures are present in the reach, and half of the shoreline area is forested.

Dense residential development is present at Diamond Point, portions of which lie within mapped tsunami and flood hazard areas. Some low-density residential development is located along the feeder bluffs in the Travis Spit vicinity and bordering Discovery Bay. Approximately one-third of the shoreland area is in public ownership, managed by WSP (Miller Peninsula State Park [undeveloped]) and DNR.

Under current zoning regulations, approximately one-third of the reach area has potential for new residential development. The developable land is generally located in the eastern and western portions of the reach. Existing parcel boundaries at the southwestern portion of the reach (Discovery Bay feeder bluffs) have narrow shoreline frontages, which could lead to dense shoreline development in this area. Parcels in the Travis Spit vicinity are generally larger.



Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

Reach shoreform consists of bluff-backed beaches (54%), with barrier beaches (31%) along Kiapot Point, Thompson Spit, and Diamond Point. Geomorphic shoretypes in the reach are feeder bluffs (30%), exceptional feeder bluffs (14%) transport zones (4%), and accretion shoreforms (22%). Approximately 5% of the reach is mapped as artificial.

Net Shore Drift

The reach contains 4 net shore-drift cells. A cell with northward drift extends from the Clallam county line and converges at Diamond Point with a drift cell with eastward drift at Diamond Point. A divergence zone located along the central, north-facing shore of the Miller Peninsula marks the origin the cell with eastward drift. Westward drift from that same divergence zone supports the north shore of Travis Spit. The leeward side of Travis Spit and the barrier protecting Paradise Cove are maintained by a net shore-drift cell with north then westward drift along the northeast shore of Sequim Bay.

Hazard Areas

Most bluff areas are unstable (58%) with recent slides into Discovery Bay and the Strait of Juan de Fuca (10%). Some recent slides are near existing homes. Diamond Point, Thompson Spit, and Travis Spit are in a tsunami hazard zone (39%) and FEMA coastal 100-year floodplain (51%).

REACH REACH MR-1: Diamond Point

Degree of Process Degradation
The sediment input, sediment transport, tidal flow, tidal channel formation, and freshwater input processes within the reach have low degradation levels. In the western portion of the reach, the erosion/accretion of sediment, detritus import and export, and exchange of aquatic organisms processes also have low degradation levels, but these processes are moderately degraded in the western portion.

ECOLOGY

Offshore Vegetation
Eelgrass is mapped throughout 77% of the reach (continuous along Discovery Bay and Sequim Bay and patchy along the Strait). Kelp is mapped along the Strait (7%), but absent along Discovery Bay and Sequim Bay.

Onshore Vegetation
50% of the shoreland area in reach is mapped as forest habitat; 29% is mapped as natural shrub, herbaceous, and aquatic bed vegetation; and 13% is mapped as lawn/landscaping.

Habitats and Species
Wetland habitat (10% of landward portion of reach) is mapped at Travis Spit, Thompson Spit, and Diamond Point. Designated priority habitats within the reach include bald eagle, shorebird and waterfowl concentrations at Travis Spit, and cliffs/bluffs along Miller Peninsula. In addition, a marine mammal haulout area is mapped at the end of Travis Spit.

Forage fish habitat (herring and sand lance) is mapped along the shoreline bordering Sequim Bay, and a lesser amount along Discovery Bay. Both coho salmon and cutthroat trout are mapped in Eagle Creek, at the southeast portion of the reach.

The nearshore areas in the reach provide habitat for a wide variety of salmonids and other marine species. The Sequim Bay and Discovery Bay shorelines are particularly important rearing areas for salmonids.

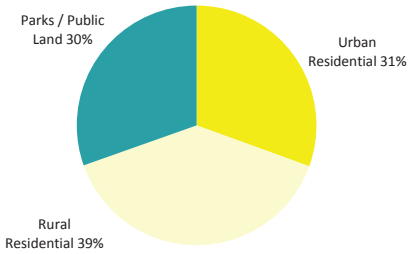
Shellfish
Hardshell clam is mapped along Discovery and Sequim bays (29% of reach). Patches of geoduck (15%) and pandalid shrimp (11%) are also mapped in the reach. Recreational shellfishing is available on the north shore of Miller Peninsula.

Water Quality
The reach has no State impaired water quality listings. However, shellfish harvesting in Discovery Bay was closed in 2007 because of elevated fecal coliform levels. Harvesting has since reopened.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land usage in the shoreland area includes open space (43%), residential (28%), vacant (21%), timber (5%), and roads (3%). The densest concentration of residential development is located in the Diamond Point vicinity, while the central portion of the reach is primarily undeveloped open space. Land ownership within the reach is 70% private and 30% public.

Zoning and Parcel Data



Under current zoning regulations the reach has moderate potential for significant new residential development, particularly within the Travis Spit and Diamond Point vicinities.

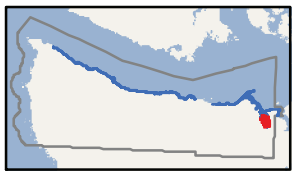
Public Access
55% of the shoreline in this reach is publicly owned, and 52% is public shoreline that is accessible from land. Public shoreline in the northern portion of the reach can be accessed via trail from Panorama Vista County Park. The shoreline along Discovery Bay can be accessed at one location, via an informal trail at Miller Peninsula State Park.

Impervious Surfaces
Approximately 6% of the shoreland area is covered by impervious surfaces.

Shoreline Modifications
Shoreline armoring (7% of reach total) is mapped along Diamond Point and Paradise Cove . A small levee section (1%)is identified on Eagle Creek, at the southeast portion of the reach. Three docks are mapped in the Diamond Point vicinity.

Contaminated Sites
There are no identified contaminated sites within the reach.

Cultural Resources
The Surgeon's Residence (built 1893) associated with the Diamond Point US Quarantine Station is listed on the state and national historic registries. In addition, there are 2 inventoried pre-contact sites within the reach.



REACH MR-2: Sequim Bay

SHORELINE LENGTH
8.19 Miles

REACH AREA
254.80 Acres

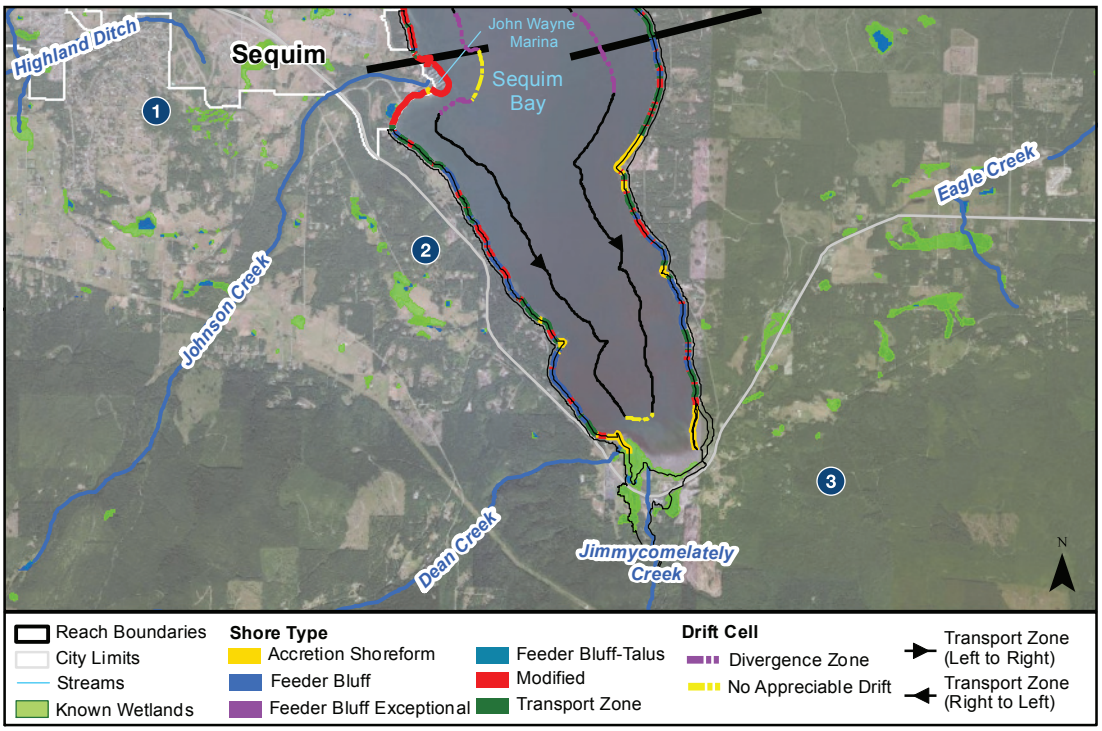
PSNERP PROCESS UNITS
SPU 1018 - 1020

REACH SUMMARY

The "Sequim Bay" reach consists of the bay shoreline, from south of Travis Spit to just south of the John Wayne Marina. The reach excludes shoreline within City of Sequim jurisdiction. Approximately one-third of the shoreline consists of feeder bluffs. However, because of the relatively sheltered position of the bay, the presence of significant erosion hazard areas is minimal. Approximately 20% of the shoreline is armored, and several overwater structures (docks and piers) are mapped throughout the reach. The Bay shoreline contains dense concentrations of submerged aquatic vegetation and significant forage fish spawning habitat, which provides important habitat for marine species, including juvenile salmonids.

The dominant land use within the reach is moderate- to low-density residential development. A commercial area is located at the Bay head. Sequim Bay State Park, a popular recreational shellfish area, is located in the western portion of the reach. Approximately half of the shoreline contains forest cover and other natural vegetation, while the other half has been altered by development.

Under current zoning regulations, approximately half of the reach area has potential for new residential development. Existing parcel boundaries vary in size, but many of the lots have narrow water frontages (approx. 75'), which could lead to dense shoreline development in these areas. With increased development, more over water structures could potentially be constructed over eelgrass and/or valuable forage fish spawning habitat.



Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

Bluff backed beaches are the most abundant shoreform in the reach (63%), followed by barrier beaches (17%). Embayments, including an open coastal inlet (11%) and a barrier estuary (9%) comprise the remaining shoreline in the reach. Geomorphic shoretypes in the reach are feeder bluffs (28%), transport zones (26%), and accretion shoreforms (18%). Accretion shoreforms account for 16% of the Reach 2 shoreline. 12% of the reach shoreline is artificial

Net Shore Drift

The reach contains two drift cells, both with southward drift that terminate at the head of Sequim Bay. No Appreciable Drift occurs within the southernmost head of the bay.

Hazard Areas

Several bluff areas are unstable (11%), but no recent slides are mapped. Most of Sequim Bay is in a tsunami hazard zone (43.6%) and FEMA coastal and stream (Jimmycomelately Creek) 100-year floodplains (45%).

REACH REACH MR-2: Sequim Bay

Degree of Process Degradation

Within the reach, the exchange of aquatic organisms process has low degradation levels, and the sediment input and detritus import and export processes have moderate degraded levels. In the eastern portion of the reach, the erosion/accretion of sediment, tidal flow, tidal channel formation, and exchange of aquatic organisms processes have low degradation levels, but these processes are moderately degraded in the western portion. The sediment export process is moderately degraded in the eastern portion of the reach, and highly degraded in the western portion.

ECOLOGY

Offshore Vegetation

Eelgrass is mapped throughout 98% of the reach, continuous (66%) along Sequim Bay, patchy (32%) at the mouth of Jimmycomelately Creek. There is no kelp mapped within the reach.

Onshore Vegetation

44% of the shoreland area of the reach is mapped as forest habitat, 21% is mapped as natural shrub and herbaceous vegetation, and 33% is mapped as lawn/landscaping.

Habitats and Species

Wetland habitat (9% of the shoreland portion of the reach) is mapped near Jimmycomelately Creek. This wetland habitat is identified as a priority shorebird and waterfowl habitat area.

Forage fish habitat (herring and sand lance) is mapped throughout the reach. Coho salmon, chum salmon, winter steelhead, and resident cutthroat trout are mapped in Jimmycomelately Creek and several other Sequim Bay drainages.

Sequim Bay provides habitat for a wide variety of marine species. The nearshore areas of the bay are very important migration and rearing areas for salmon species.

Shellfish

Hardshell clam is mapped throughout much of the reach (49% of reach total), as well as oyster beds (0.5%), geoduck (15%), and pandalid shrimp (12%). Recreational shellfish harvesting is available at Sequim Bay State Park, and a tribal oyster farm is located at the bayhead.

Water Quality

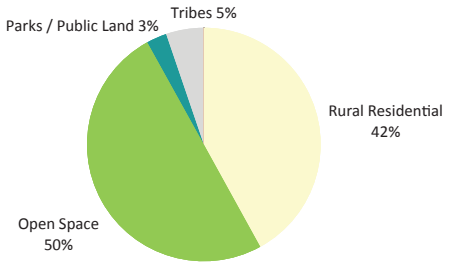
The portion of Jimmycomelately Creek within the reach has State impaired water quality listings for dissolved oxygen and fecal coliform. The Streamkeepers have listed Jimmycomelately water quality as "impaired" for both B-IBI and WQI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage in shoreland area includes residential (43%), open space (10%), roads (5%), timber (4%), vacant (26%), agriculture (3%), lodging (3%), and tribe (5%). Land ownership within the reach is 93% private, 6% public, and 1% tribe.

Zoning and Parcel Data



Under current zoning regulations the reach has high potential for significant new residential development.

Public Access

15% of the shoreline in this reach is publicly owned, and 10% is public shoreline that is accessible from land. The publically owned shoreline is located on the west shore of Sequim Bay, and can directly accessed from Sequim Bay State Park.

Impervious Surfaces

Approximately 3% of the shoreland area is covered by impervious surfaces.

Shoreline Modifications

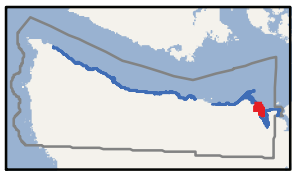
Portions of shoreline armoring (18% of reach total) are mapped throughout the reach. Tidal barriers (1%) and nearshore fill (3.1 acres) are located in the southern portion of the reach. Approximately 15 overwater structures (docks and piers) are mapped throughout the reach. There are 4 identified fish barriers (culverts) identified on an unnamed stream near Blyn Crossing.

Contaminated Sites

3 voluntary cleanup sites are mapped in the southern portion of the reach.

Cultural Resources

Port Williams (historic pier and associated structures; built 1896) is listed on the state historic registry. In addition, there are 3 inventoried pre-contact sites within the reach.



REACH MR-3: Gibson Spit

SHORELINE LENGTH
6.07 Miles

REACH AREA
616.68 Acres

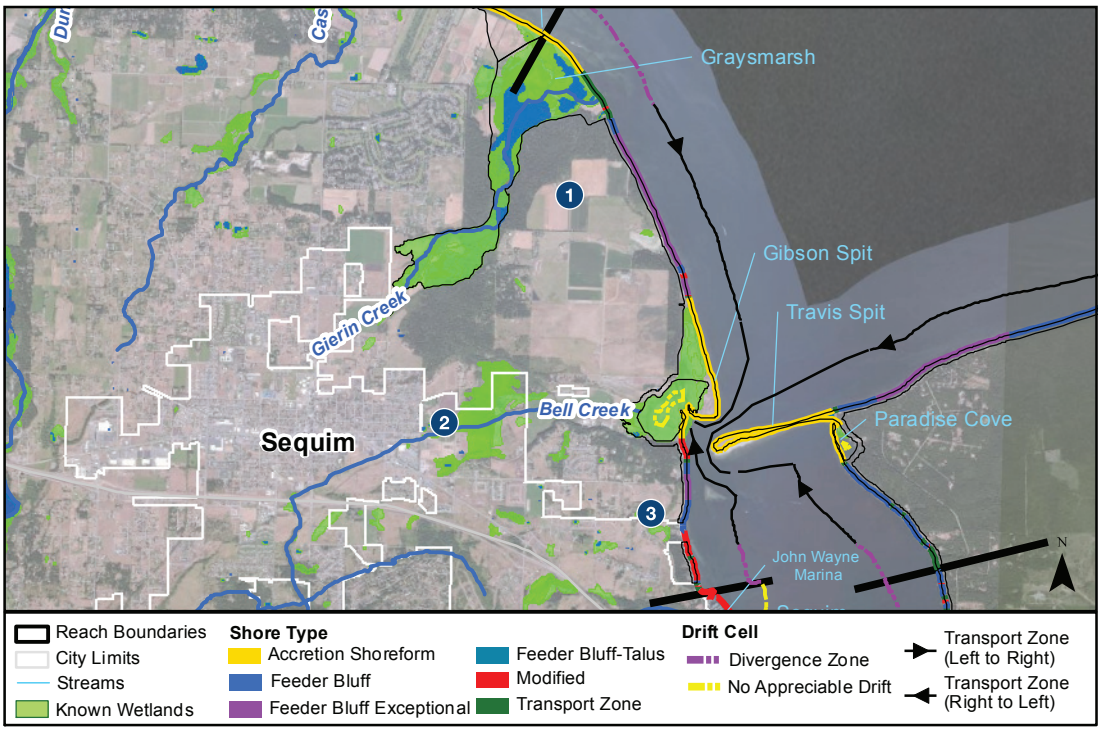
PSNERP PROCESS UNITS
SPU 1016, 1019-1021, & Delta DUN

REACH SUMMARY

The "Gibson Spit" reach extends from north of the John Wayne Marine in Sequim Bay to just north of Graysmarsh (Gierin Creek mouth). The reach excludes shoreline within City of Sequim jurisdiction. The southern end of reach borders Sequim Bay, and the northern portion borders the Strait of Juan de Fuca. The feeder bluffs along the central portion of the reach, combined with southward net shore drift, maintain the Gibson Spit beaches. Minimal shoreline armoring and overwater structures are present in the reach, and the majority of the shoreline area consists of natural vegetation. Graysmarsh and the Bell Creek estuary provide important habitat for a variety of wildlife species.

Moderate- to high-density development is present along Sequim Bay (which is within tsunami and coastal floodplain areas), but most of the shorelands in the reach are managed for timber or agriculture. All of the shoreland area and most of the shoreline is in private ownership.

Under current zoning regulations, over three-quarters of the shoreland zone has potential for new residential development. The undeveloped land is generally located north of Gibson Spit. Most of the undeveloped land cannot be subdivided into small (<5 acre) lots; therefore, there is low likely of future, dense shoreline development in the reach.



Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

The dominant shoreform within the reach is bluff backed beaches (35%). Barrier beaches (26%) and barrier estuaries (22%) also comprise a large portion of the reach. Delta shores associated with Dungeness river account for 17% of the reach. Geomorphic shoretype mapping identified feeder bluffs (10%) and exceptional feeder bluffs (28%). Only 5% of the reach is mapped as transport zones. The predominant shoreform in the reach is accretion shoreform (42%). Modified shores cumulatively account for 15% of the reach.

Net Shore Drift

Net shore drift in the reach is predominantly southward, north of Sequim Bay. The drift cell terminates at the barrier beach that embays Washington Harbor. A second barrier beach encloses the Harbor from the south. This barrier is supported by another drift cell with northward drift, which originates at the John Wayne marina. A region of No Appreciable Drift is mapped in the protected shores of Washington Harbor.

Hazard Areas

Several short bluff segments are unstable (5%) with no recent slides. Graysmarsh (Gierin Creek estuary), Gibson Spit, Bell Creek estuary and the northwest portion of Sequim Bay are in a tsunami hazard zone (61%) and FEMA coastal and stream (Gierin Creek) 100-year floodplains (59%).

REACH REACH MR-3: Gibson Spit

Degree of Process Degradation

The erosion/accretion of sediment, detritus import and export, and exchange of aquatic organisms processes are moderately degraded near Graysmarsh and along Sequim Bay, but have low degradation levels along the rest of the reach. The sediment transport process is moderately degraded near the marsh, highly degraded along the Bay, but has a low degradation level in the rest of the reach. The sediment input, tidal channel formation, and freshwater input processes have low degradation levels in the northern portion of the reach, and moderate levels in the southern portion. Throughout the reach, the solar incidence process and Distributary channel migration process have low degradation levels, and the tidal flow process is moderately degraded.

ECOLOGY

Offshore Vegetation

Eelgrass is mapped throughout 66% of the reach, continuous (10%) north of John Wayne Marina and patchy (56%) from Gibson Spit to Kulakala Point. There is no kelp mapped within the reach.

Onshore Vegetation

12% of the shoreland area of the reach is mapped as forest habitat, 71% is mapped as natural shrub and herbaceous vegetation, and 12% is mapped as lawn/landscaping and agriculture.

Habitats and Species

76% of the shoreland zone contains mapped wetland habitat, which is concentrated primarily at Graysmarsh and the Bell Creek estuary. Designated priority habitats mapped throughout the reach include bald eagle, shorebird and waterfowl concentrations, wood duck, and peregrine falcon. In addition, a marine mammal haulout area, harbor seal and Taylor's checkerspot butterfly habitat is mapped in the northern portion of the reach.

Forage fish habitat (sand lance) is mapped in the southern portion of the reach, in the Gibson Spit vicinity. Coho salmon, bull trout, winter steelhead, and resident cutthroat trout are mapped in Gierin and Bell creeks.

The marine nearshore areas in the reach (Strait of Juan de Fuca and Sequim Bay) provide important habitat for a wide variety of marine species that utilize nearshore habitat, including several salmon and trout species.

Shellfish

Dungeness crab is mapped at the northern portion of the reach (27% of reach total). Hardshell clam is mapped at the southern portion of the reach (24%) (Washington Harbor). Recreational shellfish harvesting is available at Port Williams beach

Water Quality

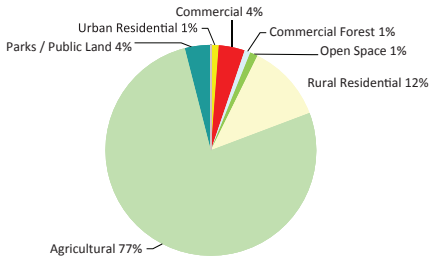
The portion of Bell Creek within the reach within the reach has impaired water quality listings for dissolved oxygen, fecal coliform, and biological impairment. The Streamkeepers have also listed the water quality of the creek as "impaired" for B-IBI and "highly impaired" for WQI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage in the shoreland area includes timber (43%), residential (31%), agriculture (17%), open space (16%), roads (12%), commercial (2%), and vacant (1%). In general, the timber and agricultural lands are concentrated in the northern portion of the reach. Land ownership within the reach is 100% private.

Zoning and Parcel Data



Under current zoning regulations the reach has a high potential for significant new development, particularly in the areas north of Gibson Spit.

Public Access

14% of the shoreline in this reach is publicly owned, and 8% is public shoreline that is accessible from land. Public shoreline can be accessed directly from the end of Port Williams Road, at Marlyn Nelson County Park.

Impervious Surfaces

Approximately 1% of the shoreland area of the reach is covered by impervious surfaces.

Shoreline Modifications

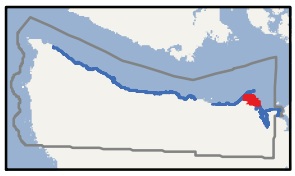
Four segments of shoreline armoring (15% of reach total) are mapped throughout the reach. Partial tidal barriers (20%) are mapped in the northern and southern portions of the reach, and 0.8 acres of nearshore fill is mapped at the end of Port Williams Road. Approximately 4 docks are mapped along the shoreline, and several bridges are identified within Graysmarsh.

Contaminated Sites

There are no identified contaminated sites within the reach.

Cultural Resources

One inventoried pre-contact village site is located within the reach.



REACH MR-4: Kulakala Point

SHORELINE LENGTH
7.89 Miles

REACH AREA
920.11 Acres

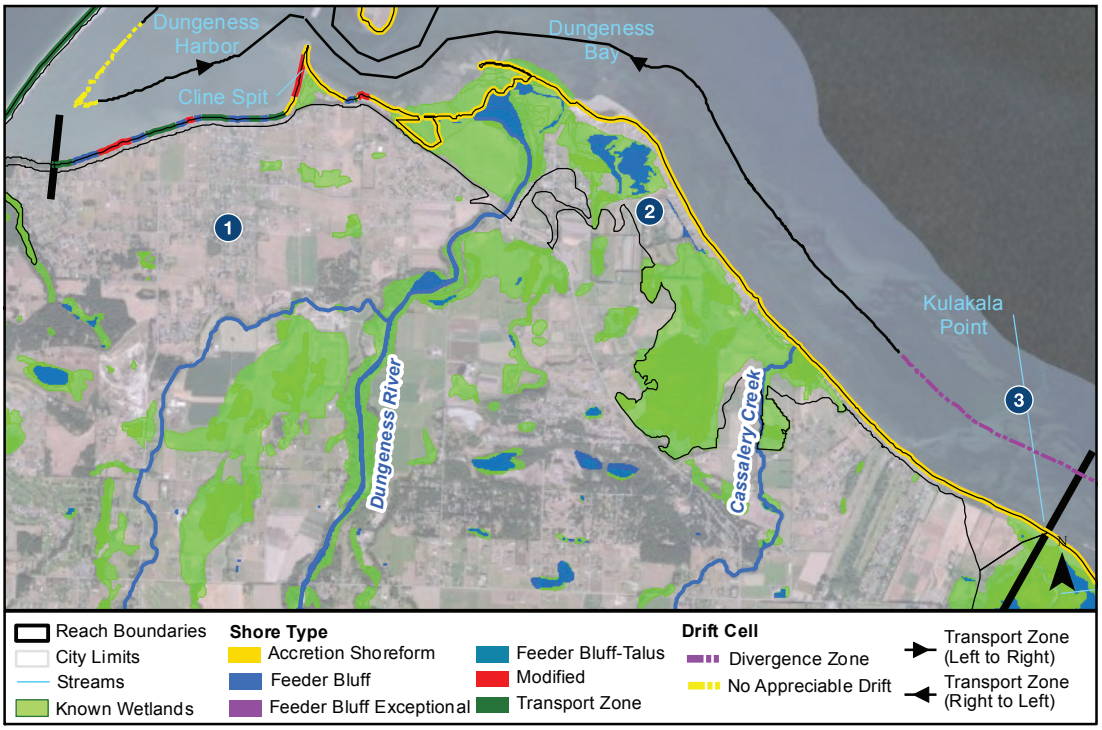
PSNERP PROCESS UNITS
SPU 1023 & Delta DUN

REACH SUMMARY

The "Kulakala Point" reach contains Strait of Juan de Fuca shoreline, extending from north of Graysmarsh (Gierin Creek mouth) to just east of the landward end of Dungeness Spit, and includes the Dungeness River delta, Cline Spit, and the south shorelines of Dungeness Bay and Dungeness Harbor. Much of the reach is within mapped tsunami and flood hazard zones. The Dungeness Harbor shoreline contains dense concentrations of submerged aquatic vegetation and significant forage fish spawning habitat, which provides important habitat for marine species, including juvenile salmonids.

High-density residential development is located along the low bank shores in the 3 Crabs Road vicinity, and several residences are protected by shoreline armoring. Land near the Dungeness River mouth is generally used for agriculture, but some residential development is present. Residential development is present along the feeder bluffs at the south shore of Dungeness Harbor. Approximately half of the shorelands contains forest cover and natural shrub/herbaceous vegetation, and the half has been impacted by development.

Under current zoning regulations, over half of the reach area has potential for new residential development, although the presence of wetlands in the Dungeness delta likely precludes intensive development in this area. Potential future development would likely be infill of existing subdivided parcels. In the event of sea level rise and increased storm activity, many landowners along 3 Crabs Road may feel the need to build bulkheads to protect property. There is also potential for an increase in overwater structures (docks) along the south shore of Dungeness Harbor.



Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

This reach consists primarily of delta shoreforms (79%) associated with the Dungeness River. Bluff backed beaches (15%) and barrier beaches (4%) represent considerably smaller portions of this reach. Geomorphic shoretypes in this reach are primarily accretion shoreform (80%), with small portions of transport zones (7%) and feeder bluffs (6%). Only 7% of the Reach 4 shoreline was mapped as modified.

Net Shore Drift

Reach 4 consists of two net shore drift cells. The southeastern drift cell exhibits northwestward drift and converges with another drift cell with eastward drift at Cline Spit. Both drift cells are protected from northerly winds and waves by Dungeness Spit. The eastern drift cell is also heavily influenced by the Dungeness River delta.

Hazard Areas

Several bluff areas are unstable (3%) with a small slide incident along Dungeness Harbor, near existing homes. Dungeness Harbor, Cline Spit, the Dungeness River floodplain, and Kulakala Point are in a tsunami hazard zone (96%) and FEMA coastal 100-year floodplain (82%).

REACH REACH MR-4: Kulakala Point

Degree of Process Degradation
The tidal flow and freshwater input processes have low degradation levels throughout the reach, but are moderately degraded in Dungeness Harbor. The detritus import and export, exchange of aquatic organisms, tidal flow, erosion/accretion of sediment, and sediment transport processes are moderate degradation levels throughout the reach, but have low degradation levels in the harbor. The sediment input, Distributary channel migration, and solar incidence processes are low degradation levels throughout the reach.

ECOLOGY

Offshore Vegetation
Eelgrass is mapped throughout 86% of the reach, patchy from Kulakala Point leading up to the Dungeness Spit. A few small patches of kelp (1%) are mapped southeast of the Dungeness River.

Onshore Vegetation
11% of the shoreland area of the reach is mapped as forest habitat, 37% is mapped as natural shrub and herbaceous vegetation, and 49% is mapped as lawn/landscaping and agriculture.

Habitats and Species
66% of the shoreland area of the reach consists of mapped wetland habitat, which is concentrated primarily near the Dungeness River delta. Designated priority habitats mapped throughout the reach include waterfowl concentrations , peregrine falcon, bald eagle , harlequin duck , and estuarine zone. In addition, Taylor's checkerspot butterfly habitat is mapped in the southern portion of the reach.

Extensive forage fish (herring, sand lance, and smelt) spawning habitat is mapped in Dungeness Harbor. Coho, pink , chum, sockeye, and Chinook salmon; bull trout; resident cutthroat trout; and steelhead are mapped in the Dungeness River and other streams within the reach.

The nearshore areas in the reach provide habitat for a wide variety of salmonids and other marine species. The Dungeness Harbor shoreline is a particularly important rearing areas for salmonids.

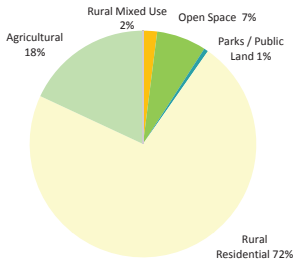
Shellfish
Dungeness crab is mapped throughout most of the reach (88% of reach total), as well as hardshell clam (85%). Recreational shellfish harvesting is available at Clint Spit.

Water Quality
The portion of Cassalery Creek within the reach has State impaired water quality listings for dissolved oxygen, fecal coliform, and biological impairment. In addition, Cline Ditch is listed for fecal coliform; Cooper Creek for dissolved oxygen and fecal coliform; Meadowbrook Creek for dissolved oxygen, fecal coliform, and pH; and Meadowbrook Slough for pH. Dungeness River water quality within the reach is listed by the Streamkeepers as "impaired" for B-IBI and "compromised" for WQI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land usage in the shoreland area includes open space (36%), residential (35%), agriculture (11%), vacant (9%), roads (4%), commercial (3%), utilities (2%), and developed parks (1%). The open space land is concentrated around the Dungeness River. Land ownership within the reach is 99.8% private and 0.2% public.

Zoning and Parcel Data



Under current zoning regulations the reach has moderate potential for significant new residential development. Development would likely be infill of existing subdivided parcels.

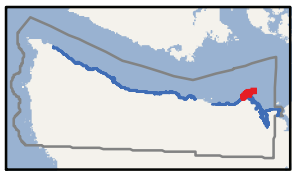
Public Access
31% of the shoreline in this reach is publicly owned, and 24% is public shoreline that is accessible from land. Small sections of public shoreline are accessible at the ends of Wilcox and Jamestown roads. Shoreline in the Cline Point vicinity is directly accessible from Pioneer Memorial Park and Cline Spit County Park.

Impervious Surfaces
Approximately 12% of the shoreland area is covered by impervious surfaces.

Shoreline Modifications
Several segments of shoreline armoring (7% of reach total) are mapped throughout the reach, and both complete and partial tidal barriers (levees) (20%) are mapped near the Dungeness River estuary. Approximately 10 overwater structures (docks, bridges, and buildings) are identified in the reach, primarily in the northwestern portion.

Contaminated Sites
1 voluntary cleanup site is mapped in the northern portion of the reach, adjacent to the mouth of the Dungeness River

Cultural Resources
McAlmond House (built 1861) is listed on the state and national historic registries, and 2 other structures are inventoried for historic significance (light station structure on Cline Spit and the Dungeness Wharf's historic remnant pilings). In addition, there are 2 inventoried pre-contact sites within the reach.



REACH MR-5: Dungeness Spit

SHORELINE LENGTH
15.74 Miles

REACH AREA
248.76 Acres

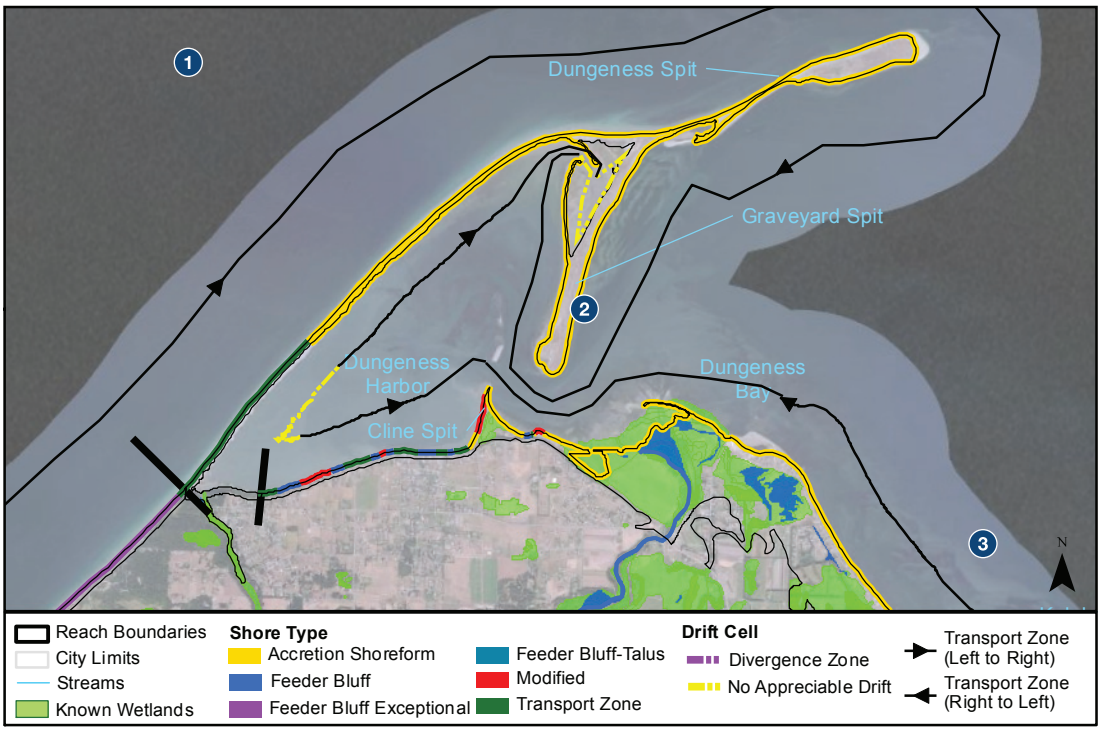
PSNERP PROCESS UNITS
SPU 1025

REACH SUMMARY

The "Dungeness Spit" reach includes the entire spit (including Graveyard Spit), and a small portion of the landward end of the spit. The spit is the longest natural sand spit in the United States. There are no shoreline modifications mapped within the reach.

The majority of the reach is within the Dungeness National Wildlife Refuge, which provides habitat for a wide variety of species. The portions of the spit within Dungeness Harbor contain dense concentrations of submerged aquatic vegetation and significant forage fish habitat, which makes the area vital rearing habitat for salmonids.

A small portion of the reach, at the landward end of Dungeness Spit, is in private ownership. Most of the parcels are developed with homes, and cannot be further subdivided. There is generally a low risk of physical and ecologic degradation of the reach.



Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

Barrier beaches associated with the greater Dungeness Spit shoreform comprise most of the Reach 5 shoreline (72%). The remaining shoreforms in the reach include the leeward barrier estuary (10%) and barrier lagoon shores (17%). Geomorphic shoretypes in the reach are accretion areas (91%) and transport zones (9%).

Net Shore Drift

Net shore drift along the Dungeness Spit shoreform is predominantly eastward, excluding the eastern, leeward portion of the spit, which exhibits westward drift to the terminus of Graveyard Spit. No Appreciable Drift occurs along the most sheltered shores and within embayments.

Hazard Areas

Several bluff areas are unstable (7%) with a small slide incident along Dungeness Harbor, near existing homes. Most of Dungeness Spit is in a tsunami hazard zone (90%) and the FEMA coastal 100-year floodplain (93%).

REACH REACH MR-5: Dungeness Spit

Degree of Process Degradation
Within the reach, the sediment input, sediment transport, erosion/accretion of sediment, tidal flow, tidal channel formation, detritus import and export, exchange of aquatic organisms, and solar incidence processes have low degradation levels. The freshwater input process has a low degradation level throughout most of the reach, but a moderate level in the portion of the reach bordering Dungeness Harbor.

ECOLOGY

Offshore Vegetation
Eelgrass is mapped throughout 17% of the reach, patchy on the Dungeness Harbor side of the spit. Kelp is mapped (14%) along the outer side of the spit.

Onshore Vegetation
4% of the shoreland area is mapped as forest habitat and 86% is mapped as natural shrub, herbaceous, and aquatic bed vegetation.

Habitats and Species
Wetland habitat (4% of the shorezone area) is mapped in Dungeness Harbor. The majority of the reach is within the Dungeness National Wildlife Refuge, which is mapped priority habitat for waterfowl concentrations, estuarine zone, peregrine falcon, black brant, and bald eagle . In addition, harbor seal habitat and several marine mammal haulout areas are mapped within the reach.

Forage fish habitat (herring, sand lance, and smelt) is mapped along the shoreline bordering Dungeness Harbor.

The nearshore areas in the reach provide habitat for a wide variety of salmonids and other marine species. The Dungeness Harbor shorelines are particularly important rearing areas for salmonids.

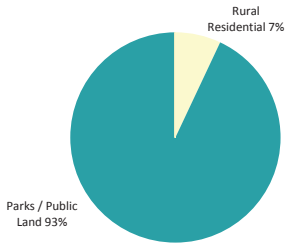
Shellfish
Dungeness crab (27% of reach total), hardshell clam (41%), and oyster beds (3%) are mapped in the reach, south of Dungeness Spit. Red sea urchin (5.4%) is mapped in the western portion of the reach.

Water Quality
The reach has no impaired water quality listings.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land usage in the shoreland area is primarily open space (94%), with some residential (5%) and vacant land (1%) located near the landward end of Dungeness Spit. Land ownership within the reach is 93% public and 7% private.

Zoning and Parcel Data



Under current zoning regulations there is minimal potential for significant new development within the reach. Most of the land within the reach is a protected wildlife refuge.

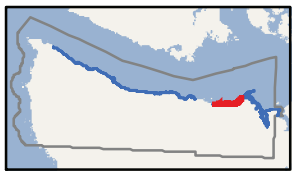
Public Access
97% of the shoreline in the reach is publicly owned (Dungeness National Wildlife Refuge) and accessible from land. However, for the purposes of wildlife protection, portions of Graveyard Spit and Dungeness Spit are closed to public entry. Dungeness Spit beaches and trail systems can be accessed from the Dungeness Recreation Area, located at the north end of Kitchen-Dick Road.

Impervious Surfaces
Less than 1% of the shoreland area is covered by impervious surfaces.

Shoreline Modifications
There are no shoreline modifications mapped within the reach.

Contaminated Sites
There are no identified contaminated sites within the reach.

Cultural Resources
New Dungeness Light Station (first built 1857) is listed on the state and national historic registries, and the New Dungeness historic town site (early development in 1860s) is listed on the state registry. A cabin within Dungeness Recreation Area is inventoried for historic significance but not listed. In addition, there is 1 inventoried pre-contact site within the reach.



REACH MR-6: Green Point

SHORELINE LENGTH
11.40 Miles

REACH AREA
280.06 Acres

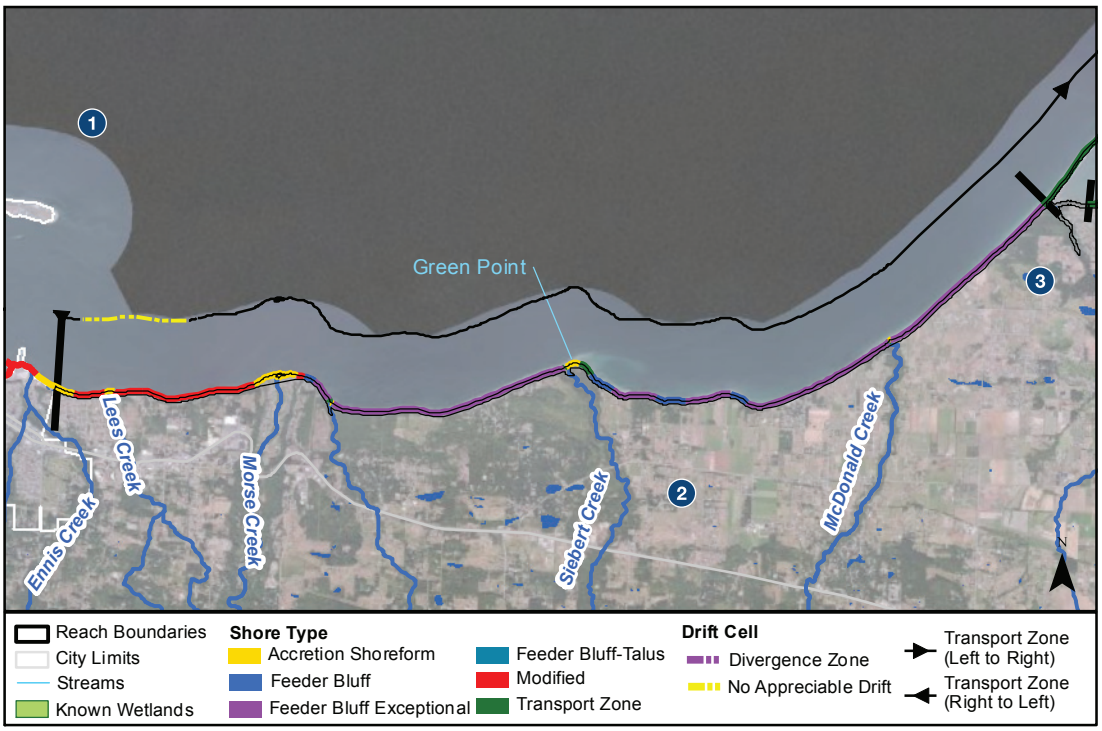
PSNERP PROCESS UNITS
SPU 1025

REACH SUMMARY

The "Green Point" reach contains Strait of Juan de Fuca shoreline, extending from just west of Dungeness Spit to the Port Angeles city limits. Over 70% of the reach consists off feeder bluffs, which along with westward net shore drift, supplies the sediments that maintain Dungeness Spit. The reach contains patches of submerged aquatic vegetation and forage fish spawning habitat, which supports salmonid rearing habitat and important habitat for other marine species

Moderate-density residential development is located throughout the reach, with lesser amounts of open space, vacant, and timber land. Many existing homes on the shoreline are at risk because of their proximity to highly-erosive feeder bluffs. There are no overwater structures and minimal amounts of shoreline armoring mapped within the reach.

Under current zoning regulations, approximately 40% of the shoreland area has potential for new residential development. Parcel sizes vary, but many of the lots have narrow shoreline frontages (75 to 150 feet), which could lead to dense shoreline development in some areas. Placing structures too close to the feeder bluffs within the area is a substantial risk to property, as well as human health and safety



Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

Shoretypes within the reach consist predominantly of bluff backed beaches (81%) with smaller portions of barrier beach (7%) and barrier estuary (3%). Predominant geomorphic shoretypes are feeder bluff exceptional (63%) and feeder bluff (8%). Transport zones account for only 3% of the reach and accretion shoreforms represent 10% of the shoreline. 16% of the reach shoreline is modified.

Net Shore Drift

Net shore drift is predominantly eastward throughout this reach. Bluff derived sediment from this reach maintains the Dungeness spit barrier complex. A very small region of No Appreciable Drift is mapped at the mouth of Lees Creek, west of which is entirely westward drift towards Port Angeles.

Hazard Areas

Several bluff areas are unstable (55%) with recent slides mapped near Port Angeles city limits, in addition to central and northeast portions of the reach (6%). Some recent slides are near existing homes. Most of Morse and McDonald Creek shoreline areas are in a tsunami hazard zone (28%) and FEMA coastal and stream 100-year floodplains (36%).

REACH REACH MR-6: Green Point

Degree of Process Degradation
The sediment input, sediment transport, erosion/accretion of sediment, tidal flow, detritus import and export, and exchange of aquatic organisms have low degradation levels throughout most of the reach, but are highly degraded west of Morse Creek. The tidal channel formation, freshwater input, and solar incidence processes have low degradation levels throughout most of the reach, but are moderately degraded west of Morse Creek.

ECOLOGY

Offshore Vegetation
Eelgrass is mapped throughout 4% of the reach, patchy directly east of Green Point. Patches of kelp (37%) are mapped throughout the reach.

Onshore Vegetation
30% of the shoreland area of the reach is mapped as forest habitat, 42% is mapped as natural shrub and herbaceous vegetation, and 19% is mapped as lawn/landscaping.

Habitats and Species
3% of the landward portion of the reach consists of mapped wetland habitat, which is concentrated primarily around stream mouths. Designated priority habitats within the reach include bald eagle, peregrine falcon, waterfowl concentrations, and cliffs/bluffs . In addition, a gray whale feeding area is identified near the mouth of Siebert Creek.

Patches of forage fish habitat (smelt) are mapped within the reach, primarily east of Morse Creek. Coho, chinook, chum, and pink salmon; bull trout; rainbow and residential cutthroat trout; and steelhead are mapped in the streams within the reach.

The marine nearshore areas in the reach (Strait of Juan de Fuca) provide important habitat for a wide variety of marine species that utilize nearshore habitat, including several salmon and trout species.

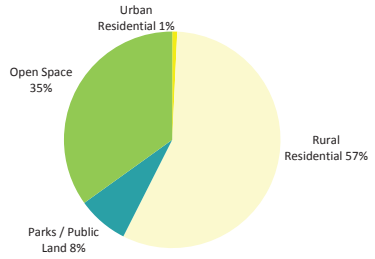
Shellfish
Abalone (57% of reach total) and red sea urchin (59%) are mapped throughout a majority of the reach. Hardshell clam is mapped near the western portion of the reach (2%).

Water Quality
The portion of Lees Creek within the reach has a State impaired water quality listing for dissolved oxygen. The water quality of Morse and McDonald Creeks is listed by the Streamkeepers as "compromised" for B-IBI and "healthy" for WQI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land usage in the shoreland area is residential (37%), open space (34%), vacant (14%), timber (11%), agriculture (2%), and roads (2%). Land ownership within the reach is 93% private and 7% public.

Zoning and Parcel Data



Under current zoning regulations there is moderate potential for significant new development within the reach.

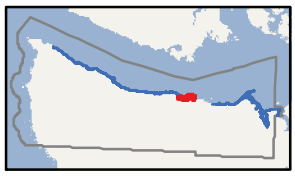
Public Access
15% of the shoreline in the reach is publicly owned and accessible by land. Public shoreline in the eastern portion of the reach can be accessed from the Dungeness Recreation Area (via trails), and shoreline in the western portion can be accessed via the Olympic Discovery Trail.

Impervious Surfaces
Approximately 10% of the shoreland area is covered by impervious surfaces.

Shoreline Modifications
Shoreline armoring (7% of reach total) and nearshore fill (11.0 acres) is mapped in the western portion of the reach, near Port Angeles city limits. There are no mapped overwater structures within the reach.

Contaminated Sites
There are no identified contaminated sites within the reach.

Cultural Resources
The Bagley Lake Farm Tunnel (built approximately 1870) is listed on the state registry; built to drain historic lake behind bluff to create farmland (runs from back beach up to landward of bluff). .



REACH MR-7: Angeles Point

SHORELINE LENGTH
7.31 Miles

REACH AREA
322.07 Acres

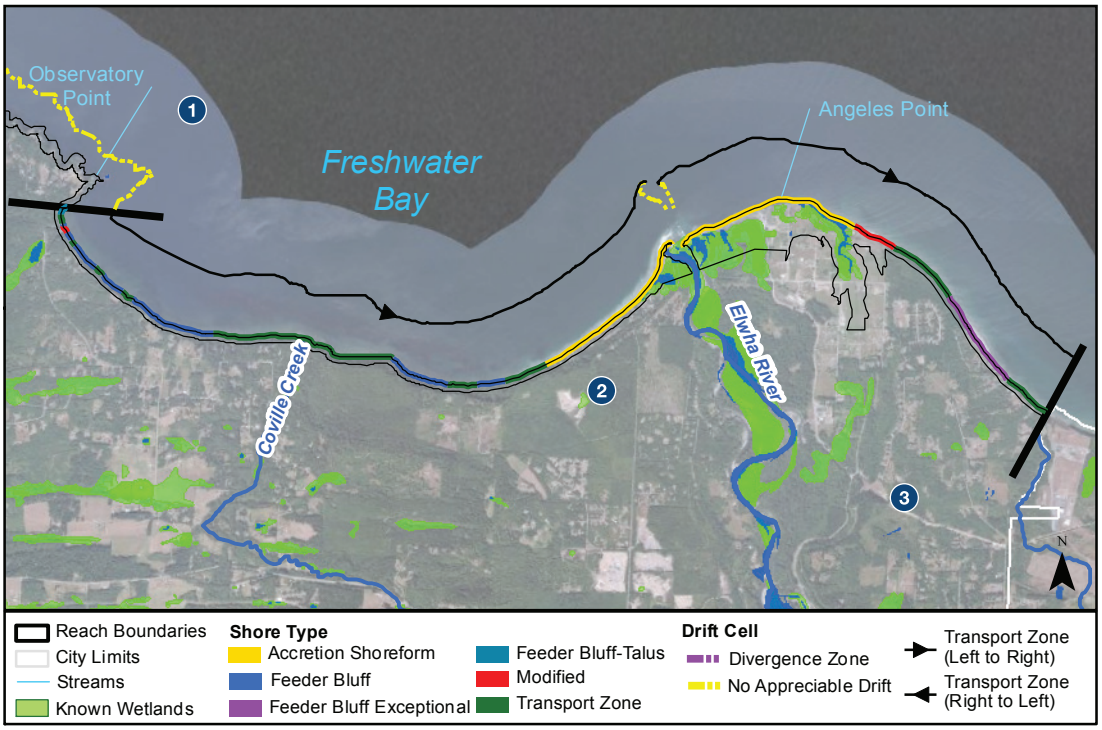
PSNERP PROCESS UNITS
SPU 1027, 1400, & Delta ELW

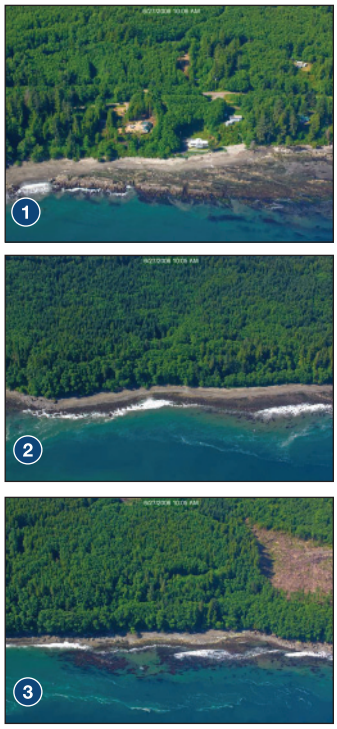
REACH SUMMARY

The "Angeles Point" reach extends from the western Port Angeles city limits to just south of Observatory Point. The reach contains Strait of Juan de Fuca and Freshwater Bay shoreline, and the Elwha River delta. With the exception of levees at the Elwha River mouth, the shoreline within the reach is unmodified. The reach contains patches of submerged aquatic vegetation and forage fish spawning habitat, which supports salmonid rearing habitat. The wetland habitat at the Elwha River estuary provides important habitat for waterfowl and other species.

Major land uses within the reach are high- and moderate-density residential, commercial forestry, and agriculture. Some of the residential areas are located within mapped tsunami and coastal flood areas. The majority of the shoreland area is undeveloped, and in forested condition. The forest land within the reach provides habitat for a variety of wildlife species.

Under current zoning regulations, approximately two-thirds of the shoreland area has potential for new residential development. Existing parcel boundaries vary in size and shape.





Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

Bluff backed beaches are the predominant shoretype within the reach (48%), followed by Elwha River delta shores (28%). Barrier beaches represent 10% of the reach. Transport zones are the most abundant geomorphic shoreform within the reach (39%), followed by accretion shoreforms (31%). Exceptional feeder bluff (3%), feeder bluff (22%), feeder bluff-talus (1%), and modified shoreform (4%) comprise the remainder of the reach.

Net Shore Drift

Net shore drift within the reach is entirely eastward, originating along the west shore of Freshwater Bay, and flowing across the mouth of the Elwha River to the terminus at the tip of Ediz Hook. Ediz Hook is located within City of Port Angeles jurisdiction.

Hazard Areas

Several bluff areas are unstable (26%) mapped east of Angeles Point and within Freshwater Bay with no recent slides. Freshwater Bay and Angeles Point are mostly within the tsunami hazard zone (69%) and FEMA coastal and stream 100-year floodplains (72%).

REACH REACH MR-7: Angeles Point

Degree of Process Degradation

Within the reach, the sediment input and freshwater input processes have low degradation levels in Freshwater Bay, high levels at Angeles Point, and moderate levels east of the point. The sediment transport process has a low degradation level in the bay, moderate level at the point, and high level east of the point. The erosion/accretion of sediment, detritus import and export, tidal flow, and exchange of aquatic organisms processes have low degradation levels throughout most of the reach, but are highly degraded east of Angeles Point. The tidal channel process has a low degradation level throughout most of the reach, but is moderately degraded east of the point. The solar incidence and Distributary channel migration processes have low degradation levels throughout the reach.

ECOLOGY

Offshore Vegetation

Eelgrass is mapped throughout 74% of the reach, patchy primarily from Angeles Point to Observatory Point. Kelp is mapped (61%) throughout the reach.

Onshore Vegetation

52% of the shoreland area is mapped as forest habitat, 25% is mapped as natural shrub and herbaceous vegetation, and 13% is mapped as lawn/landscaping.

Habitats and Species

28% of the landward portion of the reach consists of mapped wetland habitat, which is concentrated around the Elwha River delta. Designated priority habitats within the reach include bald eagle, harlequin duck (at the Elwha River estuary), common loon (at west end of reach) , and cliffs/bluffs.

A patch of forage fish habitat (smelt) is mapped to the east of the Elwha River. Coho, chinook, chum, pink, and sockeye salmon; bull trout, resident cutthroat trout, and steelhead are mapped in Colville Creek and the Elwha River.

The marine nearshore areas in the reach (Strait of Juan de Fuca and Freshwater Bay) provide important habitat for a wide variety of marine species that utilize nearshore habitat, including several salmon and trout species.

Shellfish

Abalone is mapped throughout the reach (100% of reach total). However, the abalone population in the area has been heavily impacted by poaching. Dungeness crab is mapped at the western portion of the reach (21%) and red sea urchin at the eastern portion (40%).

Water Quality

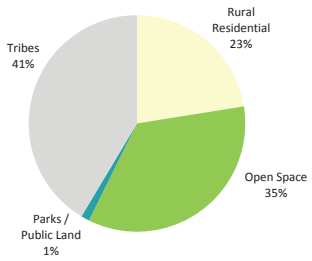
The portion of the Elwha River within the reach has a State impaired water quality listing for temperature. Elwha water quality is listed by the Streamkeepers as "compromised" for WQI. Coville Creek is listed as "healthy" for WQI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage in the shoreland area is residential (29%), open space (20%), tribe (29%), vacant (9%), timber (8%), agriculture (5%), and roads (trace). Land ownership within the reach is 58% private, 18% public, and 24% tribe.

Zoning and Parcel Data



Under current zoning regulations there is high potential for new residential development within the reach.

Public Access

75% of the shoreline in this reach is publicly owned, and 33% is public shoreline that is accessible from land. Public shoreline near the Elwha River mouth can be accessed directly from the north end of Elwha Dike Road, and limited public parking is available. Shoreline at the western end of the reach (Freshwater Bay) can be accessed directly from Freshwater Bay County Park.

Impervious Surfaces

Approximately 1% of the landward portion of the reach is covered by impervious surfaces.

Shoreline Modifications

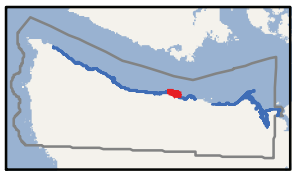
Sections of shoreline armoring (9% of reach total) are mapped at the western end of the reach and near the Elwha River. In addition, a small levee section (1%) is identified on the Elwha. No overwater structures or areas of nearshore fill are mapped within the reach.

Contaminated Sites

There are no identified contaminated sites within the reach.

Cultural Resources

Inventoried sites include 1 pre-contact site, 2 pre-contact isolates, and 1 historic residential site.



REACH MR-8: Observatory Point

SHORELINE LENGTH
4.85 Miles

REACH AREA
107.29 Acres

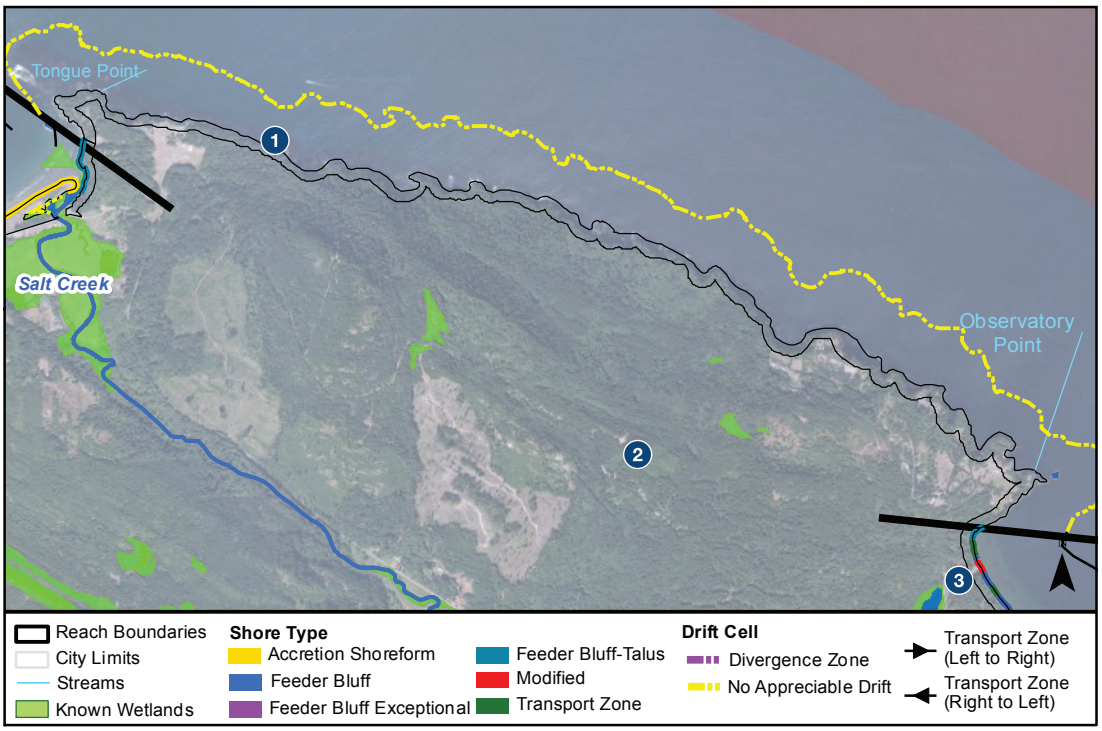
PSNERP PROCESS UNITS
SPU 1027

REACH SUMMARY

The "Observatory Point" reach extends from Observatory Point to Tongue Point, along the Strait of Juan de Fuca. The reach consists of bedrock shores, with no appreciable net shore drift along the shoreline. No shoreline modifications are mapped within the reach. Most of the shoreland area is forested, and the nearshore area contains dense concentrations of submerged aquatic vegetation which provides important habitat for marine species, including juvenile salmonids.

The majority of the reach is public land, contained within the Salt Creek and Striped Peak Recreation Areas. The eastern third of the reach contains moderate-density residential development. Most of the homes are set back more than 200 feet from the shoreline.

Under current zoning regulations, only 6% of the reach has potential for new residential development. Future development would consist of residential infill adjacent to existing developed parcels. Given the relatively limited area of potential development in the reach, and the stable adjacent bedrock shores, potential future development impacts to shoreline ecology are likely minimal.



Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

Rocky platform shores comprise over 96% of the reach, most of which consists of bedrock ramp shore. A single plunging bedrock shore (3%) and a single bluff backed beach (1%) are located in the eastern portion of the reach.

Net Shore Drift

Because of the bedrock geology, there is no appreciable net shore drift within the reach.

Hazard Areas

An unstable bluff area (8%) is mapped in the eastern portion of the reach. However, no recent slides are mapped. A portion the shoreline between Observatory Point and Tongue Point are in a tsunami hazard zone (33%) and FEMA coastal and stream 100-year floodplains (42%).

REACH REACH MR-8: Observatory Point

Degree of Process Degradation
Within the reach, the sediment input, sediment transport, erosion/accretion of sediment, tidal flow, tidal channel formation, detritus import and export, exchange of aquatic organisms, exchange of aquatic organisms, and solar incidence processes have low degradation levels.

ECOLOGY

Offshore Vegetation
Eelgrass is mapped throughout 45% of the reach, patchy from Observatory Point halfway towards Tongue Point. Kelp is mapped (45%) throughout the reach.

Onshore Vegetation
59% of the shoreland area is mapped as forest habitat, 26% is mapped as natural shrub and herbaceous vegetation, and 7% is mapped as lawn/landscaping.

Habitats and Species
No wetland habitat is mapped in this reach. Designated priority habitats within the reach include cliffs/bluffs , harbor seal, bald eagle, and harlequin duck (near Tongue Point). In addition, 5 marine mammal haulout areas are mapped within the reach.

No forage fish presence is mapped within the reach. There are no streams within the reach; therefore, there is no mapped freshwater fish use.

The marine nearshore areas in the reach (Strait of Juan de Fuca) provide important habitat for a wide variety of marine species that utilize nearshore habitat, including several salmon and trout species.

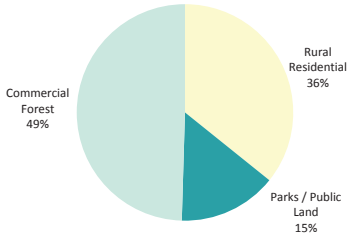
Shellfish
Abalone (100% of reach total), Dungeness crab (97%), and red sea urchin (88%) are mapped throughout the reach.

Water Quality
The reach has no impaired water quality listings.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land usage in the shoreland area is timber (50%), residential (30%), open space (15%), and vacant (6%). The timber land is in the center of the reach, with open space to the west and residential land to the east. Land ownership within the reach is 70% private and 30% public.

Zoning and Parcel Data



Under current zoning regulations there is minimal potential for significant new development within the reach. Most of the land is zoned for commercial forestry.

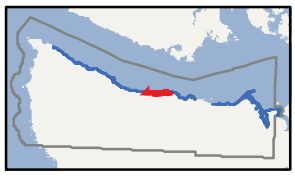
Public Access
63% of shoreline in the reach is publicly owned and accessible from land. Public shoreline in the western portion of the reach can be directly accessed from the Salt Creek Recreation Area. From the recreation area, access to eastern shoreline (Striped Peak Recreation Area) is available via a trail.

Impervious Surfaces
No impervious surface is mapped within the reach.

Shoreline Modifications
There are no shoreline modifications mapped within the reach.

Contaminated Sites
There are no identified contaminated sites within the reach.

Cultural Resources
At Tongue Point, at the border of Reaches 8 and 9, Fort Hayden (built in 1940s for military purposes) is listed on the state historic registry. There are also 3 inventoried pre-contact sites within the reach, including a pre-contact camp site.



REACH MR-9: Crescent Bay-Low Point

SHORELINE LENGTH
10.73 Miles

REACH AREA
252.67 Acres

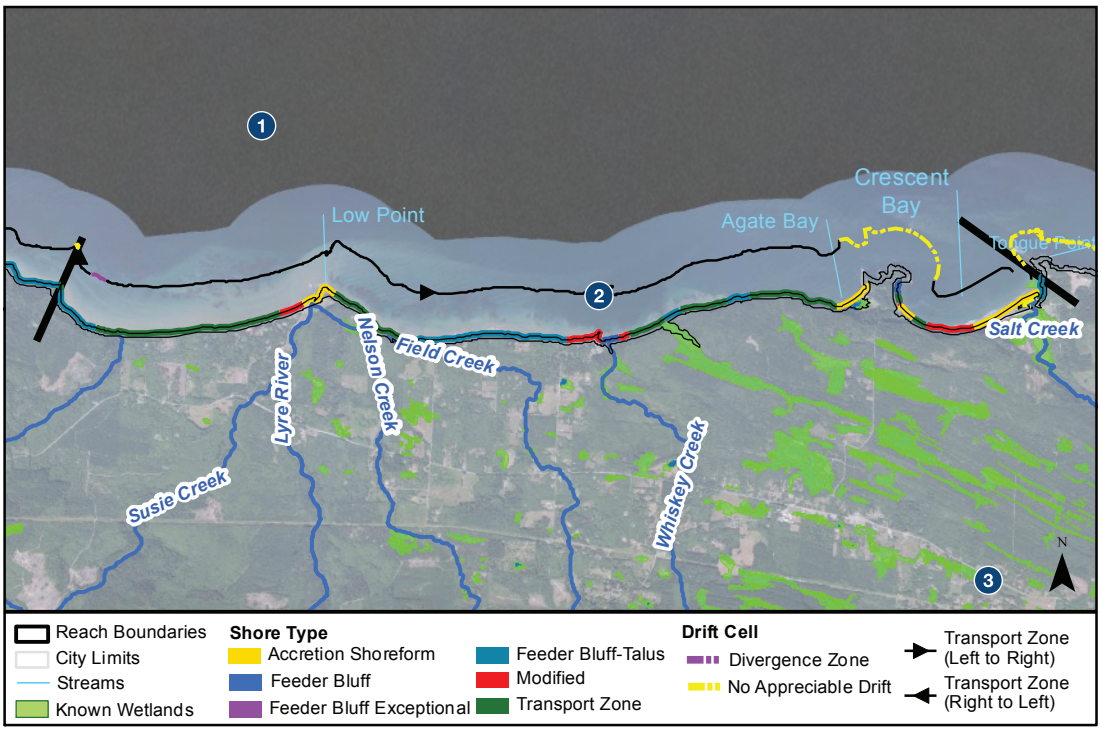
PSNERP PROCESS UNITS
SPU 1027

REACH SUMMARY

The "Crescent Bay-Low Point" reach extends from the east end of Crescent Bay to approximately 2 miles west of Low Point along the Strait of Juan de Fuca. The feeder bluffs at the western portion of the reach, combined with eastward net shore drift, maintain the beaches at Crescent Bay. There are no identified shoreline modifications within the reach. Most of the shoreland area is forested, and the nearshore area contains dense concentrations of submerged aquatic vegetation which provides important habitat for marine species, including juvenile salmonids.

Land uses and ownership within the shoreland zone vary throughout the reach. The reach contains DNR-managed forest land, privately-owned campgrounds, residential development, and a large amount of undeveloped, privately owned land. Most of Crescent Bay, Agate Bay, and Low Point are in tsunami hazard zones and FEMA-mapped floodplain.

Under current zoning regulations, almost three-quarters of the shoreland area has potential for new residential development. Undeveloped parcel sizes, shapes, and zoning categories vary throughout the reach. Many of the parcels are large in area, and could be subdivided into 2 to 20 acre lots, depending upon the zoning category.



Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

The most common shoretype within the reach is bluff backed beaches (43%) followed by rocky platform shores (23%). Other shoretypes mapped within the reach include barrier beaches (13%), pocket beaches (9%), and barrier estuaries (5%). Mapped geomorphic shoreforms within the reach are feeder bluffs (4%), talus feeder bluffs (35%), transport zones (33%), and accretion shoreforms (17%). 12% of the reach is mapped as modified.

Net Shore Drift

Net shore drift is predominantly eastward throughout the reach, but with one short drift cell exhibiting westward drift is located in the western end of the reach. A small area of No Appreciable Drift occurs at the bedrock headland that separates Crescent and Agate Bays.

Hazard Areas

Most bluff areas are unstable (53%) with recent slides (1%) mapped in Agate Bay and the southwestern portion of the reach. Most of Crescent Bay thru Agate Bay, and Low Point is in a tsunami hazard zone (51%) and FEMA coastal and stream 100-year floodplains (46%).

REACH REACH MR-9: Crescent Bay-Low Point

Degree of Process Degradation
Within the reach, the sediment input, sediment transport, erosion/accretion of sediment, tidal flow, tidal channel formation, detritus import and export, exchange of aquatic organisms, exchange of aquatic organisms, and solar incidence processes have low degradation levels.

ECOLOGY

Offshore Vegetation
Eelgrass is mapped throughout 17% of this reach, patchy (14%) followed by continuous (3%) from Tongue Point to the western end of Crescent Bay. Kelp is mapped throughout the reach (42%), but is somewhat sparse in Crescent Bay.

Onshore Vegetation
56% of the shoreland area of the reach is mapped as forest habitat, 12% is mapped as natural shrub and herbaceous vegetation, and 10% is mapped as lawn/landscaping.

Habitats and Species
6% of the landward portion of the reach consists of wetland habitat. Designated priority habitats within the reach are bald eagle and cliffs/bluffs. In addition, harbor seal habitat and a marine mammal haulout are mapped at Low Point, and a gray whale feeding area (1%) is mapped at Crescent Bay.

Patches of forage fish spawning habitat (smelt) are mapped east of Whiskey Creek and west of the Lyre River. Coho, chinook, and chum; resident cutthroat trout, and steelhead are mapped in the streams within the reach.

The marine nearshore areas in the reach (Strait of Juan de Fuca and Crescent Bay) provide important habitat for a wide variety of marine species that utilize nearshore habitat, including several salmon and trout species.

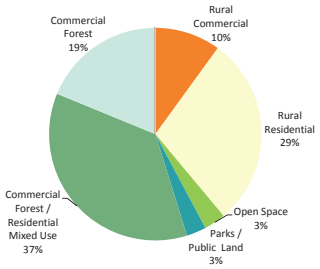
Shellfish
Red sea urchin is mapped throughout the reach (88% of reach total). Abalone is mapped at the eastern portion of the reach (41%), and Dungeness crab at the western and eastern portions (51%).

Water Quality
The reach has no State impaired water quality listings. However, Streamkeepers has listed Whiskey Creek water quality as "impaired" for WQI, and the Lyre River is listed as "impaired" for B-IBI but "healthy" for WQI. Salt Creek is listed as "compromised" for both B-IBI and WQI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land usage in the shoreland area is timber (40%), residential (30%), lodging (14%), vacant (8%), open space (6%), and roads (2%). Land ownership within the reach is 81% private and 19% public.

Zoning and Parcel Data



Under current zoning regulations there is moderate potential for significant new development within the reach.

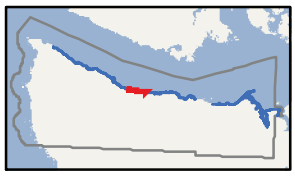
Public Access
52% of the shoreline in this reach is publicly owned, but only 3% of the reach is public shoreline that is accessible from land. Public shoreline in the far eastern portion of the reach can be directly accessed from the Salt Creek Recreation Area. Shoreline in the western end of the reach An additional 36.4% of the shoreline in the reach is not publically owned, but can be accessed by patrons of privately-owned campgrounds (Crescent Beach and RV Park, Whiskey Creek Campground, and Lyre River Campground).

Impervious Surfaces
Approximately 2% of the landward portion of the reach is covered by impervious surfaces.

Shoreline Modifications
A breakwater, associated with a boat ramp, is located at the Whiskey Creek Beach Resort.

Contaminated Sites
There are no identified contaminated sites within the reach.

Cultural Resources
There are 7 inventoried pre-contact sites within the reach, including 2 pre-contact camp sites.



REACH MR-10: Twin Rivers

SHORELINE LENGTH
7.40 Miles

REACH AREA
174.99 Acres

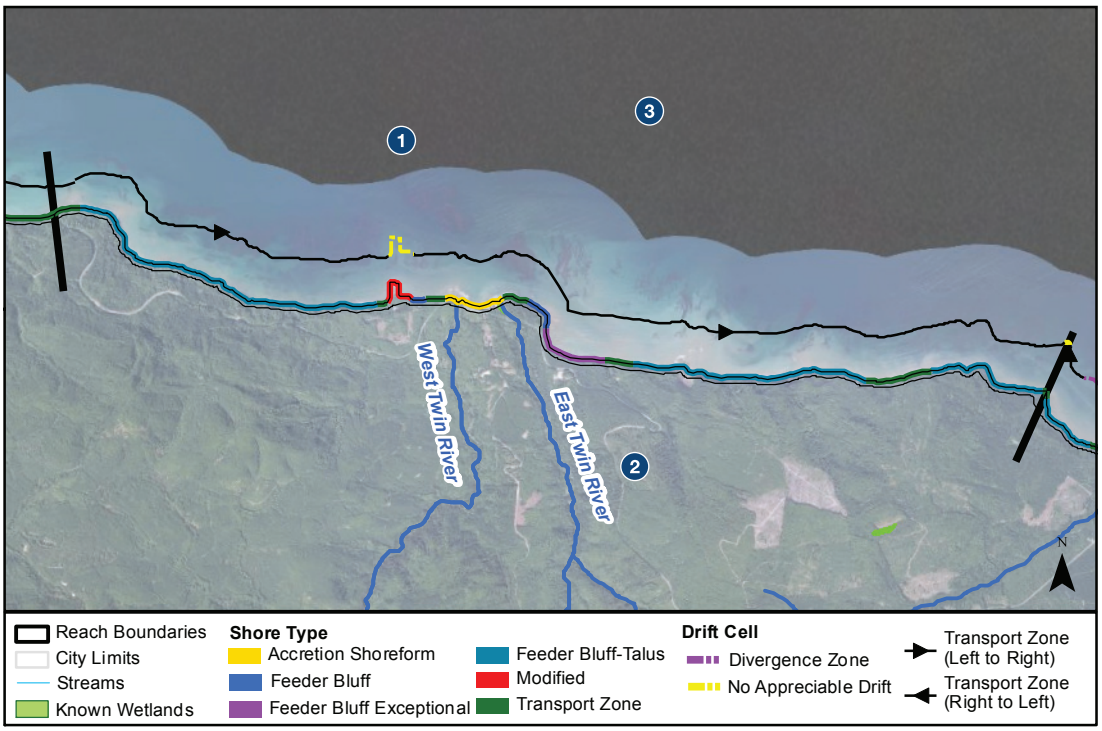
PSNERP PROCESS UNITS
SPU 1027

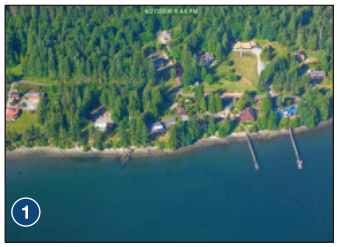
REACH SUMMARY

The "Twin Rivers" reach extends from approximately 2 miles west of Low Point to 1 mile east of the mouth of Deep Creek, along Strait of Juan de Fuca shoreline. The predominant shoretype within the reach is bedrock ramp shores, with some beach areas located at the Twin River mouths. Net shore drift is eastward through the reach; however, a large manmade obstruction is located in the western portion of the reach. Most of the shoreland area is forested, and the nearshore area contains dense concentrations of submerged aquatic vegetation which provides important habitat for marine species, including juvenile salmonids.

Most of the land within the shoreland zone is privately owned, and zoned for commercial forestry. Some DNR-managed forest land is located in the eastern portion of the reach. The shorelands within the reach are largely undeveloped.

Under current zoning regulations, approximately one-third of the shoreland area has potential for new residential development. However, most of this land is zoned for commercial forestry. Most of the forestry land in the reach is not eligible for subdivision. Actual development potential within this reach is minimal.





Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

The predominant shoretype in Reach 10 is bedrock ramp shores (84%), with portions of barrier beaches (4%) and bluff backed beaches (4%). Geomorphic shoreforms within the reach consists of feeder bluff (7%), feeder bluff exceptional (7%), and feeder bluff-talus (68%). 12% of the shoreline is mapped as transport zones and 6% is mapped as accretion shoreforms.

Net Shore Drift

Net shore drift is entirely eastward through Reach 10. A large, man-made obstruction to littoral drift occurs in the western portion of the reach, essentially bisecting drift into two separately functioning cells. This obstruction has been identified as a possible restoration site by state and federal agencies.

Hazard Areas

Most bluff areas are unstable (59%) with recent slides mapped in the southeastern portion of the reach (6%). The East and West Twin River shoreline areas are in a tsunami hazard zone (16%) and the FEMA coastal 100-year floodplain (16%).

REACH REACH MR-10: Twin Rivers

Degree of Process Degradation
Within the reach, the sediment input, sediment transport, erosion/accretion of sediment, tidal flow, tidal channel formation, detritus import and export, exchange of aquatic organisms, exchange of aquatic organisms, and solar incidence processes have low degradation levels.

ECOLOGY

Offshore Vegetation
Eelgrass is mapped throughout 39% of this reach, primarily in the eastern half. Kelp is mapped throughout the reach (52%), with the exception of near the mouths of the Twin Rivers.

Onshore Vegetation
63% of the shoreland area is mapped as forest habitat, 13% is mapped as natural shrub and herbaceous vegetation, and 5% is mapped as lawn/landscaping.

Habitats and Species
No wetland habitat is mapped in the reach. Designated priority habitats mapped throughout the reach include cliffs/bluffs, bald eagle, and harbor seal. In addition, 3 marine mammal haulout areas are located within the reach.

Two patches of forage fish spawning habitat (smelt) are mapped near the mouth of the Twin Rivers. Coho salmon, chum salmon, resident cutthroat trout , and steelhead are mapped in the rivers.

The marine nearshore areas in the reach (Strait of Juan de Fuca) provide important habitat for a wide variety of marine species that utilize nearshore habitat, including several salmon and trout species.

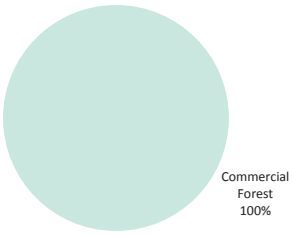
Shellfish
Red sea urchin is mapped throughout the reach (92% of reach total), and Dungeness crab is mapped at the western portion (42%).

Water Quality
The reach has no State impaired water quality listings. However, within the reach boundary, Streamkeepers lists the water quality of the East Twin River as "impaired" for WQI, and the West Twin River is listed as "compromised" for B-IBI but "healthy" for WQI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land usage in the shoreland area is timber (64%), vacant (21%), commercial (6%), residential (4%), roads (4%), and open space (2%). The majority of non-timber land is located in the center of the reach, near the Twin Rivers. Land ownership within the reach is 67% private and 33% public.

Zoning and Parcel Data



Under current zoning regulations there is minimal potential for significant new residential development within the reach. Land within the reach is zoned for commercial forestry.

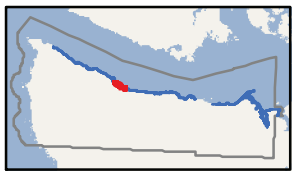
Public Access
95% of the shoreline in this reach is publicly owned, but only 7% of the reach contains public shoreline that is accessible from land. This shoreline area (Twin Rivers) is accessible from Highway 112; however, there are no dedicated parking areas available.

Impervious Surfaces
Approximately 4% of the landward portion of the reach is covered by impervious surfaces.

Shoreline Modifications
An area of nearshore fill (4.12 acres) is mapped to the west of West Twin River. There are no other shoreline modifications mapped within the reach.

Contaminated Sites
There are no identified contaminated sites within the reach.

Cultural Resources
There is 1 inventoried pre-contact site within the reach.



REACH MR-11: Deep Creek

SHORELINE LENGTH
5.30 Miles

REACH AREA
127.36 Acres

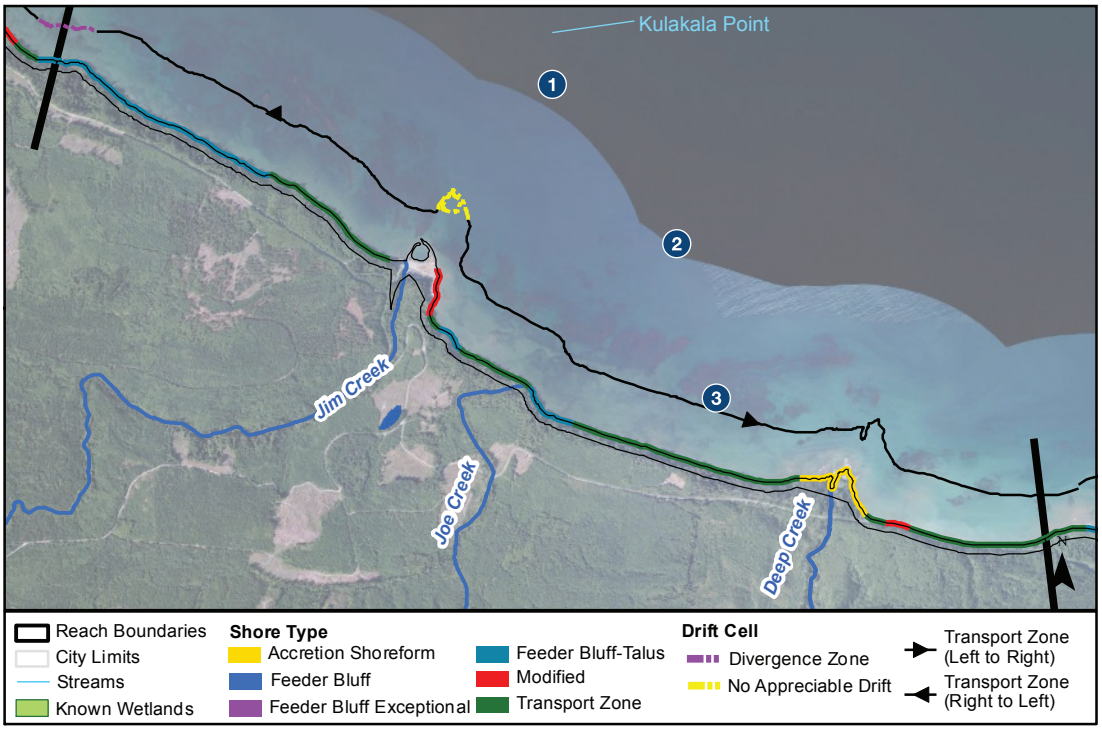
PSNERP PROCESS UNITS
SPU 1027

REACH SUMMARY

The "Deep Creek" reach extends from approximately 1 mile east of the mouth of Deep Creek to approximately 1 mile east of the Pysht River estuary, along the Strait of Juan de Fuca. The eastern half of the reach is composed of bluff backed beach, while the western half is comprised primarily of rocky platform shores. Net shore drift along the reach is entirely eastward; however, a large obstruction (the Silver King Resort breakwater) is located at the mouth of Jim Creek. Most of the shoreland area is forested, and the nearshore area contains dense concentrations of submerged aquatic vegetation that provides important salmonid rearing habitat, as well as habitat for other marine species.

Land usage within the shoreland area is commercial forestry, with the exception of the Silver King Resort area. The shorelands within the reach are largely undeveloped.

Under current zoning regulations, almost the entire shoreland zone has potential for new residential development. However, most of this land is zoned for commercial forestry. Most of the forestry land in the reach is not eligible for subdivision. Actual development potential within this reach is minimal.



Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

Shoretypes within the reach include bluff backed beaches in the eastern portion of the reach (50%), while the western portion consists of rocky platform shores (34%) and barrier beaches (6%). Geomorphic shoreforms are feeder bluff-talus (47%), transport zones (34%), and accretion shoreforms (11%). 8% of the reach is mapped as modified.

Net Shore Drift

Net shore drift is entirely eastward and encompasses the origin or western extent of the same drift cell found in Reach 10. A large obstruction to littoral drift bisects the historic drift cell (breakwater) at the mouth of Jim Creek in the northern portion of the reach.

Hazard Areas

Most bluff areas are unstable (64%) with recent slides mapped directly west of Deep Creek (2%). Most of the Jim Creek and Deep Creek shoreline areas are in a tsunami hazard zone (53%) and FEMA coastal and stream 100-year floodplain (20%).

REACH REACH MR-11: Deep Creek

Degree of Process Degradation
Within the reach, the sediment input, sediment transport, erosion/accretion of sediment, tidal flow, tidal channel formation, detritus import and export, exchange of aquatic organisms, exchange of aquatic organisms, and solar incidence processes have low degradation levels.

ECOLOGY

Offshore Vegetation
Patches of kelp are mapped (37%) throughout the reach.

Onshore Vegetation
71% of the shoreland area of the reach is mapped as forest habitat, 9% is mapped as natural shrub and herbaceous vegetation, and 13% is mapped as lawn/landscaping.

Habitats and Species
No wetland habitat is mapped in this reach. Designated priority habitats mapped throughout the reach include cliffs/bluffs, bald eagle, and harbor seal . In addition, 3 marine mammal haulout areas are identified within the reach.

Two patches of forage fish spawning habitat (smelt) are mapped at the eastern and western ends of the reach. Coho, chinook, and chum salmon; resident cutthroat; and steelhead are mapped in Jim and Deep creeks.

The marine nearshore areas in the reach (Strait of Juan de Fuca) provide important habitat for a wide variety of marine species that utilize nearshore habitat, including several salmon and trout species.

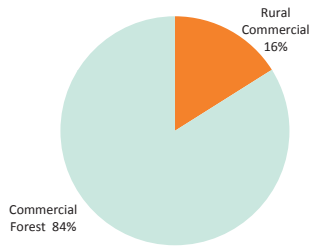
Shellfish
Dungeness crab (90% of reach total) and red sea urchin (88%) are mapped throughout the reach. A patch of hardshell clam (3%) is mapped at the western portion of the reach.

Water Quality
The portion of Deep Creek within the reach has State impaired water quality listings for dissolved oxygen and temperature. Water quality is listed by Streamkeepers as "healthy" for WQI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land usage in the shoreland area is timber (61%), lodging (34%), roads (5%), and vacant (1%). The lodging area is located at the center of the reach, and is surrounded by timber land. Land ownership within the reach is 100% private.

Zoning and Parcel Data



Under current zoning regulations, there is a low potential for significant new residential and commercial development within the reach. Most of the land within the reach is zoned for commercial forestry.

Public Access
69% of the shoreline in this reach is publicly owned; however, none of this area is accessible from land. An additional 22% of the shoreline in the reach is not publically owned, but can be accessed by Silver King owners and guests.

Impervious Surfaces
Approximately 5% of the landward portion of the reach is covered by impervious surfaces.

Shoreline Modifications
Shoreline armoring (9% of reach total), nearshore fill (1.86 acres), and 3 overwater structures (building, dock, and bridge) are mapped in the center of the reach, at Silver King boat launch. The remainder of the reach has no mapped shoreline modifications.

Contaminated Sites
There are no identified contaminated sites within the reach.

Cultural Resources
There is 1 inventoried pre-contact site within the reach.

REACH MR-12: Pysht River

SHORELINE LENGTH
2.38 Miles

REACH AREA
65.66 Acres

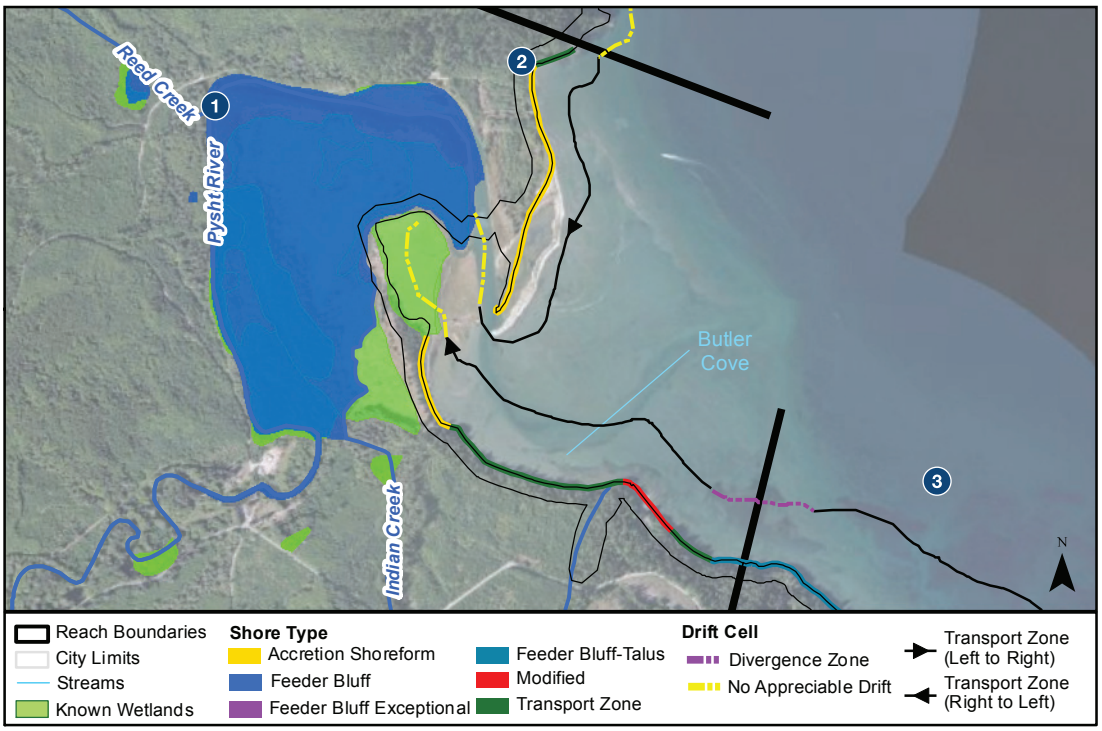
PSNERP PROCESS UNITS
SPU 1027

REACH SUMMARY

The "Pysht River" reach extends from approximately one-third of a mile east of the Butler Creek mouth to just south of Pillar Point, and includes the Pysht River estuary. A south-trending drift cell maintains barrier beach near the river mouth. Rocky platform shores comprise the eastern portion of the shoreline. The shoreline is unaltered, with the exception of levees at the river mouth. Most of the shoreland area is forested, and the nearshore area contains dense concentrations of submerged aquatic vegetation that provides important salmonid rearing habitat. The wetland habitat at the Pysht River estuary is an important waterfowl habitat area.

Land usage within the shoreland area is commercial forestry, low-density residential, and open space. The shorelands within the reach are largely undeveloped. A small portion of the shoreline is publically owned, and be accessed from Pillar Point Recreation Area (at Butler Cove).

Under current zoning regulations, almost the entire shoreland zone has potential for new residential development. However, most of this land is zoned for commercial forestry. Most of the forestry land in the reach is not eligible for subdivision. Actual development potential within this reach is minimal.



Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

The most abundant shoretype in the reach barrier estuary (54%) associated with the mouth of the Pysht River. The barrier itself represents 23% of the reach, and rocky platforms comprise the remaining 23%. Geomorphic shoreforms mapped within the reach are primarily accretion shoreforms (49%) and transport zones (37%), with a lesser amount of feeder bluff-talus (4%). 9% of the shoreline is mapped as modified.

Net Shore Drift

Short net shore-drift cells originating at Pillar Point and slightly east of Butler Cove converge at the Pysht River estuary.

Hazard Areas

Several bluff areas are unstable (27%) in the southeast and northern portion of the reach with no recent slides mapped. Nearly all of the Pysht River estuary is in a tsunami hazard zone (64%) and FEMA coastal and stream 100-year floodplains (76%).

REACH REACH MR-12: Pysht River

Degree of Process Degradation
Within the reach, the sediment input, sediment transport, erosion/accretion of sediment, tidal flow, tidal channel formation, detritus import and export, exchange of aquatic organisms, exchange of aquatic organisms, and solar incidence processes have low degradation levels.

ECOLOGY

Offshore Vegetation
There is no kelp or eelgrass mapped within the reach.

Onshore Vegetation
52% of the shoreland area is mapped as forest habitat, 41% is mapped as natural shrub and herbaceous vegetation, and 3% is mapped as lawn/landscaping.

Habitats and Species
11% of the shoreland area of the reach is identified as wetland habitat, primarily in the Pysht River estuary. Designated priority habitats within the reach include estuarine zone, harbor seal, and waterfowl concentrations.

A patch of forage fish spawning habitat (sand lance is mapped in the northern portion of the reach. Coho, chinook, and chum salmon; resident cutthroat trout; and steelhead are mapped in the Pysht River.

The marine nearshore areas in the reach (Strait of Juan de Fuca and Pysht River estuary) provide important habitat for a wide variety of marine species that utilize nearshore habitat, including several salmon and trout species.

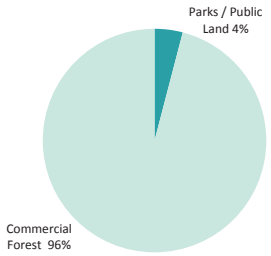
Shellfish
Dungeness crab (80% of reach total) and red sea urchin (77%) are mapped throughout the reach. Hardshell clam is mapped along the reach, of which 7% is located within the reach boundary.

Water Quality
The portion of the Strait of Juan de Fuca within the reach has a State impaired water quality listing for fecal coliform. Pysht River water quality within the reach is listed by Streamkeepers as "compromised" for B-IBI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land usage in the shoreline area is timber (33%), residential (33%) and vacant (30%), and open space (4%). The residential land is located in the northern portion of the reach, near the Pysht River. Land ownership within the reach is 100% private.

Zoning and Parcel Data



Under current zoning regulations, there is a low potential for significant new residential development within the reach. Most of the land within the reach is zoned for commercial forestry.

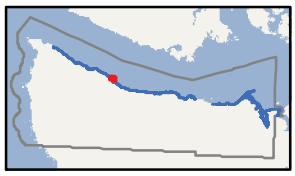
Public Access
5% of the shoreline in this reach is publicly owned, and can be directly accessed at Pillar Point County Park (located near Butler Cove). Recreational crab harvesting is available at the park.

Impervious Surfaces
No impervious surface is mapped within the reach.

Shoreline Modifications
Tidal barriers (levees) (11% of reach total) are mapped in the reach, at the mouth of the Pysht River. A fish passage barrier (culvert) is mapped in the southern portion of the reach, at Butler Creek.

Contaminated Sites
There are no identified contaminated sites within the reach.

Cultural Resources
There are 2 inventoried pre-contact sites and 1 inventoried historic site (the Pysht River log camp – yard and log raft site for Merrill and Ring Company) within the reach.



REACH MR-13: Pillar Point

SHORELINE LENGTH
2.14 Miles

REACH AREA
48.60 Acres

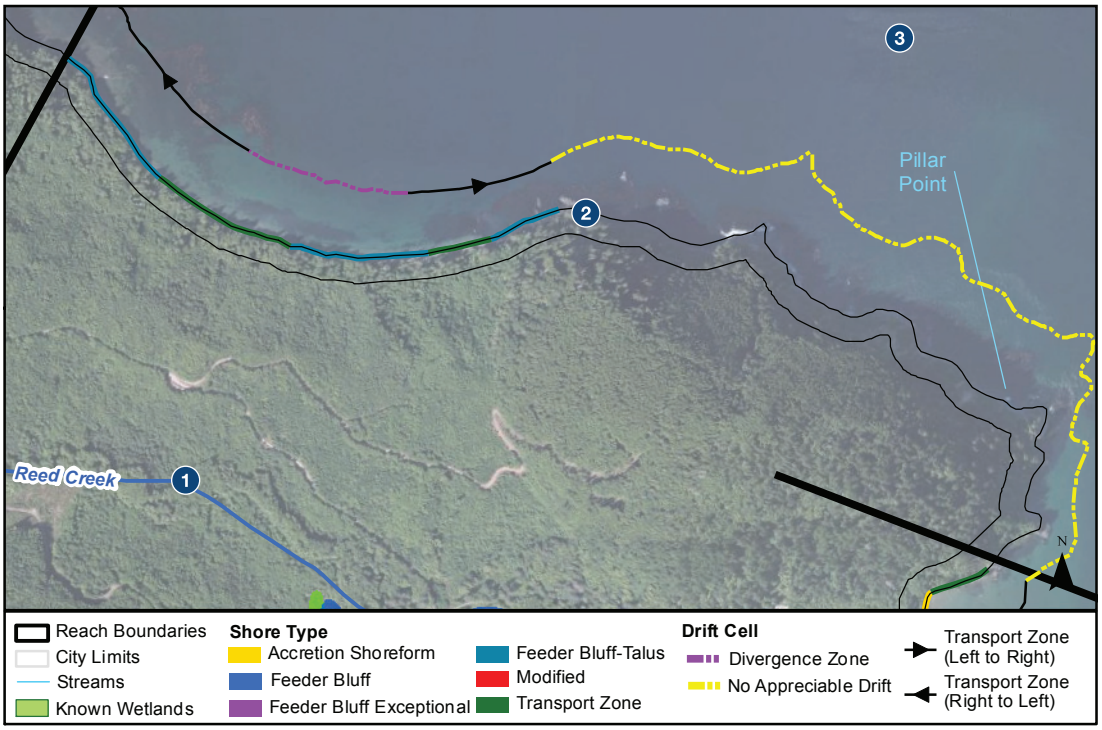
PSNERP PROCESS UNITS
SPU 1027 & 1028

REACH SUMMARY

The "Pillar Point" reach extends from Pillar Point to approximately a mile and a half west of the point, along the Strait of Juan de Fuca. Almost the entire shoreline of the reach consists of bedrock shores, with rocky platforms comprising the eastern half and a broad pocket beach in the western half. There are no identified shoreline modifications within the reach. Most of the shoreland area is forested, and the nearshore area contains dense concentrations of submerged aquatic vegetation which provides important habitat for marine species, including juvenile salmonids.

Land ownership within the reach is almost entirely private, and usage is primarily timber, with a smaller amount of low-density residential located in the eastern portion of the reach. Most of the actual shoreline is publically owned, but cannot be accessed from land.

Under current zoning regulations, more than half of the entire shoreland zone has potential for new residential development. However, most of this land is zoned for commercial forestry. Most of the forestry land in the reach is not eligible for subdivision. Actual development potential within this reach is minimal



Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

Shoretypes within the reach consist primarily of rocky platforms (57%), with a broad pocket beach (41%) located in the western portion of the reach. Geomorphic shoreforms are feeder bluff-talus units (63%) backing the pocket beach, with No Appreciable Drift (41%) in the eastern portion of the reach. The remaining shoreline in the reach consists of transport zones (37%).

Net Shore Drift

This reach consists of 2 short drift cells and one area of no appreciable drift. West of Pillar Point, two short drift cells converge, both of which are adjacent to areas of No Appreciable Drift, where bedrock shores and deep water preclude beach development.

Hazard Areas

Many bluff areas are unstable (94%) with recent slides mapped in the northwestern portion of the reach (4%). A portion of Pillar Point and the northwestern shoreline of the reach is in a tsunami hazard zone (17%) and the FEMA coastal floodplain (10%).

REACH REACH MR-13: Pillar Point

Degree of Process Degradation
Within the reach, the sediment input, erosion/accretion of sediment, tidal flow, tidal channel, freshwater input, detritus important and export, exchange of aquatic organisms, and solar incidence processes have low degradation levels. The sediment transport process is moderately degraded in the western half of the reach, and has a low degradation level in the east half.

ECOLOGY

Offshore Vegetation
Kelp is mapped throughout the reach (54%).

Onshore Vegetation
84% of the shoreland area is mapped as forest habitat and 8% is mapped as natural shrub and herbaceous vegetation.

Habitats and Species
No wetland habitat is identified within the reach. Designated priority habitat habitats mapped throughout the reach include cliffs/bluffs, bald eagle, and harbor seal. In addition, 2 marine mammal haulout areas are mapped within the reach.

No forage fish presence is mapped within the reach. There are no streams within the reach; therefore, there is no mapped freshwater fish use.

The marine nearshore areas in the reach (Strait of Juan de Fuca) provide important habitat for a wide variety of marine species that utilize nearshore habitat, including several salmon and trout species.

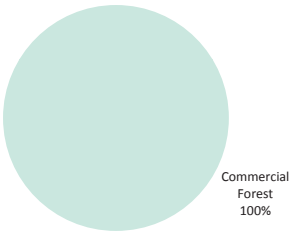
Shellfish
Red sea urchin is mapped throughout the reach (59% of reach total). Hardshell clam (32%) and Dungeness crab (13%) are mapped in the eastern portion of the reach.

Water Quality
The reach has no impaired water quality listings.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land usage in the shoreland area is timber (62%) and residential (38%). The residential land is located at the eastern end of the reach, adjacent to Pillar Point. Land ownership within the reach is 97% private and 3% public.

Zoning and Parcel Data



Under current zoning regulations, there is a low potential for significant new residential development within the reach. Most of the land within the reach is zoned for commercial forestry.

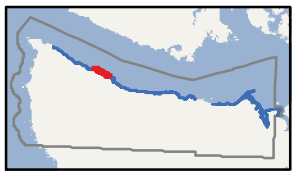
Public Access
73% of the shoreline in this reach is publicly owned. However, the water can not be accessed from land.

Impervious Surfaces
No impervious surface is mapped within the reach.

Shoreline Modifications
There are no shoreline modifications mapped within the reach.

Contaminated Sites
There are no identified contaminated sites within the reach.

Cultural Resources
There is 1 inventoried WWII-era historic site within the site.



REACH MR-14: Slip Point

SHORELINE LENGTH
6.77 Miles

REACH AREA
154.73 Acres

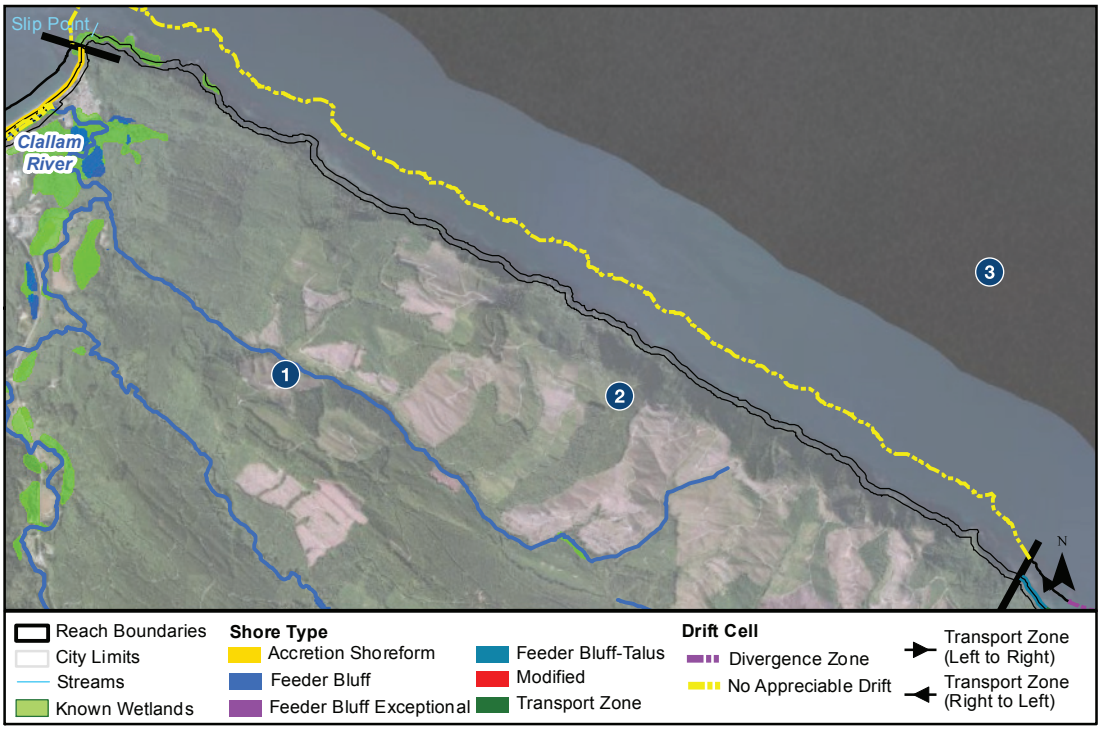
PSNERP PROCESS UNITS
SPU 1028

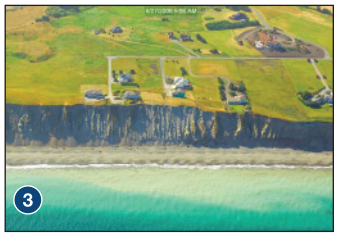
REACH SUMMARY

The "Slip Point" reach extends from approximately a mile and a half west of Pillar Point to Slip Point, along the Strait of Juan de Fuca. Bedrock rocky platform shores comprise the shoreline within the reach, and there is no appreciable net shore drift along the shores. There are no identified shoreline modifications within the reach. Most of the shoreland area is forested, and the nearshore area contains dense concentrations of submerged aquatic vegetation which provides important habitat for marine species, including juvenile salmonids.

Almost the entire shoreland area is privately-owned timber land. Nearly the entire shoreline is publically owned; however, the water can be accessed from land within the reach.

Under current zoning regulations, more than 90% of the entire shoreland zone has potential for new residential development. However, all of this land is zoned for commercial forestry. Most of the forestry land in the reach is not eligible for subdivision. Actual development potential within this reach is minimal





Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

Bedrock rocky platform shores comprise 98% of the reach shoreline.

Net Shore Drift

There is no appreciable net shore drift within the reach.

Hazard Areas

Many bluff areas are unstable (90%), but no recent slides are mapped within the reach. Most of the shoreline near Slip Point is in a tsunami hazard zone (15%) and the FEMA coastal floodplain (10%).

REACH REACH MR-14: Slip Point

Degree of Process Degradation
Within the reach, the erosion/accretion of sediment, freshwater input, detritus import and export, exchange of aquatic organisms, and solar incidence processes have low degradation levels. The sediment transport process is moderately degraded.

ECOLOGY

Offshore Vegetation
Kelp is mapped throughout the reach (57%).

Onshore Vegetation
92% of the shoreland area is mapped as forest habitat and 4% is mapped as natural shrub and herbaceous vegetation.

Habitats and Species
5% of the landward portion of the reach is mapped as wetland habitat, located primarily near Slip Point. Designated priority habitats mapped throughout the reach include cliffs/bluffs, bald eagle, and harbor seal. In addition, 4 identified marine mammal haulout areas are mapped throughout the reach.

No forage fish presence is mapped within the reach. There are no streams within the reach; therefore, there is no mapped freshwater fish use.

The marine nearshore areas in the reach (Strait of Juan de Fuca) provide important habitat for a wide variety of marine species that utilize nearshore habitat, including several salmon and trout species.

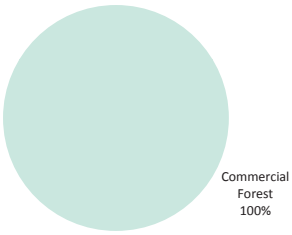
Shellfish
Red sea urchin is mapped throughout the reach (55% of reach total), and abalone is mapped at the western half (64%). Dungeness crab (10%) and hardshell clam (3%) are mapped at the western end of the reach, near Clallam Bay.

Water Quality
The reach has no impaired water quality listings.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land usage in the shoreland area is primarily timber (98%), with some open space (2%). Land ownership within the reach is 99.8% private and 0.2% public.

Zoning and Parcel Data



Under current zoning regulations, there is a low potential for significant new residential development within the reach. Most of the land within the reach is zoned for commercial forestry.

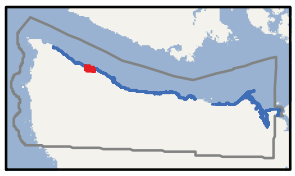
Public Access
97% of the shoreline in this reach is publicly owned; however, it can not be accessed from land.

Impervious Surfaces
No impervious surface is mapped within the reach.

Shoreline Modifications
There are no shoreline modifications mapped within the reach.

Contaminated Sites
There are no identified contaminated sites within the reach.

Cultural Resources
There are no inventoried sites within the reach.



REACH MR-15: Clallam Bay

SHORELINE LENGTH
5.65 Miles

REACH AREA
96.06 Acres

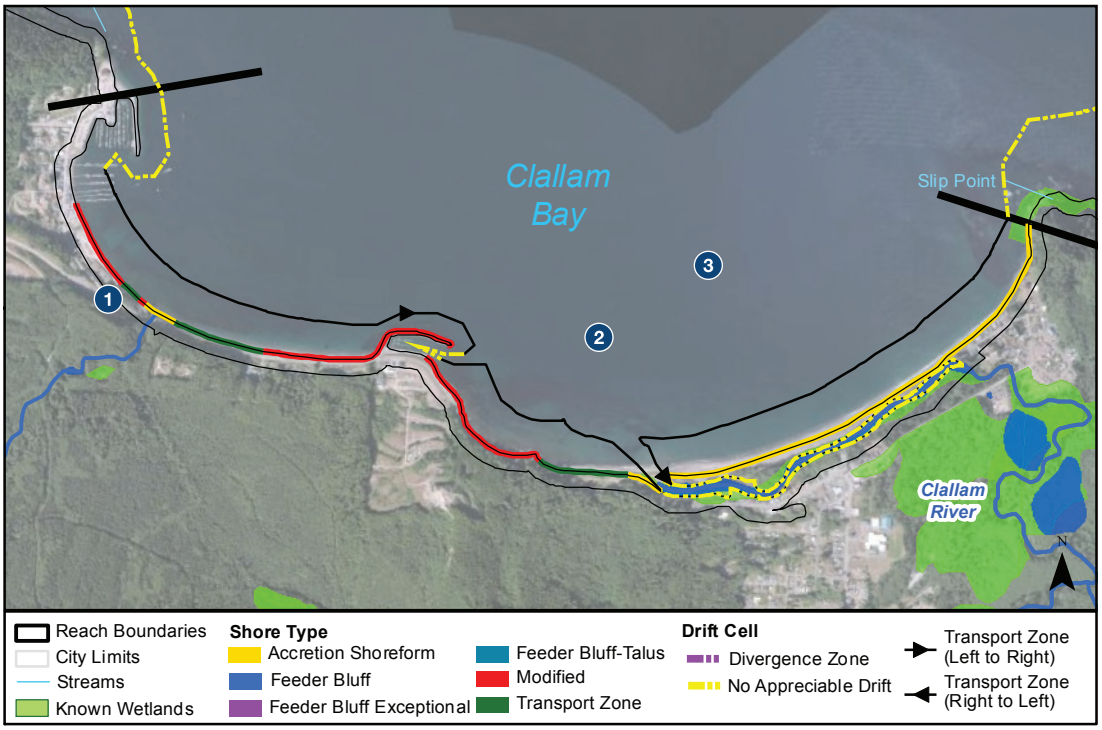
PSNERP PROCESS UNITS
SPU 1028 & 1029

REACH SUMMARY

The "Clallam Bay" reach consists of the shoreline in the entire bay. The eastern half of the shoreline consists of low beaches, which are maintained by two drift cells that converge near the mouth of the Clallam River. The western half of the shoreline is composed of bluff-backed beaches. Approximately 20% of the shoreline is armored, which is concentrated two marinas within the bay. The bay shoreline contains kelp stands and two patches of forage fish spawning habitat, which provides important habitat for marine species, including juvenile salmonids.

Major land uses within the shoreland area include open space, roads, lodging, high-density residential development, and commercial. Clallam Bay Spit Park is located at the eastern end of the reach. Approximately one-quarter of the reach contains forest habitat, which provides habitat for many species, including bald eagle. Most of the vegetation within the shorelands has been altered by development.

Under current zoning regulations, approximately half of the shoreland area has potential for new development. Most of the undeveloped land is zoned for lodging or commercial development. These undeveloped parcels are narrow in width, with wide water frontages. Development in these parcels would likely require the installation of shoreline armoring to protect structures, which may degrade salmon rearing habitat and impede natural sediment processes.



Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

Barrier estuary (32%) and barrier beach (19%) associated with the mouth of the Clallam River account for a large portion of the reach shoretype. Bluff backed beaches (36%) are present in the western portion of the bay. Geomorphic shoretypes mapped within the reach are primarily mapped transport zones (11%), with accretion shoreforms (48%) in the eastern half of the reach. Modified shores account for the remaining 41% of the reach.

Net Shore Drift

Two drift cells originating near that headlands at the eastern and western end of Clallam Bay converge in the central portion of the bay, near the mouth of the Clallam River.

Hazard Areas

Several bluff areas are unstable (27%) with recent slides mapped near the center of the reach. Recent slides are near existing buildings and marinas. Most of Clallam Bay and the Clallam River floodplain is in a tsunami hazard zone (70%) and FEMA coastal and stream 100-year floodplains (40%).

REACH REACH MR-15: Clallam Bay

Degree of Process Degradation
Within the reach, the erosion/accretion of sediment, freshwater input, and solar incidence processes have low degradation levels, while the sediment input and sediment transport processes have moderate degradation levels. The detritus import and export and exchange of aquatic organisms processes are moderately degraded in the western half of the reach, and have low degradation levels in the eastern half.

ECOLOGY

Offshore Vegetation
Kelp is mapped throughout the reach (57%).

Onshore Vegetation
23% of the shoreland area is mapped as forest habitat, 17% is mapped as natural shrub and herbaceous vegetation, and 54% is mapped as lawn/landscaping.

Habitats and Species
7% of the shoreland area is mapped as wetland habitat, primarily along the Clallam River. The designated priority habitat mapped within the reach is bald eagle (5%).

Two patches of forage fish spawning habitat are mapped in along the Clallam Bay shoreline. Sand lance is mapped near the mouth of the Clallam River, and smelt is mapped west of a marina in the central portion of the reach. Coho salmon, chum salmon, resident cutthroat trout, and steelhead are mapped in the Clallam River.

The marine nearshore areas in the reach (Clallam Bay) provide important habitat for a wide variety of marine species that utilize nearshore habitat, including several salmon and trout species.

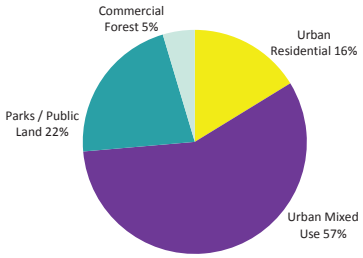
Shellfish
Clallam Bay supports significant populations of shell fish. Abalone is mapped throughout the reach (100.0% of reach total), as well as Dungeness crab (80%), red sea urchin (74%), and hardshell clam (25%).

Water Quality
The portion of the Clallam River within the reach has a State impaired water quality listing for temperature. Water quality of the river within the reach boundary is listed by Streamkeepers as "impaired" for WQI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land usage in the shoreland area is open space (23%), vacant (21%), roads (20%), lodging (14%), residential (13%), commercial (5%), timber (4%), and utilities (2%). Land ownership within the reach is 91% private and 9% public.

Zoning and Parcel Data



Under current zoning regulations, there is high potential for significant new residential and commercial development.

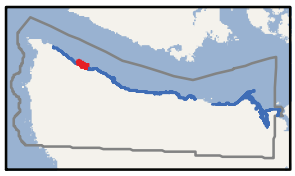
Public Access
50% of the shoreline in this reach is publicly owned and accessible from land. Public shoreline in the eastern portion of the reach is directly accessible from Clallam Bay Spit Community Beach County Park. The public tidelands near the western end of the reach are accessible from Highway 112; however, no dedicated parking is available. An additional 21.0% of the shoreline in the reach (private marinas) is not publically owned, but can be accessed by marina patrons.

Impervious Surfaces
Approximately 28% of the landward portion of the reach is covered by impervious surfaces.

Shoreline Modifications
Shoreline armoring (22% of reach total) associated with two marina breakwaters is located at the western portion of the reach and at center of the reach. Several overwater structures (docks) are located behind the two breakwaters.

Contaminated Sites
There are no identified contaminated sites within the reach.

Cultural Resources
Sekiu School (built 1916) is listed on the state and national historic registries, and the Slip Point Light Station Keeper's Residence historic town site (built 1905) is listed on the state registry. Hotel structure along shoreline (built 1954) is inventoried for historic significance but not listed. In addition, there is 1 inventoried pre-contact site within the reach.



REACH MR-16: Sekiu-Kydaka Point

SHORELINE LENGTH
3.64 Miles

REACH AREA
93.42 Acres

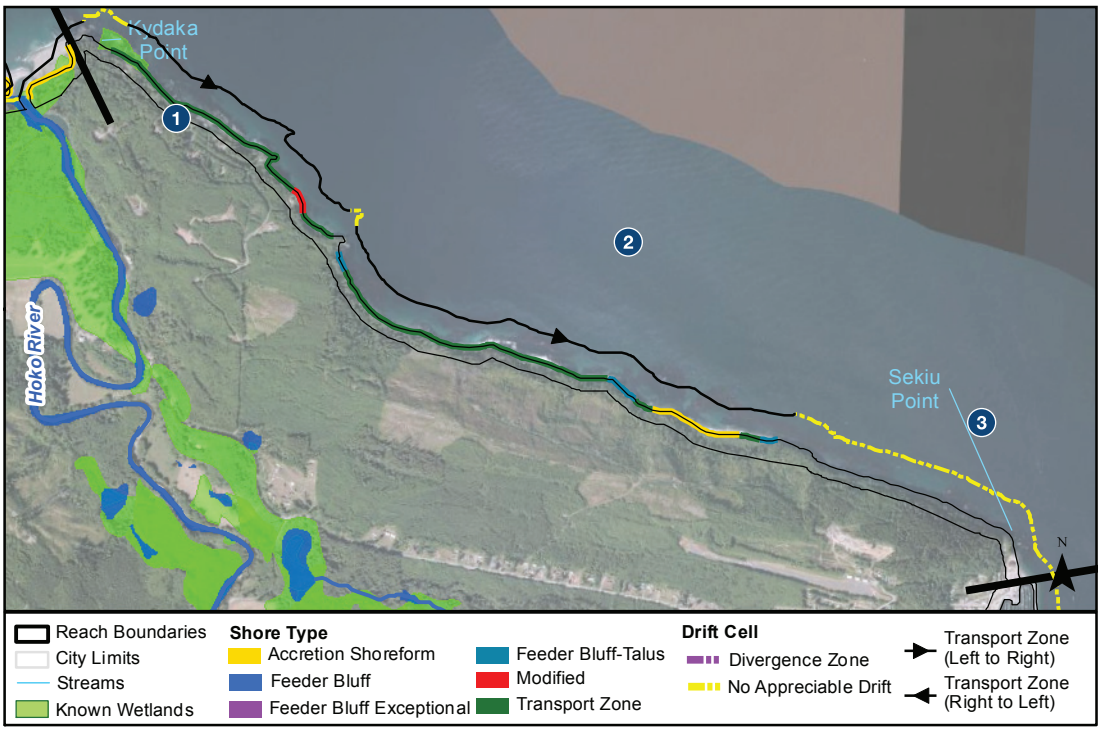
PSNERP PROCESS UNITS
SPU 1029

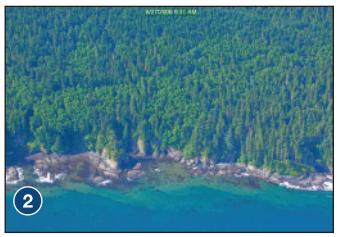
REACH SUMMARY

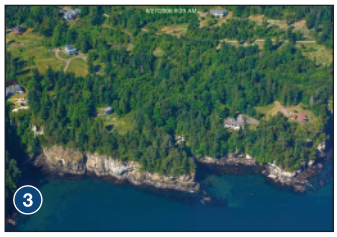
The "Sekiu-Kydaka Point" reach extends along the Strait of Juan de Fuca, from Sekiu Point to Kydaka Point. Bedrock ramp shores comprise a majority of the shoreline, with bluff backed beach in the center of the reach. Net shore drift is entirely eastward through the reach. With the exception of a small section of armoring at the east end, the shoreline is unaltered. Most of the shoreland area is forested, and the nearshore area contains dense concentrations of submerged aquatic vegetation which provides important habitat for marine species, including juvenile salmonids.

The eastern two-thirds of the reach is commercial timber land, with the exception of a WSP-managed parcel at the center of the reach. The western third of the reach consists of residential land (1 to 2 acre parcels), but most of the lots are undeveloped and forested.

Under current zoning regulations, approximately two-thirds of the shoreland area has potential for new residential development. However, most of this land is zoned for commercial forestry. Most of the forestry land in the reach is not eligible for subdivision. Development in the western end of the reach would consist of moderately-density residential infill. The waterward ends of these parcels are within mapped tsunami and coastal flood hazard area.







Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

Shoretypes in the reach are predominantly rocky platform shores (58%), with bluff backed beaches (36%) in the center of the reach. Two pocket beaches (4%) are mapped in the western portion of the reach. Geomorphic shoreforms within the reach are primarily transport zones (68%). Smaller portions of the shore are mapped as feeder bluff-talus (14%) and accretion shoreforms (11%). Modified shores comprised 6% of the reach.

Net Shore Drift

Net shore drift within the reach is eastward. Areas of no appreciable drift are found in both the east and west ends of the reach.

Hazard Areas

Most bluff areas are unstable (65%) with recent slides mapped southwest of Kydaka Point (3%). Most of the northwest portion of this reach is in a tsunami hazard zone (38%) and the FEMA coastal 100-year floodplain (88%).

REACH REACH MR-16: Sekiu-Kydaka Point

Degree of Process Degradation
Within the reach, the erosion/accretion of sediment, freshwater input, and solar incidence processes have low degradation levels. The sediment input, sediment transport, detritus important and export, and exchange of aquatic organisms processes are moderately degraded.

ECOLOGY

Offshore Vegetation
Kelp is mapped throughout the reach (64%).

Onshore Vegetation
81% of the shoreland area is mapped as forest habitat, 3% is mapped as natural shrub and herbaceous vegetation, and 6% is mapped as lawn/landscaping.

Habitats and Species
1% of the shoreland area consists of wetland habitat, which is located primarily near Kydaka Point. Designated priority habitats identified throughout the reach include cliffs/bluffs, bald eagle, and harbor seal. 3 marine mammal haulout areas are also mapped within the reach.

A patch of forage fish spawning habitat (smelt) is mapped at the east end of the reach. There are no streams within the reach; therefore, there is no mapped freshwater fish use.

The marine nearshore areas in the reach (Strait of Juan de Fuca) provide important habitat for a wide variety of marine species that utilize nearshore habitat, including several salmon and trout species.

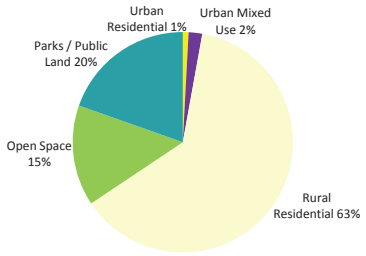
Shellfish
Red sea urchin is mapped throughout the reach (80% of reach total). Abalone is mapped at the eastern end of the reach (17%), hardshell clam at the western end (17%), and a patch of geoduck is mapped near the center of the reach (8%).

Water Quality
The reach has no impaired water quality listings.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land usage in the shoreland area is timber (45%), vacant (21%), open space (20%), residential (12%), and lodging (1%). In general, the timber land is located in the eastern half of the reach. Land ownership within the reach is 85% private and 15% public.

Zoning and Parcel Data



Under current zoning regulations there is moderate potential for significant new development within the reach, particularly in the western end of the reach.

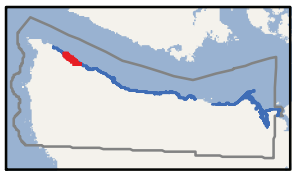
Public Access
85% of the shoreline in this reach is publicly owned; however, it cannot be accessed from land.

Impervious Surfaces
Less than 2% of the landward portion of the reach is covered by impervious surfaces.

Shoreline Modifications
A portion of shoreline armoring (4% of reach total), is mapped at the east end of the reach, near Sekiu. There are no other shoreline modifications mapped within the reach.

Contaminated Sites
There are no identified contaminated sites within the reach.

Cultural Resources
There are no inventoried sites within the reach.



REACH MR-17: Shipwreck Point

SHORELINE LENGTH
6.89 Miles

REACH AREA
156.91 Acres

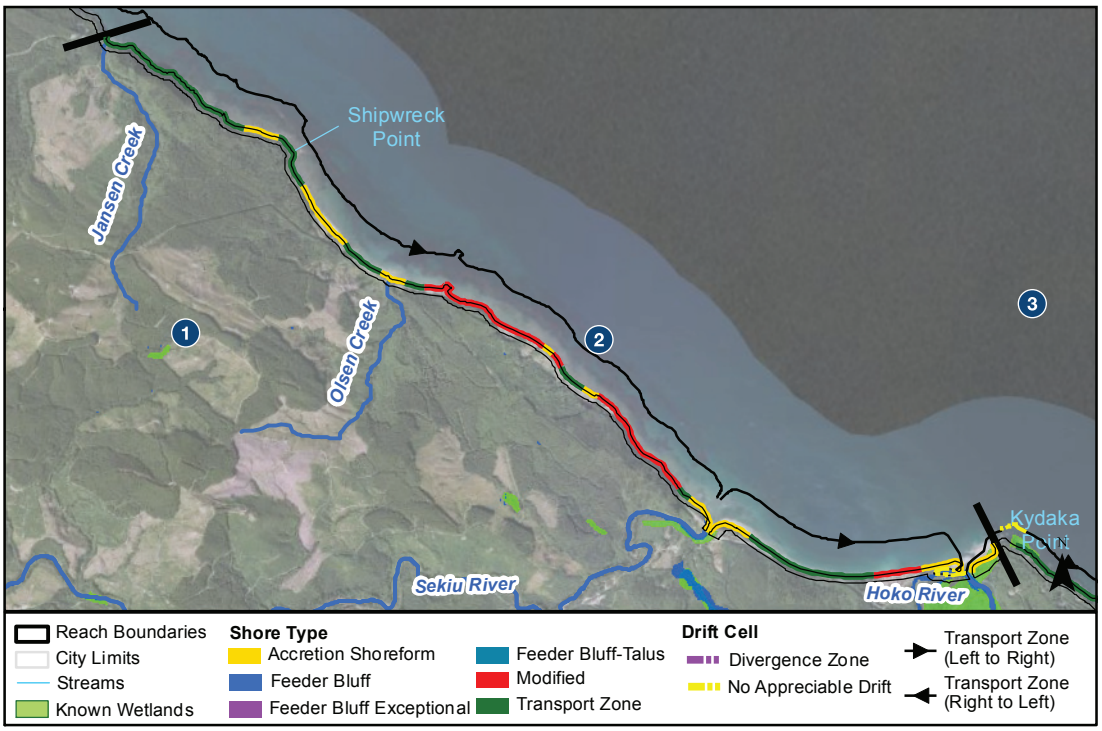
PSNERP PROCESS UNITS
SPU 1029

REACH SUMMARY

The "Shipwreck Point" reach extends from Kydaka Point to the Jansen Creek mouth, along the Strait of Juan de Fuca. The reach contains a diversity of shoretypes, including barrier beach, barrier estuary, bluff backed beach, and pocket beach. Net shore drift in the reach is entirely eastward. Nearly the entire eastern half of the reach is armored, which protected Highway 112. The shoreline contains dense concentration of submerged aquatic vegetation, which provides important habitat for marine species, including juvenile salmonids.

Land use within the shoreland area is predominantly timber, with other significant land uses being residential development, open space, and roads. Moderate- to high-density residential subdivisions are located in several locations within the reach. Many of these areas are located on low bank habitat, within tsunami and coastal flooding hazard areas. Most of the shoreline is publically owned, and can be informally accessed from Highway 112.

Under current zoning regulations, approximately one-third of the shoreland area has potential for new residential development. Most of the undeveloped parcels are located in a narrow strip of land between Highway 112 and the shoreline, within tsunami and floodplain hazard areas. In addition, given the shape and location of the parcels, shoreline armoring would likely be necessary to protect future structures.



Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

Rocky platforms are the most commonly occurring shoretype within the reach (45%). The remaining shoreline is comprised of barrier beaches (12%) and barrier estuary (13%) at the Hoko and Sekiu estuaries, bluff backed beaches (11%) between the estuaries, and a pocket beach in the western portion of the reach (20%). Geomorphic shoreforms in the reach are primarily transport zones (24%) and accretion shoreforms (29%). Most of the shoreline in the eastern half of the reach is mapped as modified (47%).

Net Shore Drift

Eastward net shore-drift occurs along the entire shore of the reach, from Jansen Creek just west of Shipwreck Point to Kydaka Point.

Hazard Areas

Several bluff areas in the reach are unstable (11%) no with recent slides. Most of the Sekiu and Hoko River shoreline areas are in a tsunami hazard zone (70%) and FEMA coastal and stream 100-year floodplains (28%).

REACH REACH MR-17: Shipwreck Point

Degree of Process Degradation
Within the reach, the erosion/accretion of sediment, freshwater input, and solar incidence processes have low degradation levels. The sediment input, sediment transport, detritus important and export, and exchange of aquatic organisms processes are moderately degraded.

ECOLOGY

Offshore Vegetation
Kelp is mapped throughout the reach (60%), and patchy eelgrass is mapped at the western end of the reach (19%).

Onshore Vegetation
36% of the shoreland area is mapped as forest habitat, 16% is mapped as natural shrub and herbaceous vegetation, and 36% is mapped as lawn/landscaping.

Habitats and Species
4% of the landward portion of the reach consists of wetland habitat, which is concentrated primarily at the Hoko and Sekiu river mouths. The designated priority habitat within the reach is bald eagle, and harbor seal (13.8%) near the center of the reach.. In addition, two marine mammal haulout areas are mapped in the reach.

No forage fish presence is mapped within the reach. Coho, chinook, and chum salmon; resident cutthroat trout; and steelhead are mapped in the streams within the reach.

The marine nearshore areas in the reach (Strait of Juan de Fuca) provide important habitat for a wide variety of marine species that utilize nearshore habitat, including several salmon and trout species.

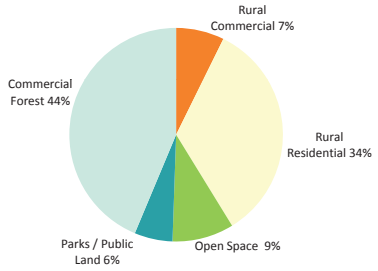
Shellfish
Red sea urchin is mapped throughout the reach (89%). Abalone is mapped in the eastern half of the reach (36%), and a patch of hardshell clam is mapped near the center (9%).

Water Quality
The portion of the Sekiu River within the reach has a State impaired water quality listing for temperature. Hoko River water quality is listed by Streamkeepers as "compromised" for B-IBI but "healthy" for WQI. The Sekiu River is listed as "compromised" for B-IBI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land usage in the landward portion of the reach is timber (40%), residential (20%), open space (12%), vacant (12%), roads (9%), lodging (5%), and commercial (0.3%). The western two-thirds of the reach is primarily timber land. Land ownership within the reach is 75% private and 25% public.

Zoning and Parcel Data



Under current zoning regulations there is moderate potential for significant new residential development within the reach.

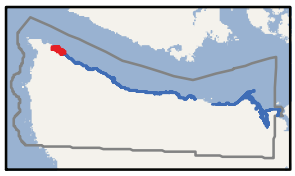
Public Access
84% of the shoreline in this reach is publicly owned and accessible from land. Shoreline access in the western and eastern portions of the reach is available from Highway 112; however, no dedicated parking areas are available. Washington State Parks recently acquired 1,000 acres near the Hoko Estuary, but no formal public access has been established.

Impervious Surfaces
Approximately 13% of the landward portion of the reach is covered by impervious surfaces.

Shoreline Modifications
A significant amount of shoreline armoring (40% of reach total) associated with SR 112 is mapped in the eastern portion of the reach. Three fish passage barriers (SR 112 culverts) are identified on Jansen Creek and two small, unnamed streams. Two docks are mapped near the center of the reach.

Contaminated Sites
A leaking underground storage tank is mapped near the center of the reach.

Cultural Resources
Three inventoried structures, including a motel structure along Chito Beach (built 1930) are inventoried for historic significance, but not listed. In addition, there are 4 inventoried pre-contact sites within the reach.



REACH MR-18: Rasmussen (Bullman Creek)

SHORELINE LENGTH
4.55 Miles

REACH AREA
119.24 Acres

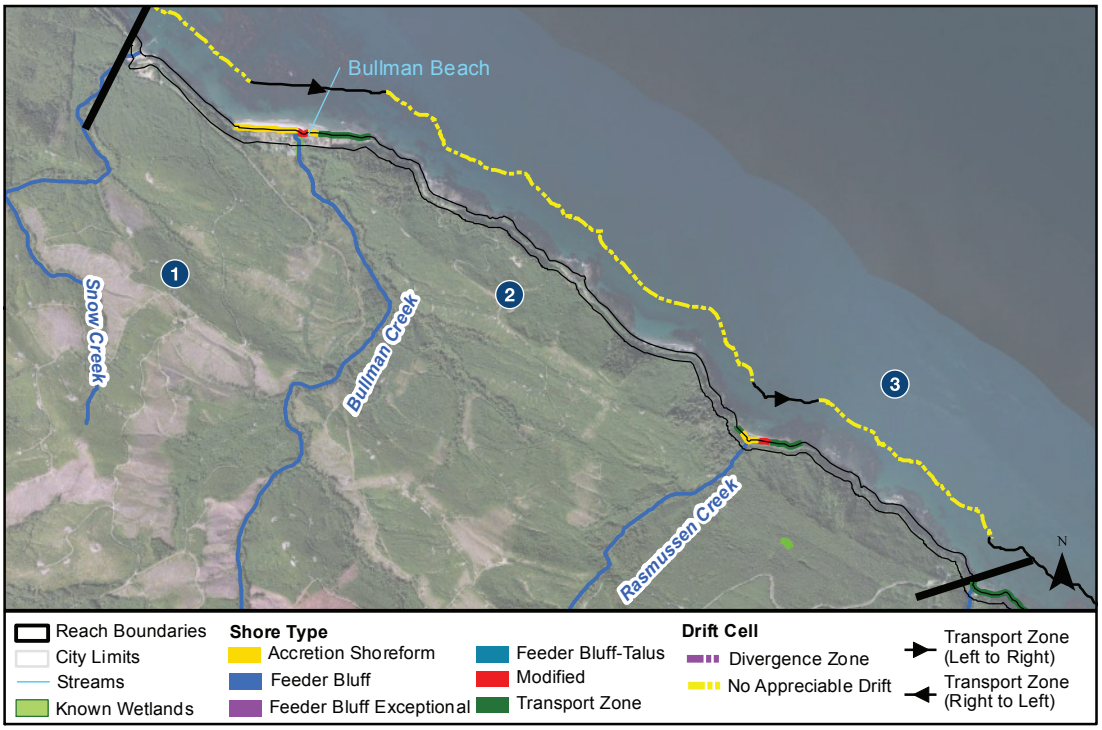
PSNERP PROCESS UNITS
SPU 1029 & 1100

REACH SUMMARY

The "Rasmussen (Bullman Creek)" reach extends along the Strait of Juan de Fuca from just west of the mouth of Jansen Creek to the Makah Tribe reservation boundary. The predominant shoretype within the reach is plunging rocky shoreline, with some intermittent pocket beaches. Most of the shoreline within the reach has no appreciable net shore drift. Two small segments of shoreline armoring and 1 dock are mapped in the western portion of the reach. Approximately half of the shoreland area within the reach is heavily forested, which provides habitat for a diversity of wildlife species. The nearshore areas have dense communities of submerged aquatic vegetation, which provides important habitat for marine species, including juvenile salmonids.

The predominant land usage within the reach is timber, with residential, lodging, and open space land at the west end of the reach. A high-density residential development is located at Bullman Beach. Nearly the entire shoreline is publically owned and accessible from land. Shoreline at the western end of the reach can be accessed from the Snow Creek boat launch.

Under current zoning regulations, approximately one-third of the shoreland area has potential for new residential development. However, most of this land is zoned for commercial forestry that is not eligible for subdivision. With the exception of a few undeveloped lots, the residential-zoned land at Bullman Beach is already fully developed. However, there is potential for an increase in shoreline armoring in this area.



Shoreline Oblique Photos (Ecology, 2005)

PHYSICAL CHARACTERISTICS

Shoreform and Shoretype

Shoretypes within the reach consist of rocky platform shores (80%) with intermittent pocket beaches (20%). Geomorphic shoreforms within the reach are transport zones (44%) and accretion shoreforms (44%) mapped in equal proportions. The remaining 11% of the reach is mapped as modified shores.

Net Shore Drift

Most of the shoreline within the reach No Appreciable Drift; however, eastward drift occurs along two beaches, both of which contain stream mouths (Bullman Beach and mouth of Rasmussen Creek).

Hazard Areas

Some slopes are mapped as unstable (33%) with recent slides mapped in the southeast portion of the reach and west of Bullman Creek (4%). Most of Snow and Bullman Creek shoreline areas are in in a tsunami hazard zone (47%) and the FEMA coastal and stream 100-year floodplains (48%).

REACH REACH MR-18: Rasmussen (Bullman Creek)

Degree of Process Degradation
Within the reach, the freshwater input, erosion/accretion of sediment, and solar incidences processes have generally low degradation levels. The sediment input, sediment transport, detritus import and export, and exchange of aquatic organisms processes are moderately degraded.

ECOLOGY

Offshore Vegetation
Kelp (80%) and patchy eelgrass (74%) is mapped throughout the reach (80%)

Onshore Vegetation
42% of the shoreland area is mapped as forest habitat, 19% is mapped as natural shrub and herbaceous vegetation, and 28% is mapped as lawn/landscaping.

Habitats and Species
1% of the landward portion of the reach is mapped as wetland habitat, which is located at the mouth of Bullman Creek. The designated priority habitats within the reach are bald eagle (11%) and harbor seal (7%) at the west end of the reach. A marine mammal haulout area is also mapped at the west end.

A small patch of forage fish habitat (smelt) is mapped near the mouth of Bullman Creek. Steelhead and Coho, chinook, and chum salmon are mapped within the streams in the reach.

The marine nearshore areas in the reach (Strait of Juan de Fuca) provide important habitat for a wide variety of marine species that utilize nearshore habitat, including several salmon and trout species.

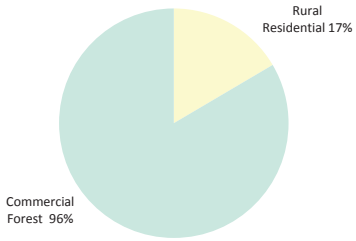
Shellfish
Red sea urchin (95% of reach total) and abalone (100%) are mapped throughout the reach. A patch of hardshell clam is mapped at the southern end of the reach (15%).

Water Quality
The portions of Rasmussen Creek and Snow Creek within the reach have State impaired water quality listings for temperature. Water quality within the streams is listed by the Streamkeepers as "compromised" for WQI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land usage in the shoreland area is timber (72%), roads (13%), residential (9%), vacant (3%), open space (3%), and lodging (0.4%). The eastern three-quarters of the reach contains almost entirely timber land. Land ownership within the reach is 89% private and 11% public.

Zoning and Parcel Data



Under current zoning regulations there is low potential for significant new residential development within the reach. Most of the undeveloped land is zoned for commercial forestry.

Public Access
99.7% of the shoreline in this reach is publicly owned and accessible from land. Shoreline at the western end of the reach can be accessed from the Snow Creek boat launch. Other portions of the shoreline can be accessed informally from Highway 112.

Impervious Surfaces
Approximately 13% of the landward portion of the reach is covered by impervious surfaces.

Shoreline Modifications
Portions of shoreline armoring (8% of reach total) are mapped in the western portion of the reach, at Bullman Beach and the mouth of Snow Creek. In addition, there is one overwater structure (dock) mapped at Snow Creek.

Contaminated Sites
There are no identified contaminated sites within the reach.

Cultural Resources
There are no inventoried sites within the reach.

5. NORTH OLYMPIC ECOSYSTEM: FRESHWATER SHORELINES

Newcomers to the north shores of the Olympic Peninsula often have trouble orienting themselves to a landscape where the mountains are south and the rivers[1] flow north. This is a landscape that drops from snowfields at 7,000 feet to sea level in 30 miles or less, resulting in swift and cold rivers that have produced salmon of legendary proportions (real and imagined). The steep drop and heavy winter precipitation of the Olympic Peninsula also creates dynamic rivers that can flood within hours of a heavy rain event, scouring the banks as they move through narrow valleys. In the summer the north Olympic Peninsula rivers look fairly tame, and many rivers and creeks can experience extreme low flow conditions. Summer streamflow in the large rivers depends largely on snowpack, but many local streams are fed primarily by groundwater and wetlands that store winter precipitation. Forest cover plays an essential part in moderating flows by intercepting precipitation, slowing runoff, retaining water, shading rivers (to keep water temperatures low), providing large woody structure and nutrients, and stabilizing banks. The riparian habitats along Clallam County freshwater shorelines also provide critical habitat for many fish and wildlife species, including many State-identified "priority species" (Table 5-1).

Table 5-1. Priority wildlife species mapped along Clallam County freshwater shorelines (Sources: WDFW, WDNR)

Terrestrial	Aquatic
Bald eagle	Coho salmon
Band-tailed pigeon	Chum salmon (fall and summer)
Elk	Pink salmon
Harlequin duck	Sockeye salmon
Peregrine falcon	Chinook salmon (fall and spring)
Red-tailed hawk	Steelhead (summer and winter)
Trumpeter swan	Cutthroat trout
Wood duck	Rainbow trout
	Dolly Varden/Bull Trout

[1] This report uses the terms river and stream interchangeably.

The people who live on the north Olympic Peninsula are very attached to their rivers. West end steelhead fishermen can tell if the river color is right with one glance, and long-time Dungeness farmers can judge the remaining snowpack by looking up at Mount Baldy in July. County residents also know that living in proximity to these rivers can be unpredictable, and fighting natural processes of flooding and channel migration is costly.

The information on freshwater resources in this report (Chapters 5 and 6) is generally confined to the rivers and streams in WRIA 17, 18 and 19 that fall within the jurisdiction of the Clallam County Shoreline Master Program. Rivers and streams are emphasized because there is only one lake in the study area that is a shoreline of the state—Lake Sutherland. The County's stream and river systems have been studied at length for salmon recovery and watershed management purposes, and this chapter does not attempt to repeat the extensive ecosystem analysis that is already available. Information in this chapter is intended to briefly describe ecosystem processes and summarize baseline conditions of the freshwater shorelines as they presently exist. The chapter also discusses shoreline management considerations-- how the placement of structures in and near the shoreline can affect ecosystem processes and impact downstream neighbors, water quality, and habitat formation in the future. A reach by reach description of the freshwater shorelines is contained in Chapter 6, covering shoreline development, public access, and species and their habitats.

5.1 *Overview of Freshwater Shorelines Ecosystem Processes*

Rivers and major creeks on the North Olympic Peninsula pass through a complex set of jurisdictions and land uses as they flow north from the Olympic Mountains and foothills to the Strait of Juan de Fuca. Freshwater areas that are designated as shorelines of the state along the north coast of Clallam County include the following (Figure 5-1):

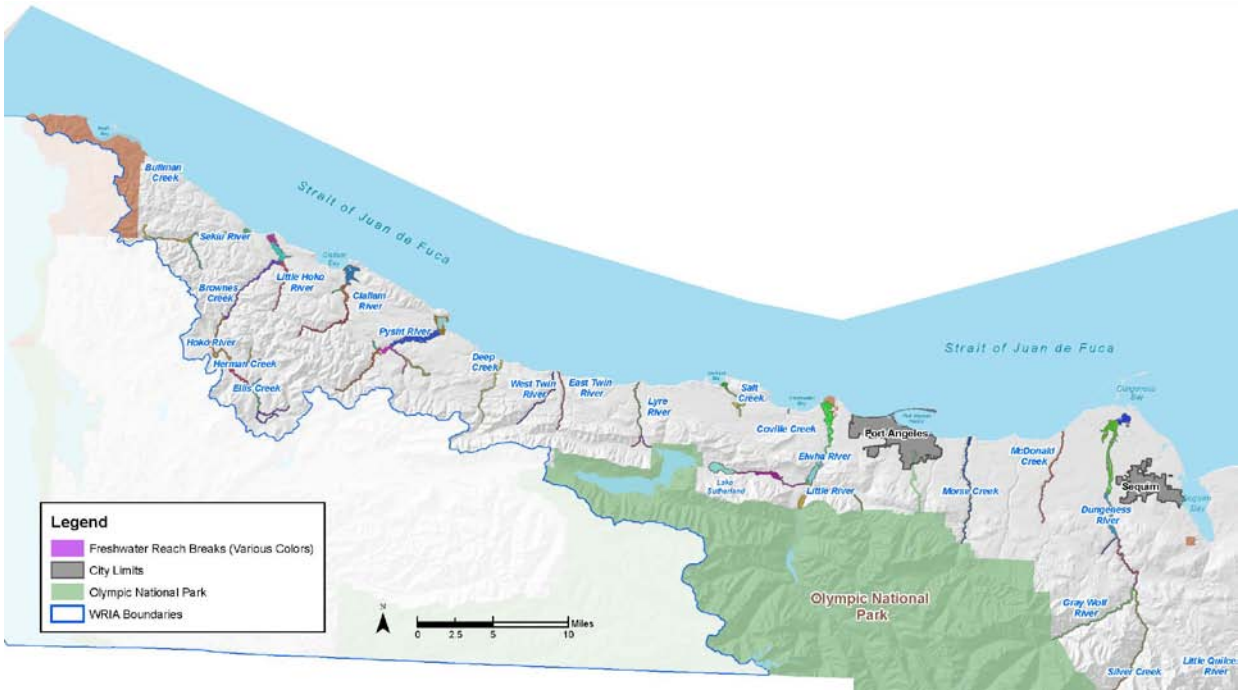


Figure 5-1. Freshwater shorelines of the North Olympic Coast in Clallam County

- East of the City of Port Angeles the shorelines of the state are located in the Dungeness, McDonald, and Morse Creek watersheds. These streams originate on federal lands, and pass through a checkerboard of state and private commercial forest lands before entering areas of dispersed or concentrated residential development and scattered agriculture.

- Similarly, the Elwha River originates in Olympic National Park, and passes through a mix of state and private forest land. The upper Glines Canyon dam is located inside of the National Park, and the lower Elwha dam is downstream of the park. The shoreline areas below the dams have scattered residential development, and portions of the Lower Elwha Klallam Reservation are located in the floodplain.

- Lake Sutherland, which is predominately surrounded by residential development, is drained by Indian Creek, entering the Elwha River at Lake Aldwell--above the lower dam.

- West of the Elwha watershed, land use is predominately forested. The streams that are large enough to be designated as shorelines of the state originate on federal, state, or private forest lands. There is limited residential development along the streams except near the river mouths. Shorelines of the state in the west of the Elwha include Colville Creek, Salt Creek, the Lyre River/Boundary Creek, East and West Twins, Deep Creek, and Pysht and Clallam River watersheds. West of Clallam Bay are the Hoko and Sekiu Rivers, and Bullman (Rasmussen) Creek.

- A small, upper watershed portion of the Little Quilcene River (tributary to Hood Canal) is located in Clallam County, but is within the Olympic National Forest boundary. There is no residential development potential in this reach.

5.2 *Processes Affecting Freshwater Shorelines*

As with nearshore areas, the health and functioning of freshwater shoreline systems is influenced to a large degree by the movement of water, sediment, nutrients, pathogens, and organic material (e.g., large wood) across watersheds. The freshwater streams and lakes of Clallam County are fed by surface water runoff and groundwater recharge. Precipitation is the primary source of groundwater recharge. Soil permeability and underlying geology influence the amount of precipitation that becomes surface runoff. In mountainous areas shallow soils tend to limit infiltration so water either travels laterally as shallow subsurface flow, or percolates to deep groundwater through cracks and fissures in the bedrock. River valleys in the lowlands tend to have deeper, porous soils that create favorable conditions for groundwater discharge. These areas can store large quantities of water in shallow aquifers (Cox et al. 2005). As a result, naturally functioning floodplains are important for maintaining healthy stream and river systems.

Soils in Clallam County vary from well drained to poorly drained (Clallam County 2011). Based on County soil maps (Figure 5-2), major areas with slow drainage occur around the Sequim/Dungeness Peninsula, near Joyce, and in the western portion of the County (outside of the study area of this report). Well-drained soils occur predominantly in the eastern end of the County, mostly along creeks and rivers.

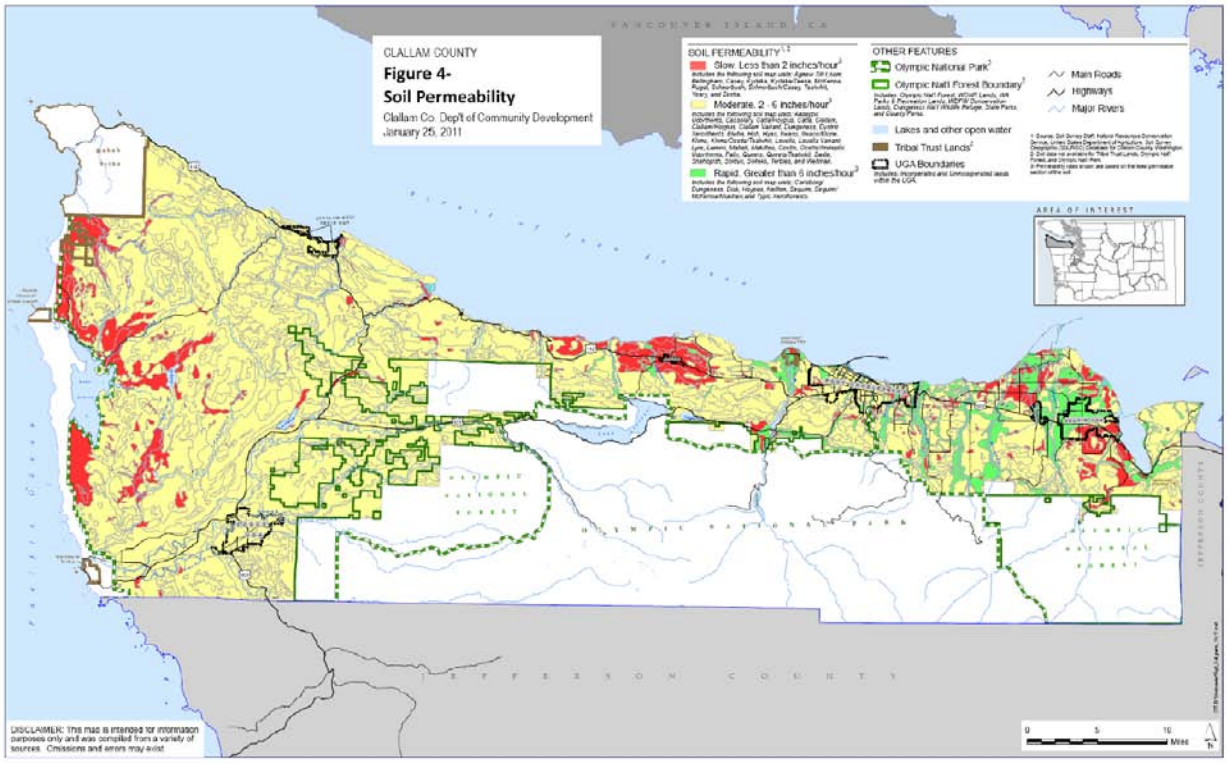


Figure 5-2. Soil permeability in Clallam County (from the Draft Comprehensive Stormwater Management Plan, 2011)

High runoff rates can be damaging to rivers, streams and lakes because they can erode banks, cause scour and contribute sediments and nutrients that harm water quality. On the North Olympic Peninsula, high runoff rates occur due to natural geologic conditions and climate factors. Projections by the University of Washington Climate Impacts Center indicate that runoff patterns in the Puget Sound region are likely to change in the next 50 years, with reduced snowpack and earlier runoff. Although overall levels of impervious surfaces in Clallam County are low, except in a few localized areas, these surfaces can block infiltration resulting in significant and measurable changes in flow.

Runoff rates also increase when surface water storage areas become disconnected from the hydrologic system. Reduced storage and connectivity occur as a result of dikes, revetments and/ or levees along stream channels; stream channelization; and floodplain and wetland fill. The loss of surface water storage potential can increase the magnitude and frequency of peak flows and can increase water level fluctuations in river and lake systems (Collins et al., 2003). In contrast, unaltered floodplains help to mitigate effects of increased runoff. Connected floodplains allow for overbank storage, which dissipates the erosive forces of the flood. Floodplains often contain important wetland and side channel habitats that serve as foraging, over-wintering, and refuge areas for fish (Swales and Levings, 1989; Bjornn and Reiser, 1991).

As with marine systems, sediment delivery and transport processes have a substantial effect on the health and sustainability of freshwater aquatic ecosystems. Surface erosion and landslides are naturally occurring mechanisms of sediment supply, but large amounts of sediment can have adverse effects on salmon and other species (Figure 5-3). Sediment can build up in stream

channels and reduce conveyance capacity, which can lead to flooding. Changes in stream morphology brought on by altered sediment supply-transport processes can also increase bank erosion and channel migration rates. Fine sediment can impact fish habitat quality and availability by causing turbidity or smothering spawning gravels. The Dungeness River is one area where the contribution of sediment to the river by landslides in the upper watershed is a major concern due to the potentially adverse impacts of this sediment to anadromous fish habitat (Bureau of Reclamation 2002). Conversely, the Elwha dams cut off sediment transport to lower portions of the river, starving the lower system of course gravels that form potential spawning areas and eliminating a portion of the sediment delivery to the nearshore of the Strait (Shaffer et al., 2008; Press et al., 2008).

Water flow and sediment dynamics can influence water quality processes in aquatic ecosystems. This is because water and sediment transports nutrients and pathogens from upland areas to receiving waters. For example, runoff from fertilized agricultural fields or residential areas can carry excess nitrogen and other nutrients to nearby streams or lakes. Fertilized areas that are also prone to erosion can be a major source of phosphorous pollution since phosphorus binds to sediment particles. Surface runoff is also believed to be a major transporter of bacteria and other pathogens, so areas that retain water and sediments such as wetlands, floodplains, permeable soils and forest cover are important areas for pathogen removal. The U.S. Environmental Protection Agency (2001) showed that standing water (in wetlands, for example) promotes pathogen removal through increased filtration and predation by other microbes.

Figure 5-3. Pacific salmon need healthy rivers for spawning, rearing and migration

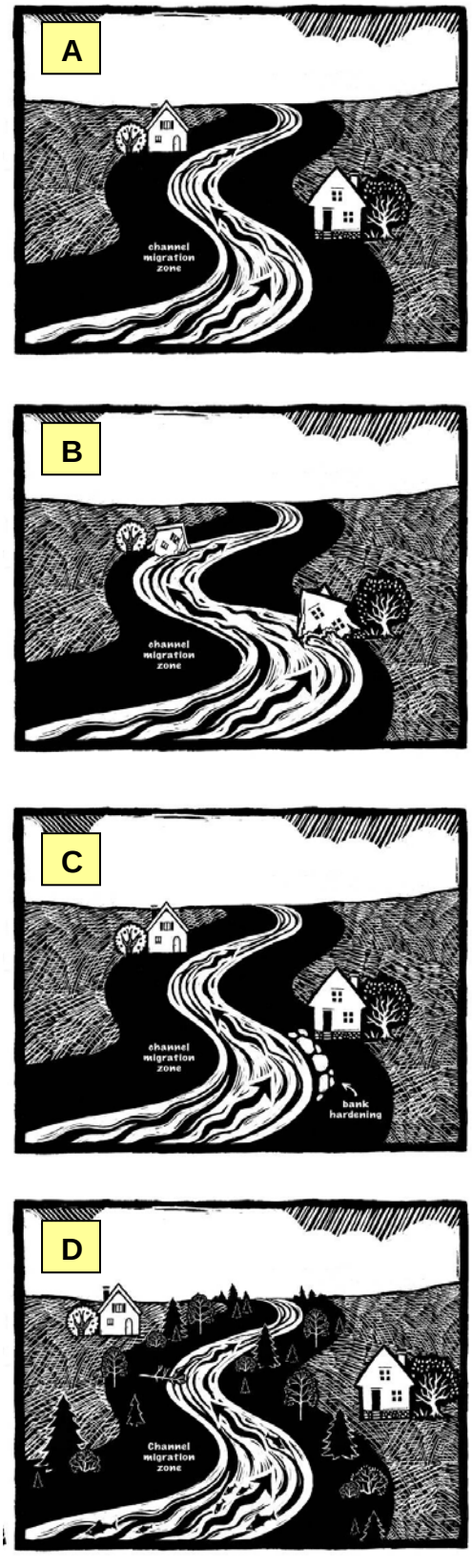
Water quality is a significant factor in maintaining suitable habitats for fish and other aquatic species. Salmonids, in particular, require water that is both colder and has lower nutrient levels than many other types of native fish. Dissolved oxygen (DO) is one of the most influential water

quality parameters for stream biota, including salmonids (Bjornn and Reiser, 1991). The most significant factor affecting DO levels in most streams is temperature, with cooler waters maintaining higher levels of oxygen than warmer waters. Other factors that can contribute to DO levels include water turbulence (the amount of aeration) and biochemical oxygen demand created by decomposition of nutrients. Nutrients may originate from human-induced sources such as fertilizers (both chemical and natural), leaking sewers and septic systems, municipal sewer discharge, pet waste, or from natural processes such as decomposing algae or dead plant materials that fall into streams (Lamb, 1985).

Organic material, including large woody debris, enters freshwater systems primarily via streambank erosion and treethrow/windthrow processes operating within roughly 200 feet of stream channels. These processes play a significant role in stream channel maintenance and in-stream habitat formation and are therefore critical to the heath of freshwater systems. Woody debris adds roughness to the stream channel, which slows water velocities and traps sediment (Shirvell, 1990). Because coniferous logs are slower to decompose, they generally provide more benefit as large woody debris than deciduous species (May et al., 1997). Riparian forest cover is the primary source of organic / woody debris. According to some studies more than half of all large woody debris recruitment is from within 25 feet of streams, and about 90 percent comes from trees growing within about 50 feet of streams (Murphy and Koski, 1989; McDade et al., 1990; Van Sickle and Gregory, 1990). In addition, for larger streams that are prone to avulsion (such as the lower Dungeness River), large woody debris can be recruited from distances much greater than 50 feet. For these reasons, forested riparian buffers are essential for healthy streams (Figure 5-3).

Riparian vegetation also provides food for salmonids, both directly and indirectly (Meehan et al., 1977). Insects falling from overhanging vegetation provide food for fish, while leaves and other organic matter falling into streams provide food and nutrients for many species of aquatic insects, which in turn provide forage for fish. Salmonids consume a wide range of food sources throughout their life cycles. Most juvenile salmonids that rear in streams prey on aquatic invertebrates and terrestrial insects that fall into streams from overhanging vegetation (Horner and May, 1999; May et al., 1997).

Figure 5-4. Large woody debris "recruited" from adjacent riparian forest (Photo: Dungeness River Audubon Center)



5.2.1 Channel Migration Zones

Channel migration is a natural process that has a dramatic effect on freshwater rivers and streams and the people who live near them (Figures 5 and 6). River channels naturally move across and sometimes outside of their mapped floodplains by eroding the outside banks of a meander bend, or through channel avulsion. This can create very hazardous situations for development within the channel migration zone (CMZ), which can be damaged or destroyed by gradual or sudden channel shifts (Figure 5-5b). Where vegetation along the river has been removed, the risk of channel migration is generally greater.

People often try to contain rivers within their channels by hardening the banks with riprap or other materials that resist erosion (Figure 5-5c). Bank hardening reduces the quality for the stream for salmon and other species and can accelerate the flow, transferring the erosive energy downstream and potentially creating problems for other property owners. Locating development outside of the CMZ and maintaining riparian vegetation along stream banks is a safer, less costly and ecologically preferred alternative (Figure 5-5d).

In general, the extent of a CMZ is difficult to accurately determine at a site- or parcel-scale; an in-depth study of an entire river reach by a professional hydrogeologist is required for accurate mapping. Some rivers in Clallam County have been analyzed by qualified professionals trained in CMZ mapping: the Jamestown S'Klallam Tribe (2008) mapped the Dungeness River and Ecology (2011) mapped several other river systems (Table 5-2). This existing CMZ mapping generally excludes commercial forestry-zoned lands, and is limited to the lower reaches of the studied rivers. The presence and extent of CMZs on other rivers within the County is unknown. Existing CMZ mapping is presented in Appendix B.

Figure 5-5a-d. Channel migration areas are potentially hazardous areas and development within these areas should be avoided to reduce safety risk and prevent ecological impacts (From the Dungeness Flood Hazard Management Plan; sketches by Amanda Kingsley, used with permission)

Figure 5-6. Dungeness River channel migration event (Photo: Randy Johnson)

Table 5-2. Clallam County streams with mapped channel migration zones

Stream	Mapping Source
Clallam River	Ecology (2011)
Deep Creek	Ecology (2011)
Dungeness River	Jamestown S'Klallam Tribe (2008)
East Twin River	Ecology (2011)
Herman Creek	Ecology (2011)
Hoko River	Ecology (2011)
Little Hoko River	Ecology (2011)
Lyre River	Ecology (2011)
Morse Creek	Ecology (2011)
Pysht River	Ecology (2011)
Seiku River	Ecology (2011)
West Twin River	Ecology (2011)

5.2.2 Evaluation of Freshwater Processes along the Strait of Juan de Fuca Tributaries

Freshwater processes have been thoroughly reviewed and documented watershed by watershed for most Strait of Juan de Fuca tributaries through salmon recovery plans and watershed management planning efforts.

The Department of Ecology and the Puget Sound Partnership evaluated the condition of all of the freshwater watersheds in the Puget Sound Basin in terms of water flow processes as part of the Puget Sound watershed characterization project (Stanley et al. 2010). This coarse-scale analysis considers the degree of importance that each sub basin has in performing natural hydrologic processes and the degree to which those processes have been impaired or altered by increased impervious surface, reduced forest cover, loss of wetlands, floodplain disconnection, etc.

The results provide a relative ranking of sub basins into one of three categories (Figure 5-7):

- Protection – these sub basins are highly important in terms of infiltration, recharge, water storage and other natural water flow processes and have minimal alteration. Protection of the existing conditions is a high priority.

- Restoration – these sub basins areas are also very important to natural hydrology, but have experienced alteration. Restoration in these areas could help to increase ecological process and functions.

- Development – these sub basins are less important—on a relative scale—for hydrology processes and they have been moderately to highly altered. Development in these areas would generally have less impact on hydrology than in either of the other two categories.

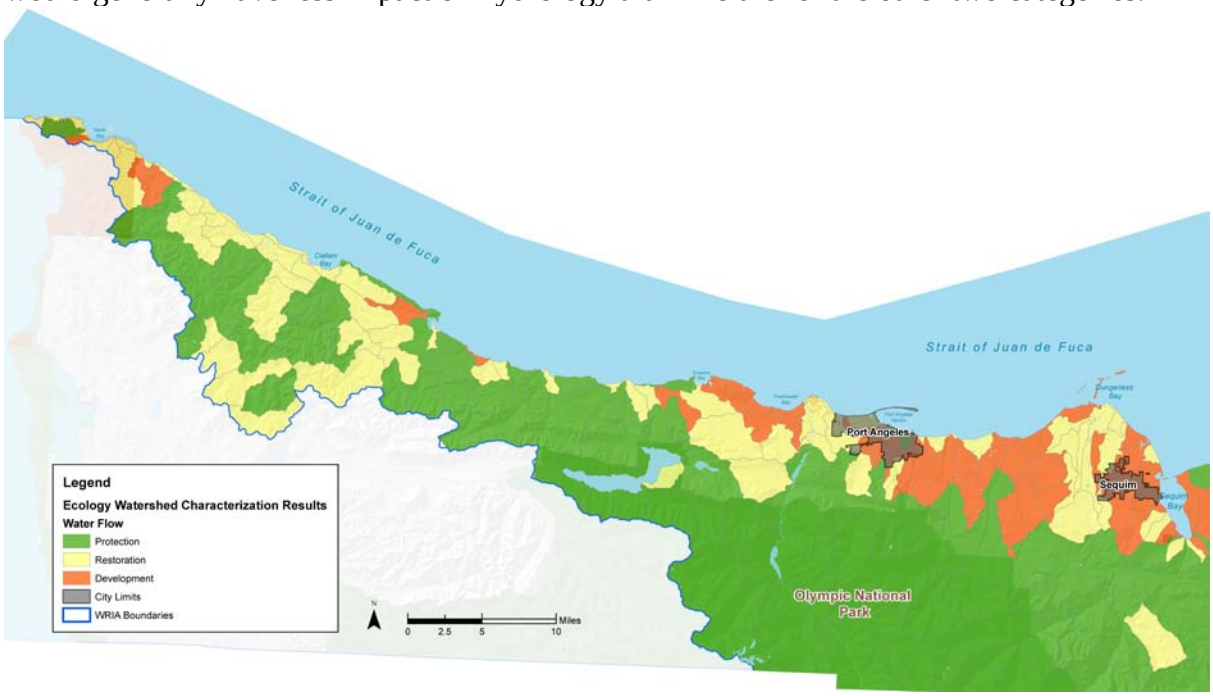


Figure 5-7. • Ecology's relative ranking of the water flow processes for each sub basin draining to the Strait of Juan de Fuca

- In Clallam County most of the lowland sub basins are in the protection or restoration categories. A few of the sub basins around Sequim Bay, McDonald Creek, Morse Creek, and Freshwater Bay are considered to be more appropriate for development given existing levels of alteration. However, development within these sub-basins may negatively impact valuable fish and wildlife habitats.

5.3 *Establishing a Baseline to Measure and Track Freshwater Ecological Functions*

As noted in Chapter 3, shoreline master programs regulate development actions, which can affect shoreline processes, structure and functions. As an example, an SMP can regulate how much streamside vegetation must be retained on a parcel slated for development. The amount of vegetation will have a direct influence on the stability of the streambed and banks, which can affect the quality of the spawning habitat, which has a direct effect on the productivity of the salmon runs in that watershed (Figure 5-8). This basic model applies to a wide range of actions—meaning that many different ecological functions are affected by human actions and therefore have a direct link to SMP decisions. As a result, SMP decisions can lead to increases or decreases in ecological functions over time.

Figure 5-8. Relationship between vegetation retention regulations and salmon production in freshwater rivers and streams

In order to document existing functions and track changes that occur over time, a set of measurable **indicators** is needed to help determine if ecological functions are increasing, decreasing, or remaining the same. The set of indicators must be specific enough to be tallied in a reliable and systematic way, using available data from existing sources. Table 5-1 contains a set of suggested indicators that could be used to assess ecological function of Clallam County's freshwater shorelines. Measuring these indicators over time would provide an indication of whether, how and to what degree shoreline conditions and functions are changing. The changes could then be reviewed in light of shoreline management decisions to determine if the shoreline master program is achieving no net loss. The Puget Sound Partnership has identified a similar set of indicators to determine how efforts to restore, protect and prevent pollution in Puget Sound are going (see http://www.psp.wa.gov/pm_dashboard.php for more information).

The text that follows Table 5-3 describes current freshwater shoreline conditions in terms of these indicators[2] (along with some related pertinent information). Some of the indicators illustrate the intrinsic quality of the shoreline environment and other indicators are measures of

[2] There are no indicators at this time for Lake Sutherland

the degree of shoreline alteration. Readers are invited to suggest other indicators in addition to or in place of the ones suggested here.

Table 5-3. Suggested indicators of freshwater ecological function that can be systematically tallied using existing data for Clallam County

Metrics that Indicate Shoreline Quality	Why Selected?
▪ Salmonid stock status (Table 5-3) ▪ Percent of reach area within 200 feet of the ordinary high water line with closed canopy forest (Table 5-4).	▪ Salmon species a culturally and economically significant species that require a wide range of freshwater habitats for spawning, rearing, and migration. Increasing the amount and quality of available habitat is a major goal. ▪ Streamside vegetation has a major influence on stream health. It provides habitat for wildlife, stabilizes streambanks, provides a source of large woody debris and organic matter, and provides shade to lower stream temperatures.
Metrics that Indicate Shoreline Alteration	**Why Selected?**
▪ Percent of stream channel with levees or revetments (Table 5-5). ▪ Percent of impervious surface within shoreline jurisdiction (Table 5-6).	▪ Impervious surfaces adversely reduce infiltration which can impact groundwater recharge, stream baseflows, instream fauna and other functions. ▪ Levees disconnect stream channels from their banks can cause loss of beach and backshore habitat which important areas for forage fish spawning. Armoring also affects movement of materials and organisms between the riparian and the aquatic zone or alter natural drainage patterns.

Freshwater rivers and streams in Clallam County are vital to the health of many Puget Sound salmon stocks, including Chinook salmon, summer chum salmon, bull trout and steelhead, which are listed as threatened under the federal Endangered Species Act (Table 5-4, Map 3 in Appendix A). Historically, the basins of the Dungeness, Elwha, and Lyre rivers and Morse Creek were among the most productive of the north Olympic coast (NOPLE Strategy available at http://www.noplegroup.org/nople/pages/strategy/PrioritizedWatersheds.htm). These and other basins have experienced significant declines in stock productivity likely caused by habitat loss, harvest practices, and changes in ocean conditions. The Sekiu, Clallam, Pysht, Twin, Hoko, Deep Lyre-Crescent basins are all at risk of losing one or more runs of Chinook, chum and/or coho salmon (Table 5-4). The shoreline master program can play a role in helping to revise these trends by promoting effective land use practices, requiring mitigation to offset potential habitat impacts and encouraging restoration to improve the amount and quality of freshwater salmon habitat.

Table 5-4. Summary of salmon stock status for North Olympic Coast rivers in Clallam County (from NOPLE 2005, adapted to correspond to SMP study area)

Geographical Unit (Revised 15June03)	No. of Stocks or Stock Component on a Historic Basis	Critical and Extirpated Stocks		Current *Known* Trends as per NOP TRG		Specific Stocks at Risk of Extirpation as per NOP TRG
		Crit.	Ext.	Healthy or Depressed but Declining	Critical and Declining	
Central Strait Clallam Independents (McDonald, Siebert, & Bagley)	4		Fall chum	Fall coho, winter steelhead		Coho
Clallam Basin	4	Fall chum				Chum
Deep Basin	1	Fall chum			Fall chum	Chum
Dungeness Basin	11	Spring/ summer chinook, fall pink, summer steelhead			Fall pink, summer steelhead	
E&W Twin Basins	4	Fall chum		Fall coho, winter steelhead	Fall chum	Chum
Eastern Strait Clallam Independents (Bell, Gienn, Cassalery, Cooper, Meadow brook)[1]	1					Coho
Elwha Basin	10	Summer pink, fall chum	Spring/ summer Chinook	Summer/fall Chinook bull trout	Summer pink, fall chum	
Ennis Basin	3		Fall chum	Fall coho		
Goodman Complex (Cedar, Goodman, Mosquito)	1	Unknown	Unknown			

Geographical Unit (Revised 15June03)	No. of Stocks or Stock Component on a Historic Basis	Critical and Extirpated Stocks		Current *Known* Trends as per NOP TRG		Specific Stocks at Risk of Extirpation as per NOP TRG
		Crit.	Ext.	Healthy or Depressed but Declining	Critical and Declining	
Hoko Basin	5	Fall chum				Chum
Jimmy Come Lately	4	Summer chum			Summer chum	Chum, coho
Lyre-Crescent Basin	5	Fall coho		Fall chum		Chum
Morse Basin	8	Fall coho, summer pink, fall chum	Spring/ summer Chinook			
Nearshore	124+	24+	7+	16+	11+	See basins
Pysht Basin	5	Summer/ fall Chinook		Fall chum		Chinook
Salt Basin	4					
Sekiu Basin	5	Summer/ fall Chinook, fall chum				Chinook, chum
Sequim Bay (Johnson, Chicken Coop, Dean)[2]	3			Fall coho		
Western Strait Clallam Independents (Village east to Colville Creek)[1]	4	Fall coho, fall chum			Fall coho, fall chum	Coho, chum

Salmon and other aquatic organisms rely on processes sustained by the dynamic interaction between the stream and the adjacent riparian area (Naiman et al., 1992; Naiman et al, 2000; Opperman et al., 2011). Riparian forest cover has a major impact on stream functions, as described above. In Clallam County, most streams have fairly high percentage of forest cover within 200 feet of the ordinary high water line (Table 5-5). This is especially true of the rivers in

western Clallam County. The lower reaches of the Clallam River, Dungeness River, Elwha River and Salt Creek have less forest cover in the riparian zone than most other reaches.

Table 5-5. Acres of closed canopy forest within 200 feet of the ordinary high water line (Data from Point No Point Treaty Council 2011)

Reach Name	Acres of Riparian Forest within 200' Shoreline	Total Acres of Reach	% of Riparian Forest
Bear_Cr_01	121	130	93%
Boun_Cr_01	54	55	99%
Brow_Cr_01	10	13	75%
Bull_Cr_01	11	18	58%
Cany_Cr_01	71	77	91%
Char_Cr_01	30	42	72%
Clal_Rv_01	59	110	53%
Clal_Rv_02	19	30	64%
Clal_Rv_03	31	89	35%
Clal_Rv_04	291	322	90%
Covi_Cr_01	15	15	100%
Deep_Cr_01	258	280	92%
Dung_Rv_01	15	45	33%
Dung_Rv_02	114	263	43%
Dung_Rv_03	83	175	48%
Dung_Rv_04	238	250	95%
Dung_Rv_05	326	330	99%
Dung_Rv_06	170	170	100%
Elli_Cr_01	35	44	79%
Elwh_Rv_01	104	214	49%
Elwh_Rv_02	51	147	34%
Elwh_Rv_03	68	102	67%
Etwi_Rv_01	201	216	93%
Gray_Rv_01	375	392	96%
Gree_Cr_01	27	33	83%
HERM_CR_01	51	84	61%
HERM_CR_02	37	55	68%

Reach Name	Acres of Riparian Forest within 200' Shoreline	Total Acres of Reach	% of Riparian Forest
HOKO_RV_01	36	44	81%
HOKO_RV_02	66	115	57%
HOKO_RV_03	264	319	83%
HOKO_RV_04	64	103	63%
HOKO_RV_05	185	246	75%
HOKO_RV_06	131	179	73%
HOKO_RV_07	110	150	73%
HOKO_RV_08	90	117	77%
HOKO_RV_09	105	124	85%
INDI_CR_01	174	238	73%
LAST_CR_01	2	3	67%
LHOK_RV_01	149	211	71%
LITT_RV_01	111	115	96%
LYRE_RV_01	171	187	91%
LYRE_RV_02	65	65	100%
MCDO_CR_01	242	350	69%
MORS_CR_01	274	424	65%
NBHE_CR_01	43	52	82%
NFSE_RV_01	206	244	84%
OLDR_CR_01	13	24	56%
PYSH_RV_01	60	92	65%
PYSH_RV_02	189	264	72%
PYSH_RV_03	41	69	60%
PYSH_RV_04	183	251	73%
ROYA_CR_01	17	17	100%
SALM_CR_01	25	47	52%
SALT_CR_01	9	37	24%
SALT_CR_02	158	183	86%
SBLI_RV_01	69	70	100%
SEKI_RV_01	178	272	66%

Reach Name	Acres of Riparian Forest within 200' Shoreline	Total Acres of Reach	% of Riparian Forest
SFPY_RV_01	44	67	66%
SFPY_RV_02	116	145	80%
SFSE_RV_01	114	124	92%
SILV_CR_01	34	34	100%
SUTH_LK_01	1	3	39%
WTWI_RV_01	206	256	80%
Grand Total	**6,623**	**8,695**	**76.2%**

The interaction of a stream with its adjacent riparian area is adversely affected by stream bank modifications such as levees and revetments. Levees and revetments are typically constructed to constrain channels and/or prevent flooding. Although not known to be widespread in Clallam County (Table 5-6), levees and revetments restrict channel movement and can concentrate flow, which alters the natural morphology and reduces instream habitat value. Levees on the lower Dungeness River, for example, have been implicated as contributing to declining salmon runs (Recommended Restoration Projects for the Dungeness River, 1997; Limiting Factors Analysis WRIA 18, 1999; Summer Chum Initiative, 2000). Avoiding and minimizing the need for new levees and revetments will be an important element of the County's overall no net loss strategy

Table 5-6. Acres and Number of Revetments and Levees on SMP streams in WRIA 17, 18 and 19 streams in Clallam County by reach (no systematic data available; estimates are from Clallam County staff and local experts)

	Revetments / Levees	
Freshwater Reach	**ACRES**	**COUNT**
Dungeness River Reach 01	7.1	2.0
Dungeness River Reach 02	4.8	1.0
Dungeness River Reach 03	6.7	5.0
Elwha River Reach 01	14.6	22.0
Elwha River Reach 03a	7.3	2.0
Little River Reach 01	3.9	1.0
Morse Creek Reach 01	3.7	4.0
Pysht River Reach 01	18.6	3.0
Grand Total	**66.8**	**40.0**

Minimizing new impervious surfaces can also help to maintain ecological functions in freshwater streams. Currently, there is relatively little impervious cover within 200 feet of most freshwater

streams in Clallam County (Table 5-7). This means that infiltration and recharge processes are largely intact in these areas, which helps to maintain hydrologic, water quality and habitat functions. Exceptions to this are the upper reach (Reach 3) of the Clallam River, Lake Sutherland and the lower reach of Morse Creek (Reach 1). These areas have roads near the shoreline, so the levels of impervious surface areas are ~10 percent or more.

Table 5-7. Impervious surface area as a percent of the shoreland jurisdictional area for streams in WRIA 17, 18 and 19 streams in Clallam County by reach (From National Land Cover Data Set)

Freshwater Reach	Percent Impervious Area (excludes aquatic areas)
Bullman Creek Reach 01	5.0%
Canyon Creek Reach 01	1.1%
Charlie Creek Reach 01	0.9%
Clallam River Reach 01	3.0%
Clallam River Reach 02	4.9%
Clallam River Reach 03	15.0%
Clallam River Reach 04	1.3%
Deep Creek Reach 01	0.5%
Dungeness River Reach 01	2.4%
Dungeness River Reach 02	3.0%
Dungeness River Reach 03	6.1%
Dungeness River Reach 04	0.3%
East Twin River Reach 01	0.8%
Elwha River Reach 01	0.6%
Elwha River Reach 02	3.7%
Elwha River Reach 03	7.9%
Green Creek Reach 01	0.0%
Hoko River Reach 01	2.4%
Hoko River Reach 02	1.6%
Hoko River Reach 03	1.3%
Hoko River Reach 04	1.1%
Indian Creek Reach 01	5.8%

Freshwater Reach	Percent Impervious Area (excludes aquatic areas)
Lake Sutherland Reach 01	18.1%
Little River Reach 01	0.7%
Lyre River Reach 01	1.3%
McDonald Creek Reach 01	2.4%
Morse Creek Reach 01	9.8%
Pysht River Reach 01	0.2%
Pysht River Reach 02	4.1%
Pysht River Reach 03	5.7%
Pysht River Reach 04	2.1%
Salt Creek Reach 01	2.3%
Salt Creek Reach 02	1.5%
Sekiu River Reach 01	7.5%
Grand Total	3.5%

5.4 *General Management Considerations for Freshwater Shorelines*

Human development has changed the freshwater shorelines of the North Olympic Peninsula—dams, water diversions, bank armoring, bridges, roads, pavement, home building, and vegetation removal have altered freshwater ecosystem processes. Future use and development of freshwater shorelines may restore ecosystem processes as recovery plans are implemented. At the same time, continued development will put additional pressure on freshwater ecosystems. Some of the future issues and management considerations that are common to multiple areas of the Clallam County freshwater shorelines include the following:

1. Conversion of forest land and removal of existing forest cover along the river corridors may degrade habitat, reduce water quality, alter flow patterns, and destabilize river banks.

    - Limit the removal of forests and other natural vegetation communities within the watershed, and particularly within the channel migration zone of the river. Riparian vegetation helps stabilize eroding river banks, and provides habitat and shade for fish and wildlife.

    - Reforest riparian corridors and floodplain areas to increase stream bank integrity, reduce bank erosion, maintain organic inputs to streams and maintain habitat connectivity.

2. Placement of structures in floodplains, channel migration zones, and landslide hazard areas increases the risk to human health and safety, adversely alters water quality and flows, degrades habitat, and increases the risk of downstream flooding and erosion.

    - To protect property, human health and safety, and the ecological health of streams, avoid development in floodplains and channel migration zones.

    - Limit the construction of levees and other types of hard armoring along stream banks. Armoring degrades riparian habitat, and may increase erosion potential downstream.

    - Explore opportunities for land acquisition and easements to remove development or potential development in flood hazard areas including floodplains and channel migration zones.

3. There is significant restoration potential for reforestation, placement of large woody debris, barrier removal, and other restoration projects in many watersheds as outlined in detail in the NOPLE strategy and individual watershed recovery plans. These include:

    - Use LWD to improve habitat quality by restoring pool/riffle structure and forage/cover habitat. Properly designed LWD also reduces the potential for channel incision problems.

    - Protect and restore habitat connectivity where feasible by setting back or removing fill, levees, or other barriers to historic floodplain areas, former meanders, wetlands, and estuarine river deltas.

    - Identify and replace fish barriers and barrier culverts within identified watersheds. Eliminate road, culverts, or other land uses that cause mass wasting events.

    - Reforest riparian and floodplain areas to increase stream bank integrity and reduce bank erosion. Reforest unutilized pasture areas and degraded riparian/floodplain areas.

    - Explore possibility of habitat acquisition and/or easements to protect high quality riparian and floodplain estuarine habitats.

4. Regulations for SMP areas overlap with the Critical Areas Ordinance and required setbacks vary in their effectiveness.

    - Setbacks from the Ordinary High Water Mark may not sufficiently protect landowners from channel migration, resulting in flood hazards, non-conforming uses, and restrictions on rebuilding or expansion.

    - Regulations should be streamlined to allow landowners to move structures back from the channel migration zone, if feasible.

    - Provide landowners with accessible information about potential flood/erosion hazards and other potential development issues along freshwater shorelines.

6. FRESHWATER REACH SUMMARY

This chapter describes the freshwater shorelines that are within the jurisdiction of the County's SMP (in WRIAs 18, 19, and a portion of 17, excluding incorporated areas) (see Figure 5-1 for the reach locations). The 39 streams and 1 lake are described in terms of their physical attributes, ecological condition, and human environment / land use characteristics. Maps are provided in Appendix A.

Based upon available County-wide data sources, key physical, ecological, and land use characteristics for each reach are detailed on "reach sheets," located at the end of this section. A description of the available data sources, including data limitations, is presented in the "reach sheet explainer" following this chapter.

The reach descriptions below contain a summary of the data presented within the reach sheets and additional pertinent information, including potential future land use impacts to shoreline processes and management issues and opportunities.

6.1 *Little Quilcene River (Maps 1a to 6a in Appendix A)*

The Little Quilcene River originates on the north side of Mount Townsend in Olympic National Forest, in the southeast corner of Clallam County (Cascadia 2003). The river flows in a southwesterly direction through Jefferson County and empties into Hood Canal at Quilcene Bay. Of the portion of the Little Quilcene River within Clallam County, 1.3 miles is considered a "shoreline of the state."

There is minimal existing information regarding habitat conditions of the upper Little Quilcene River. The upper watershed is forested and located on National Forest land. The portion of the riparian corridor within County's jurisdiction is primarily National Forest land, with a lesser amount of private timber land. The large tracts of continuous forest land within the watershed provide important wildlife habitat, and the riparian forest cover helps maintain cool water temperatures and provides large woody debris inputs to the stream channel.

The upper portion of the river provides habitat for resident cutthroat trout. Anadromous fish passage to the upper river is blocked by a natural falls at RM 7.0 (Correa 2002). Within Clallam County, there are no known shoreline modifications or water quality issues identified on the river.

Under current zoning regulations, there is no potential for parcel subdivision or residential development within the stream corridor.

6.2 *Dungeness River and Tributaries (Maps 1a to 6a in Appendix A)*

The Dungeness River headwaters are in Olympic National Park and Olympic National Forest, in Jefferson County. The watershed area is approximately 250 square miles. Major tributaries include the Gray Wolf River, Royal Creek, Silver Creek, and Gold Creek in the upper watershed, and Beard, Hurd, Canyon, and Matriotti Creek in the lower watershed.

The Dungeness River is classified as a "shoreline of the state," and the portion within County jurisdiction is divided into 6 reaches (26.0 miles total). Four of its tributaries within the County are also shorelines of the state under County jurisdiction (1 reach each): Royal Creek (0.3 miles), Silver Creek (0.7 miles), Gray Wolf River (8.3 miles), and Canyon Creek (1.7 miles). The Gray Wolf River, Royal Creek, and Silver Creek are largely located in Olympic National Forest.

6.2.1 Summary of Baseline Conditions

The Dungeness River is relatively short (31.9 miles) and steep; its average slope is 3.3 percent in the upper half, flattening to 1.0 percent in the lower half (Bountry et al. 2002). The upper Dungeness (defined as upstream of the Gray Wolf River confluence) contains steep, unstable canyon slopes and high flow velocities, which carries gravel, large boulders, and large woody debris downriver (Entrix 2005). Emerging from its upper watershed, approximately 11 miles above its mouth, the river slows and drops its load of sediment as it flows north through an extensive, flattened middle watershed and a broad lowland plain. The river drains into Dungeness Bay, east of Graveyard and Cline spits. Tidal influence extends approximately 0.9 miles up the river.

The lower river channel is not confined by canyon walls, and has noncohesive bank material of sand and gravel (Entrix 2005). As such, the lower river meanders and can shift channels dramatically during floods, with recorded channel migrations of hundreds of feet during a single flood event (Clallam County 2009).

Upstream from RM 10.8 (confluence with Canyon Creek), the watershed and riparian corridor of the Dungeness River and its tributaries consists almost entirely of forest habitat. Forest cover dramatically decreases downstream, as the river flows through residential developments and agricultural lands. Downstream from RM 10.8, the width of the forested riparian corridor varies from 0 to approximately 500 feet (Figure 6-1).

The Dungeness River watershed supports breeding populations of bald eagle, harlequin duck, peregrine falcon, red-tailed hawk. Significant wetland habitat is present in the floodplain of the lower Dungeness; however, much of the historic wetland habitat has been drained and/or filled by agriculture and development activities. Wetland habitat is generally absent in the upper, steeper portion of the watershed.

The Dungeness and Gray Wolf rivers provide spawning and rearing habitat for Chinook and coho salmon, and two distinct steelhead runs (Table 6-1). The rivers also provide spawning habitat for pink salmon: a lower-spawning fall run, and a summer run which spawns in the Grey Wolf and the upper Dungeness. The Dungeness is also located within the designated unit for Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon, which listed as threatened under the Endangered Species Act. All of the streams in the Dungeness watershed provide habitat for resident cutthroat and rainbow trout.

Two fish hatcheries operated by WDFW are located on the Dungeness River: the Dungeness Hatchery at mainstem river mile 10.6 and the Hurd Creek hatchery, a satellite facility located on a lower river tributary. The two hatcheries are managed jointly to produce coho salmon for release into the Dungeness River, maintain a small run of locally adapted hatchery steelhead,

supplement late-timed (lower river spawners) wild pink, supplement wild Dungeness Chinook production, and incubate Chinook eggs for the Elwha River.

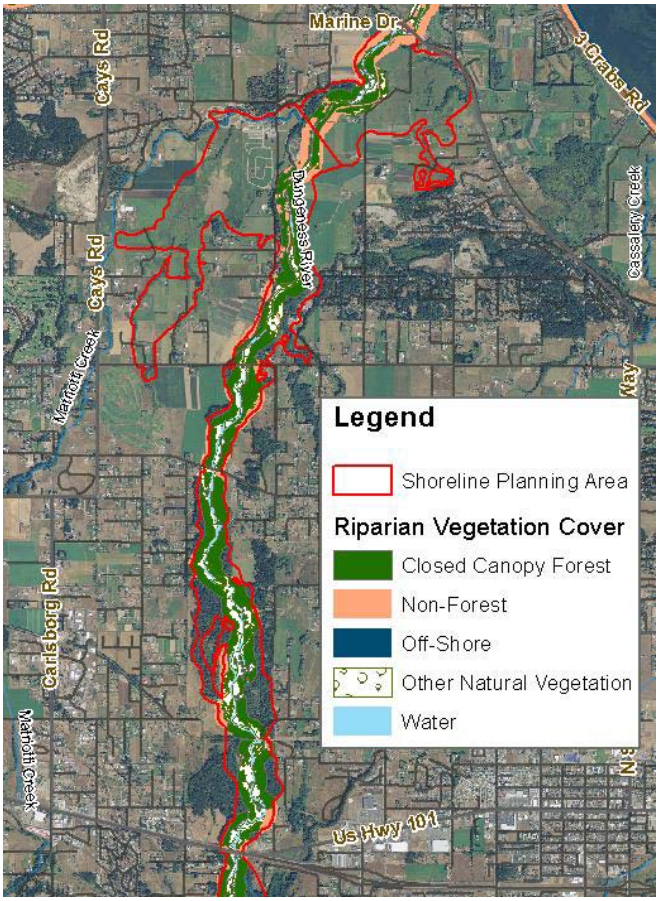


Figure 6-1. Riparian vegetation cover along the lower Dungeness River.

Table 6-1. Regulatory Status of Dungeness Salmonids, 2011

Dungeness Salmonids	Federal status under the Endangered Species Act	WA State/Tribal status under the Salmon and Steelhead Stock Inventory & Assessment
Chinook	Threatened (Puget Sound Chinook)	Critical
Chum	Summer chum threatened (Hood Canal/Strait of Juan de Fuca summer chum) (population viability unknown in Dungeness)	Summer depressed Fall unknown
Coho		Depressed
Pink		Upper – Critical Lower – Depressed
Steelhead	Threatened (Puget Sound DPS)	Summer/Winter Depressed

Dungeness Salmonids	Federal status under the Endangered Species Act	WA State/Tribal status under the Salmon and Steelhead Stock Inventory & Assessment
Cutthroat/Dolly Varden		Unknown
Bull trout	Threatened	Unknown

The upper reaches of the Dungeness River are located in Olympic National Forest and Olympic National Park. The lower 11 miles of the Dungeness watershed contains mixed use of timber, agriculture and rural residential development.

While commercial agriculture still occurs in the lower Dungeness watershed, there has been substantial conversion of agricultural land to dispersed rural and retirement development and urbanization. Urbanization in and around the City of Sequim has changed water and land use through increased impervious surfaces, reduced aquifer recharge, increased runoff, and increased withdrawal from the Dungeness area aquifers. The City of Sequim uses groundwater as a source of the municipal water supply, but an infiltration system to withdraw water from the Dungeness River at RM 10.8 is maintained as a back-up supply. Land and structures near the active river channel and its floodplain are periodically threatened by erosion and flooding. The Dungeness River Flood Plan (2009) states that residential developments along River's End Road, Kaiser Road, and Kinkade Island present exceptional risks to property damage and human safety. Another area of potential catastrophic risk is the area behind the US Army Corps of Engineers Levee, which is in jeopardy of being overtopped at 100-year flood levels. The US Army Corps of Engineers, in partnership with Clallam County, are currently engaged in a levee setback feasibility study along the lower 2.6 miles of the river. The Jamestown S'Klallam Tribe is leading a concurrent effort to plan for channel and floodplain restoration with the levee setback. Details about the levee setback plan are available in the following documents: *Physical Processes, Human Impacts, and Restoration Issues of the Lower Dungeness River* (Bureau of Reclamation, 2002) and *Numerical Modeling Study of Levee Setback Alternatives for Lower Dungeness River, Washington* (Bureau of Reclamation, 2007) In addition, the US Army Corps of Engineers is currently conducting a feasibility study for the project.

The State has listed the lower Dungeness River as impaired for temperature and fecal coliform. Sources of fecal coliform in the Dungeness and its tributaries include failing septic systems, stormwater runoff, and livestock waste (Ecology 2009). At its mouth, the river water quality is reported by the Streamkeepers of Clallam County as "impaired" for benthic biodiversity (B-IBI) and "comprised" for overall water quality (WQI). Water quality improves upstream; just downstream of the National Forest boundary the river is reported as "compromised" for B-IBI and "healthy" for WQI. At its confluence with the Dungeness, Gray Wolf River water quality is reported as "healthy" for B-IBI.

There are five principal irrigation diversions on the river, located between RM 11.3 and the Highway 101 Bridge at RM 6.5. Low flows, exacerbated seasonally by irrigation withdrawals, are a factor limiting salmon production (Haring, 1999) and have been the focus of conservation programs for 20 years. The five outtakes from the river have diversion, fish screen, and return channel structures that require periodic maintenance by the irrigation districts and companies to

access adequate flow, and maintain appropriate velocity for proper screen operation. Combining or re-designing some of these structures has been recommended in salmon recovery and irrigation management plans.

Portions of the lower Dungeness River channel are constrained by levees, with the highest concentration occurring downstream of RM 2.6 and between RM 7.5 and 10.0. Levees cut off the active channel from access to side channels and to the floodplain, where sediment and woody debris would normally be deposited to create off-channel habitat (Entrix, 2005).

The upper Dungeness and tributaries are accessible from Olympic National Forest roads and trails. Public access to the lower Dungeness is available in several locations, including the Dungeness Fish Hatchery (WDFW), the Olympic Discovery Trail at Railroad Bridge Park (Jamestown S'Klallam Tribe), and Mary Lukes Wheeler County Park.

6.2.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, the upper reaches of the Dungeness River under County jurisdiction are zoned for commercial forest, and are generally not eligible for subdivision. Downstream of the Dungeness hatchery, there is a mix of developed and undeveloped parcels along both sides of the Dungeness River to the river mouth. A parcel by parcel analysis of the lower river was completed by Dungeness River Restoration Work Group (Hals and DRRWG, 2003) with recommended priorities for acquisition and easements, and prescriptions for landowner stewardship. The River Restoration Work Group and the Dungeness Flood Hazard Management Committee (2009) have developed several recommendations related to new and existing residential development in the lower Dungeness.

Key issues for shoreline management in the lower river are preservation and restoration of forest cover, removing flood hazards in the channel migration zone, limiting or prohibiting placement of new structures in the channel migration zone, and the removal or setback of levees and shoreline armoring. The limiting factors analysis and restoration plans for the Dungeness also focus on water quality clean-up/protection and water conservation.

6.2.3 Management Issues and Opportunities

Analysis of habitat conditions and restoration planning in the Dungeness watershed began in the late 1980's due to the depressed condition of Chinook and other stocks. A key challenge in the Dungeness watershed is maintaining the ecological health and habitat forming processes of the river, as well as human health and safety, in light of the development potential in the river's floodplain and channel migration zone.

There is significant restoration potential in the watershed, particularly in the lower reaches of the river as identified by the Dungeness River Restoration Work Group (1997) and the Dungeness River Management Team (Jamestown S'Klallam Tribe, 2003). The overall strategy for Dungeness watershed restoration was summarized in the Puget Sound Salmon Recovery Plan and proposed restoration actions include the following activities relevant to shoreline management:

- Restoration of the lower river floodplain and delta to RM 2.6.

- Protection of existing functional habitat through land/easement purchase from RM 2.6 to 11.3.
- Floodplain restoration and constriction abatement RM 2.6 – 11.3.
- Water conservation and instream flow protection.
- Restoration of functional riparian and riverine habitat (revegetation of mainstem; restoration of lower river tributaries).
- Large woody debris placement.
- Sediment management throughout the river and in the upper watershed.

The Jamestown S'Klallam Tribe has identified additional management opportunities for the Dungeness River:

- Update the channel migration zone mapping.
- Promote riparian conservation with landowners.
- Create a Channel Migration Taxing District, so that landowners can get funds to move threatened houses, instead of constructing bank armoring.

Specific studies and plans have been developed for many activities in the Dungeness and implementation has been in progress on the above categories since 1994 in combination with salmon stock rehabilitation activities at the hatcheries. Existing parcelization along the river corridor and associated residential development remain a challenge for protection and restoration objectives as well as for flood hazard reduction (Clallam County, 2009).

6.3 *McDonald Creek (Maps 1a to 6a in Appendix A)*

McDonald Creek originates on the northeast flank of Blue Mountain, in Olympic National Park. Its watershed area is approximately 23 square miles. The lower 7.6 miles of the creek, downstream from Gellor Road, is considered a "shoreline of the state."

6.3.1 Summary of Baseline Conditions

McDonald Creek is a short (13.6 miles), independent drainage that flows through a deeply incised coastal upland and marine bluff into the Strait of Juan de Fuca between the western end of Dungeness Spit and Green Point (Entrix, 2005). The creek has a bar-bound estuary where for generally half the year, longshore drift block the creek mouth. The impoundment caused by the bar limits the stream's energy to erode the adjacent bluffs, which prevents a significant estuary from developing.Located in a deep ravine, McDonald Creek is moderately confined and thegradient ranges from 2.0 to 8.0 percent. Substrate generally consists of large gravel/rock, sand, and bedrock.

The upper portion of the McDonald Creek watershed is predominately forested. Watershed forest cover decreases approximately 1 mile upstream of Highway 101, and the lower portion of the

valley consists of moderate- to high-density residential and agricultural land uses. However, the creek generally has a forested riparian corridor of at least 400 feet in width throughout the developed areas. The riparian forest cover provides wildlife habitat, helps maintain cool water temperatures, and provides large woody debris inputs to the stream channel. The lower portion of the creek is identified as providing priority habitat for bald eagle, peregrine falcon, and wood duck.

McDonald Creek provides spawning habitat for steelhead and coho salmon; fall chum have been extirpated from the creek McDonald Creek has been used as a conveyance for a portion of the Dungeness irrigation system since the late 1920s. Dungeness River water from the Agnew Irrigation Ditch is put into the creek at RM 5.2 and withdrawn downstream at RM 3.2. This system has raised ongoing concerns about attraction of returning Dungeness salmon. Additionally, the diversion dam partially blocks upstream fish migration, and the dam and outtake infrastructure artificially confines the stream in this reach, creating a high-energy, lethal environment for rearing or migrating salmon.

The portion of McDonald Creek within shoreline jurisdiction has no State impaired water quality listings. Water quality of the lower portion of the creek is reported by the Streamkeepers of Clallam County as "compromised" for B-IBI and "healthy" for WQI. Erosion and landslide areas are mapped along the stream channel for most of its extent. However, these hazard areas are generally confined to the creek's forested riparian corridor on undeveloped land. Because of the confined nature of the stream channel, flood hazard areas and channel migration zones along the creek are minimal.

Informal public access to the creek is available upstream of Highway 101, off of Sherburne Road. The Olympic Discovery Trail crosses the creek, between Highway 101 and Old Olympic Highway.

6.3.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, approximately 20% of the stream corridor area within SMA jurisdiction has potential for new development. Most of the developable parcels are 1 to 5 acre residential lots that cannot be further subdivided. Development within these parcels may result in loss of riparian forest cover, which could diminish the quality of the existing fish and wildlife habitat. In addition, vegetation removal and development in erosion and landslide areas may put structures at risk and increase sedimentation rates, which negatively impacts aquatic habitat.

6.3.3 Management Issues and Opportunities

In general, there is limited development potential along McDonald Creek. New development would largely consist of infill adjacent to existing developed areas. In addition to the general management considerations for Clallam County freshwater shorelines, key issues for McDonald Creek shorelines include:

- Protection of forest cover and reforestation of harvested areas, with particular emphasis on the upper elevations where rain-on-snow events occur.

- Increase LWD presence and function from the mouth upstream to the mouth of Pederson Creek (RM 4.9).

- Best management practices to reduce sediment on Forest Service lands.

- There are limited public access opportunities within the reach. Opportunities for establishing formal public access areas are located on the DNR and Forest Service land at the northern portion of the reach.

6.4 *Morse Creek (Maps 1a to 6a in Appendix A)*

The headwaters of Morse Creek are in Olympic National Park, and drain Hurricane Ridge, Mount Angeles, and Deer Park. Its watershed area is approximately 53 square miles. The lower 9.2 miles of the creek is considered a "shoreline of the state."

6.4.1 Summary of Baseline Conditions

Morse Creek is a fairly long (15 mile) independent drainage to the Strait of Juan de Fuca (Entrix, 2005). The upper portion of Morse Creek is steep and confined, while the middle portion (below the National Park boundary) passes through a moderately incised canyon with a number of falls and cascades. The lower portion of the creek is generally confined in a ravine-like canyon; but below approximately RM 1.7, the valley broadens into a relatively wide, low-gradient floodplain. A natural falls occurs at RM 4.9. The streambed substrate generally consists of small boulders and large gravel in the steep upper portion of the stream, and silted large gravel, small boulders, cobble, and pebbles in the lower portion.

At approximately RM 7.2, a portion of Morse Creek is diverted for hydroelectric generation (Entrix, 2005). Flows are routed to a powerhouse at RM 5.0, and returned to the creek below the falls. The lower mile of the creek is diked and surrounded by intensive development.

The upper portion of the Morse Creek watershed is largely forested, with forest cover decreasing in the middle section where land use is primarily low-density residential (Figure 6-2). Forest cover is generally absent in the highly developed areas south of Highway 101, although a forested riparian corridor of approximately 200 feet in width remains. The remaining riparian forest cover provides wildlife habitat, helps maintain cool water temperatures, and provides large woody debris inputs to the stream channel. The portion of the riparian corridor within County jurisdiction is identified as providing priority habitat for harlequin duck and wood duck.

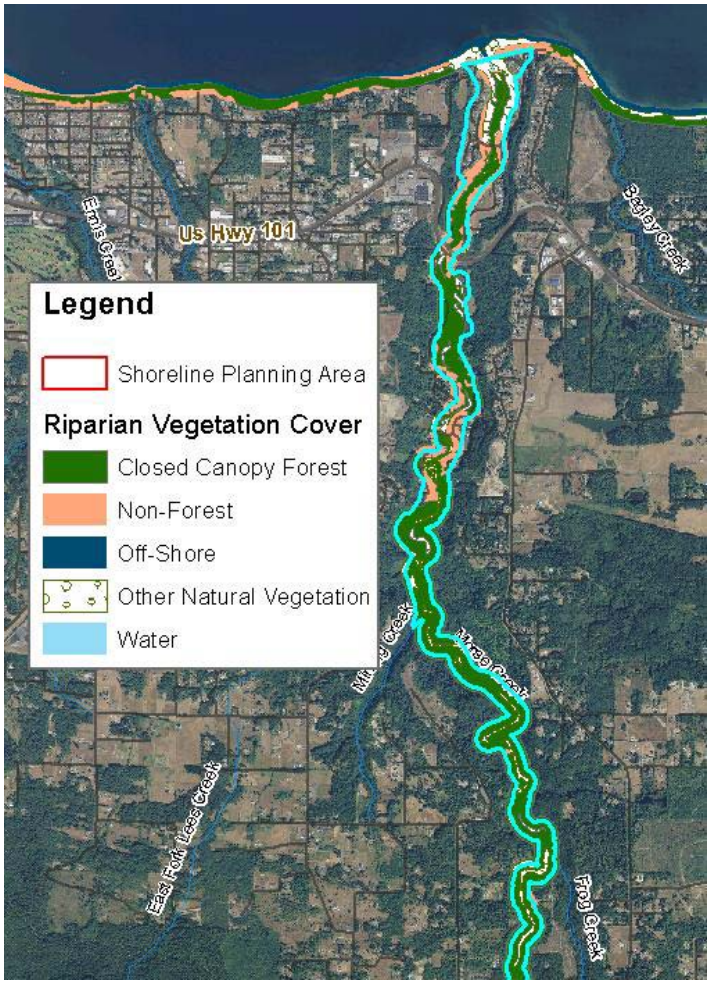


Figure 6-2. Riparian vegetation cover along the lower 4 miles of Morse Creek.

Morse Creek provides spawning habitat for steelhead, and Chinook, chum, coho, and pink salmon (pink salmon levels within the creek are low). The presence of bull trout, resident cutthroat, and rainbow trout are also identified in the creek. The Lower Elwha Klallam Tribe is currently operating an Elwha Chinook broodstock project on the creek. The objective is to establish an Elwha Chinook return to Morse Creek as "insurance," in case the Elwha River becomes temporarily inhospitable to fish due to the dam removals.

There are no human-constructed fish passage blockages on the creek, but the natural falls at RM 4.9 is a complete barrier to anadromous and resident fish. Fish habitat quality in the lower portion of the creek has been impacted by diking, and also by channelization that occurred in the late 1950s (Entrix, 2005). Morse Creek has no State impaired water quality listings. Water quality is reported by the Streamkeepers of Clallam County as "compromised" for B-IBI and "healthy" for WQI.

Downstream of the National Park boundary, land use surrounding the upper portion of Morse Creek is primarily low- to moderate- density residential, with some timber parcels. Higher density residential development occurs along the creek downstream from approximately RM 3.0.

Much of the upper portion of the Morse Creek riparian corridor lies within identified erosion and landslide hazard areas. These hazard areas generally contain dense forest cover. Channel migration zones and FEMA-mapped flood hazard areas are present along the lower portion of Morse Creek, where the creek passes through a broad, low-gradient floodplain. Many homes are present within these hazard areas (Figure 6-3).

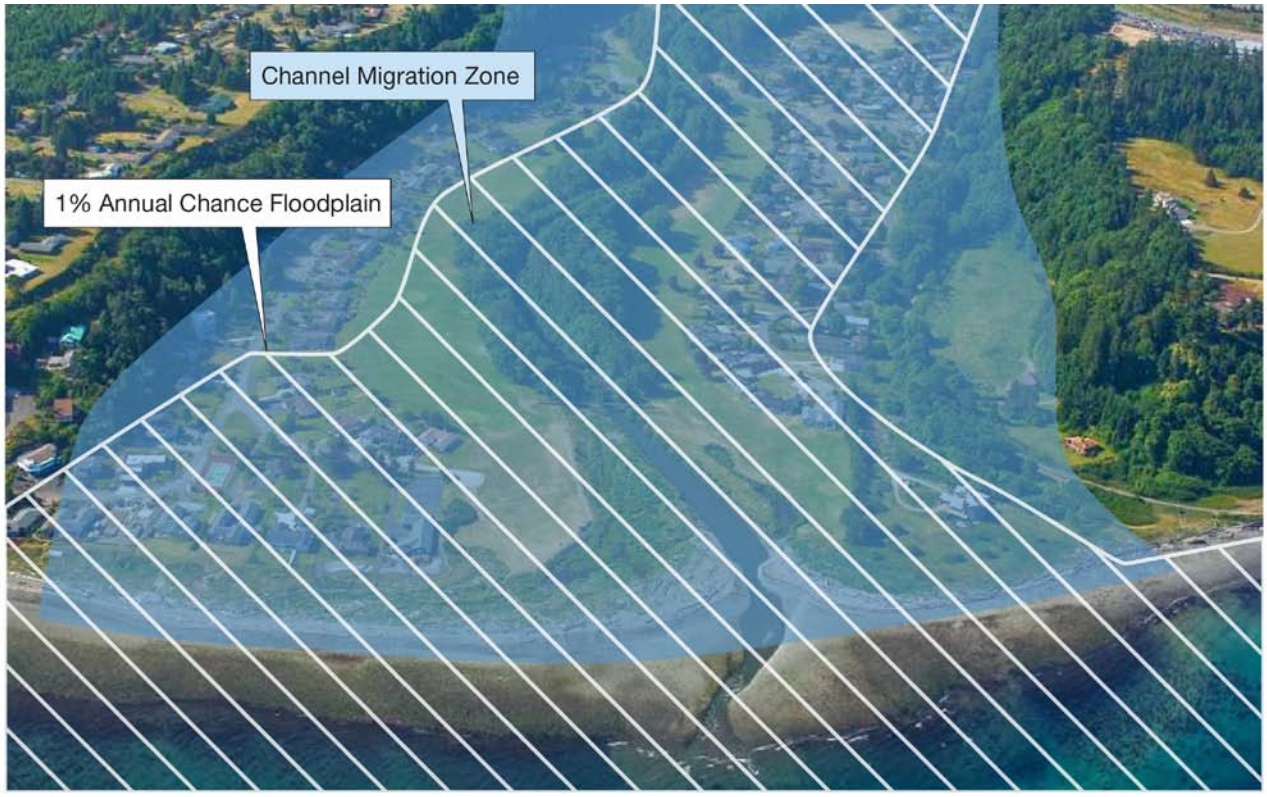


Figure 6-3. Channel migration zone and floodplain with existing development on Morse Creek

Just upstream from Highway 101 is a publically owned, WDFW-managed parcel of land surrounding Morse Creek. A large habitat restoration project was completed in 2009 on the property, restoring the creek to its historic channel. The land offers wildlife viewing opportunities, and contains a parking lot and restroom facilities. The creek can be accessed via the Olympic Discovery Trail downstream of Highway 101. Morse Creek is also being used for temporary hatchery facilities associated with the removal of the Elwha dams.

6.4.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, almost half of the stream corridor area within County jurisdiction has potential for new residential development. The undeveloped land is distributed throughout the reach, with the exception of an area approximately one mile from the mouth, which is fully developed. The undeveloped parcels vary in size, but most could be subdivided into 2 or 5 acre residential lots, depending upon zoning category. The continued conversion of forest land to residential development within the Morse Creek riparian corridor has several potential negative impacts for aquatic habitat and downstream development. Key issues include

loss of forest cover in the riparian corridor, presence of structures in the floodplain, levees and shoreline armoring, roads and impervious surfaces, and flood hazard in the lower river floodplain and channel migration zone.

6.4.3 Management Issues and Opportunities

As identified by Haring (1999) and the NOPLE Technical Review Group (2005), key restoration actions for Morse Creek include:

- Restore floodplain function downstream of RM 1.7, including the removal/pull back of dikes, elimination of floodplain constrictions, and restoration of the natural banks.
- Restore LWD presence throughout the channel downstream of the natural falls at RM 4.9.
- Reestablish estuarine characteristics and function similar to historic conditions.
- Restore riparian function by encouraging conifer regeneration in deciduous stands that historically had a conifer component.

6.5 *Elwha River (Maps 1b to 6b in Appendix A)*

The Elwha River is the fourth largest river in the Olympic Peninsula and includes 15 major tributaries: Indian Creek, Little River, Hughes Creek, Griff Creek, Boulder Creek, Wolf Creek, Cat Creek, Long Creek, Lillian River, Lost River, Goldie River, Hayes River, Godkin Creek, Buckinghorse Creek, and Delabarre Creek. Its watershed encompasses 321 square miles; 83 percent of which lie within the upper watershed and the Olympic National Park (Entrix, 2005). The Elwha River includes 100 miles of tributaries and a mainstem that flows 45 miles in a south to north direction before emptying into the Strait of Juan de Fuca five miles west of Port Angeles.

The Elwha River is classified as a "shoreline of statewide significance," and the portion within County jurisdiction is divided into 3 reaches (9.5 miles). Two of its tributaries within the County (Little River and Indian Creek) are "shorelines of the state". These streams are described in Sections 6.6 and 6.7, respectively.

6.5.1 Summary of Baseline Conditions

The Elwha's headwaters originate at high elevations within Olympic National Park, between 2100 and 2500 feet, and include the southeast slopes of Mount Olympus (Entrix, 2005). The upper Elwha River has a steep slope, steepest at its headwaters with an average 16% gradient flowing through a series of narrow bedrock canyons and wide lower-gradient, flat bottomlands. The glacially fed headwaters, in combination with the many significant tributaries within the upper watershed, provide a constant supply of gravel material to the system. Sediments are halted in the upper watershed by the Glines Canyon Dam (RM 13.4), and accumulate in the Lake Mills reservoir (RM 16). This significantly depletes sediment supply to the lower river and ultimately to the nearshore areas.

The Glines Canyon Dam and the Elwha River Dam (RM 4.9) were built in the early part of the 20th century to supply power to Port Angeles, and more recently allocated to the local pulp mill industry. These dams significantly altered the historic condition of the Elwha River, creating Lake Aldwell and Lake Mills reservoirs. Both dams are scheduled for removal starting in the fall of 2011. Potential environment affects resulting from the dam removal are wide-ranging, and described in the *Elwha River Ecosystem Restoration Final Environmental Impact Statement* (U.S. National Park Service 1995) and other related documents. In particular, the dam removals and subsequent release of river sediments is expected to significantly increase channel migration and erosion within the river's floodplain (Kloehn et al., 2008).

Below the Lake Aldwell reservoir, the segment of the river down to RM 4 is constrained by the steep bedrock walls of Elwha Canyon (Entrix, 2005). In the next half mile below Elwha Canyon, the stream gradient is less steep and the channel floodway widens. At RM 2.8, the river channel is constrained by bedrock on the right bank and narrows through this area. Between RM 2.8 and the river mouth, the floodplain widens and is bound on the west side by steep cliffs. Levees along the east side of the floodplain in this area limit eastward migration of the river. Levees are present on either side of the floodplain at the river's mouth, which has reduced the extent of available estuary. Adjacent to the Lower Elwha Klallam reservation, existing levees were recently expanded in preparation for the expected increase in river height resulting from the dam removals.

The upper Elwha watershed is protected land, located in Olympic National Park. Downstream of the National Park boundary (RM 9.7) to Highway 112 (RM 4.5), the Elwha watershed and riparian corridor is predominantly forested, although low-density residential development has removed forest cover in some areas. Forest cover in the watershed decreases somewhat downstream.

Designated priority species located along the portion of the Elwha within County jurisdiction include bald eagle throughout the reach and trumpeter swan in Lake Aldwell. Extensive areas of wetland habitat are present at the upstream end of the lake and at the Elwha estuary.

Prior to construction of the dams (Figure 6-4), the Elwha system produced abundant stocks of several different salmonid species, including Chinook that weighed in excess of 100 pounds (Entrix, 2005). Today, anadromous fish use is limited to the reach downstream of the Elwha River Dam, which provides habitat for steelhead and Chinook, coho, and chum salmon species. The Lower Elwha Hatchery is the primary source of steelhead and salmon in the river. The sockeye run, and possibly the pink run, are now extinct in the Elwha. Salmonid use above the Elwha dam is limited to resident cutthroat, rainbow, and bull trout.

The lower Elwha has State impaired water quality listings for temperature and polychlorinated biphenyls (PCBs). High summer temperatures are likely caused by the warming that occurs in the dam reservoirs. The source of PCBs within the river is unknown (Entrix, 2005). Below the Elwha River dam, water quality is reported by the Streamkeepers of Clallam County as "compromised" for WQI. Above Lake Aldwell, water quality is reported as "healthy" for WQI.

There are several significant water diversions in the lower watershed (Entrix, 2005). The City of Port Angeles holds the majority of the state-issued water rights for the river. Uses include a

municipal well that serves that City, and a surface diversion that provides water to a large paper and pulp mill and a WDFW fish rearing channel.

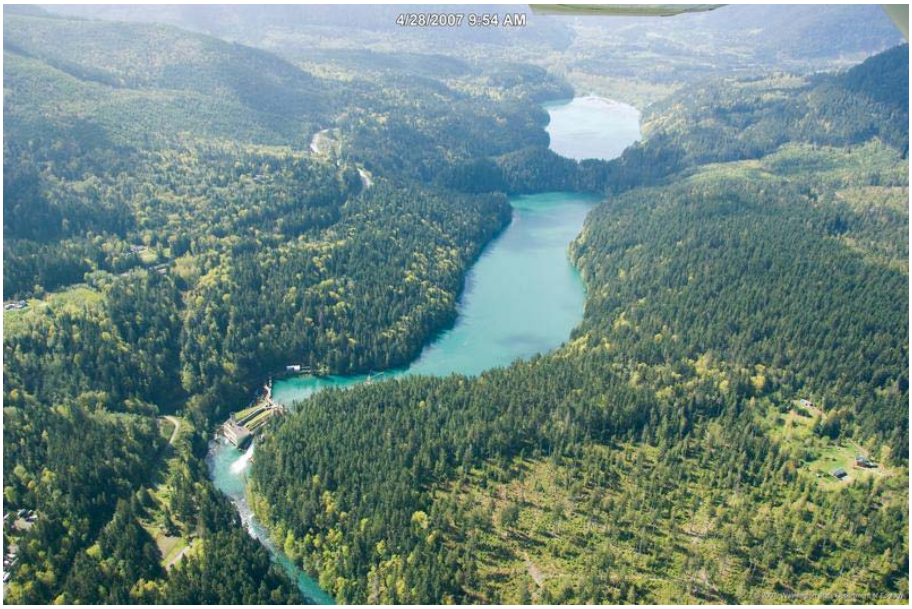


Figure 6-4. The Elwha River and Lake Aldwell (Ecology Photo)

Between the Olympic National Park boundary and Highway 112, land use along the river is primarily publically owned timber land, with the exception of a low-density residential development south of Highway 101. Land along the river south of Highway 112 is primarily undeveloped public and tribe owned land, with some private low-density residential development. In general, existing development is located outside of flood and channel migration zone hazard areas.

Public access opportunities are available in several locations along the Elwha. The river mouth can be accessed directly from the northeast end of Place Road (Elwha Dike Road). The Olympic Discovery Trail crosses the Elwha approximately 1 mile south of Highway 101. Public lands north of Highway 101 can be accessed from Olympic Hot Springs Road.

6.5.2 Future Land Use and Potential Effects on Shoreline Ecology

Most of the land bordering the Elwha River is publically owned, and not eligible for residential development. However, there is a substantial amount of land, primarily centered around Highway 101 and south of Highway 112, that has that potential for additional residential development. Under current zoning regulations, these parcels could be subdivided into 3 to 5 acre lots.

6.5.3 Management Issues and Opportunities

The upcoming removal of the Elwha dams will substantially alter habitat conditions and the physical condition of the stream channel in the lower river. Future regulations for the area should consider the effects of the dam removals, which are analyzed in the Environmental Impact

Statement (NPS, 1995) and other related documents. Key management recommendations for the lower river include floodplain structures, reforestation and shoreline armoring.

As identified by Haring (1999), additional restoration actions for the Elwha River include:

- Systemic restructuring of the lower and middle river with large wood.
- Removal of selected dikes and other channel constrictions.
- Reforestation of the riparian corridor, where altered.
- Acquisition/conservation easement access and set back of structures constructed within the channel migration zone.

6.6 *Little River (Maps 1b to 6b in Appendix A)*

The Little River is a tributary to the Elwha River with a total watershed area of approximately 23 square miles. The headwaters of the Little River lie primarily within Olympic National Park and National Forest. The mainstem of the Little River, downstream from its confluence with the South Branch Little River, is classified as a "shoreline of the state" (2.8 miles). The South Branch, downstream from the National Park boundary, is also a shoreline of the state (1.6 miles).

6.6.1 Summary of Baseline Conditions

The Little River watershed is comprised of two main tributary watersheds. The South Branch Little River is the larger of the two, and produces most of the flow in the stream. The mainstem and south branch of the river join at approximately RM 2.5. The Little River flows into the Elwha River just south of Lake Aldwell.

Most of the South Branch Little River watershed consists of protected forest land inside Olympic National Park. Downstream of the park boundary, the South Branch flows through densely forested land, through National Forest, DNR, and privately-owned timber parcels. Downstream of its confluence with the South Branch, the watershed of the mainstem Little River is also densely forested. However, vegetation in the riparian corridor of the mainstem has been altered in several locations by low-density residential development and Little River Road.

Prior to the construction of the Elwha River dams, the Little River (including the South Branch) provided habitat for a variety of anadromous salmonids (Entrix, 2005). Today, salmonid use within the watershed is limited to resident cutthroat, rainbow, and bull trout. With the upcoming Elwha dam removals, anadromous fish stocks will likely return and/or be reintroduced to the Little River system.

There are no designated terrestrial priority habitats identified within the shoreland areas of the South Branch and mainstem Little River. However, the large expanses of forest cover in the areas provide habitat for a wide variety of wildlife species. The riparian forest cover also helps maintain cool water temperatures and provides large woody debris inputs to the stream channel.

There are no State impaired water quality listings for the mainstem and South Branch of the Little River. Water quality is reported by the Streamkeepers of Clallam County as "healthy" for WQI.

Public access to the South Branch Little River is available from the Little River Trail. The mainstem of the river can be accessed informally from Little River Road, from the DNR-managed parcels.

6.6.2 Future Land Use and Potential Effects on Shoreline Ecology

Development potential is fairly low in SMA-regulated areas along the mainstem and South Branch of the Little River. Much of the riparian area is public (DNR and National Forest) land. Privately owned timber land is located at the confluence of the mainstem and south branch, and could be subdivided into 20-acre residential parcels. Some larger undeveloped parcels (5 to 40 acres in size) are located near the river's confluence with the Elwha, but these parcels cannot be subdivided under current zoning regulations.

6.6.3 Management Issues and Opportunities

In general, under current zoning regulations, there is limited development potential along the mainstem and South Branch of the Little River. In the areas where development may occur, preserving riparian forest cover will help protect fish and wildlife habitat.

When the Elwha dams are moved, the Little River system has significant potential to provide high-quality habitat for anadromous salmonids. Future shoreline regulations for the area should consider the future presence of threatened salmonid stocks.

6.7 *Lake Sutherland and Indian Creek (Maps 1b to 6b in Appendix A)*

The Lake Sutherland/Indian Creek watershed is approximately 20 square miles in area, and separated from the Lake Crescent valley to the west by a low divide (Entrix, 2005). Indian Creek drains from the eastern end of Lake Sutherland, and flows eastward down the valley, to the southern end of Lake Aldwell on the Elwha River.

Both Lake Sutherland and Indian Creek are classified as "shorelines of the state." Lake Sutherland is 4.6 miles in circumference, and Indian Creek is 5.5 miles long.

6.7.1 Summary of Baseline Conditions

Most of the shoreline along Lake Sutherland contains moderate- to high-density residential development, and many docks are present along the shoreline. While natural vegetation has been completely cleared in some areas, over half of the shoreland area contains dense forest cover. Outside of the shoreland area, the land surrounding the lake is almost exclusively forested.

FEMA-mapped flood hazard areas extend into residential areas along the lake shore that are built close to the shoreline. In addition, identified erosion and landslide hazard areas are located along the southern and northeastern portions of the lake.

The valley floor of Indian Creek is generally broad and flat from the Lake Sutherland outlet until the stream is within a mile and a half of its confluence with the Elwha River, where the stream

falls into a narrow, ravine-like valley (Entrix, 2005). The riparian corridor of Indian Creek is largely undeveloped and consists of dense forest cover. However, portions of the corridor have been altered by residential development and Highway 101, which crosses the stream in 3 locations. The lands surrounding the riparian corridor are generally forested, with the exception of the Highway 101 corridor and low-density residential development near the east end of the stream.

The predominant land use along Indian Creek is timber. Much of the land surrounding the upstream half of the creek is DNR-managed timberland. Approximately 20% of the shoreland area consists of low-density residential development.

FEMA-mapped flood hazard areas are located along Indian Creek from the Lake Sutherland outlet to approximately a mile and a half from its confluence with the Elwha. The existing residences along the creek are generally set back from the flood-prone areas. Erosion and landslide hazard areas are identified at the upstream and downstream ends of Indian Creek, but these areas generally lie on undeveloped forest land.

There are no designated terrestrial priority habitats identified within the shoreland areas of Lake Sutherland and Indian creek. However, the large expanses of forest cover in the areas provide habitat for a wide variety of wildlife species. In addition, the remaining forested riparian corridor along Indian Creek helps maintain cool water temperatures and provide large woody debris inputs to the stream channel.

There is a small outlet structure at the east end of Lake Sutherland where it flows into Indian Creek. The structure serves to retain fish stocks in the lake and, to a lesser extent, control and maintain the elevation of the lake (Entrix, 2005). Recently, Lake Sutherland residents have experienced periodic flooding along the lake shore, particularly during periods of heavy rainfall and/or snowmelt. The residents attribute this increase in flooding to a rise in the elevation of the Indian Creek outlet, caused by accumulating sediments and large woody debris.

Prior to the construction of the Elwha River dams, Lake Sutherland and Indian Creek provided habitat for a variety of anadromous salmonids (Entrix, 2005). Today, salmonid use within the watershed is limited to shore-spawning kokanee (nonanadromous salmon) and trout in Lake Sutherland, and some trout in Indian Creek. With the upcoming Elwha dam removals, anadromous fish stocks will likely return and/or be reintroduced to Lake Sutherland and Indian Creek. In addition, Lake Sutherland kokanee may reestablish a native sockeye run.

Lake Sutherland and Indian Creek have no State impaired water quality listings. However, Lake Sutherland residents report periodic algal blooms. Near the outlet of Lake Sutherland, Indian Creek water quality is reported by Streamkeepers of Clallam County as “impaired” for B-IBI, and “compromised” for WQI. Near its confluence with the Elwha River, Indian Creek water quality is reported as “healthy” for both B-IBI and WQI.

The entire shoreland area of Lake Sutherland is privately owned. However, there a public boat launch is located along South Shore Road. The aquatic bedlands of the lake are publically owned, and managed by DNR. Several parcels of timber land surrounding the upstream portion

of Indian Creek are publically owned, and managed by DNR. In these areas, the creek can be accessed informally from Highway 101. There is no formal public access to the creek.

6.7.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, approximately 15% of the Lake Sutherland shoreland area has potential for new development. Most of the undeveloped land consists of 1-acre lots, which cannot be further subdivided. The lots are generally long and rectangular in shape, with water frontages of approximately 75 feet. Future infill development would likely decrease the remaining forest coverage along the lake. In addition, new homes set close to the shoreline may be subject to increased flooding.

Approximately 15% of the Indian Creek shoreland area has potential for new, low-density residential development. The developable parcels vary in size (5 to 20 acres), and most cannot be subdivided (Figure 6-5) Development within these parcels may result in loss of riparian forest cover, which degrades fish and wildlife habitat. Portions of the undeveloped lots in the upstream portion of the river lie within FEMA-mapped flood hazard areas.

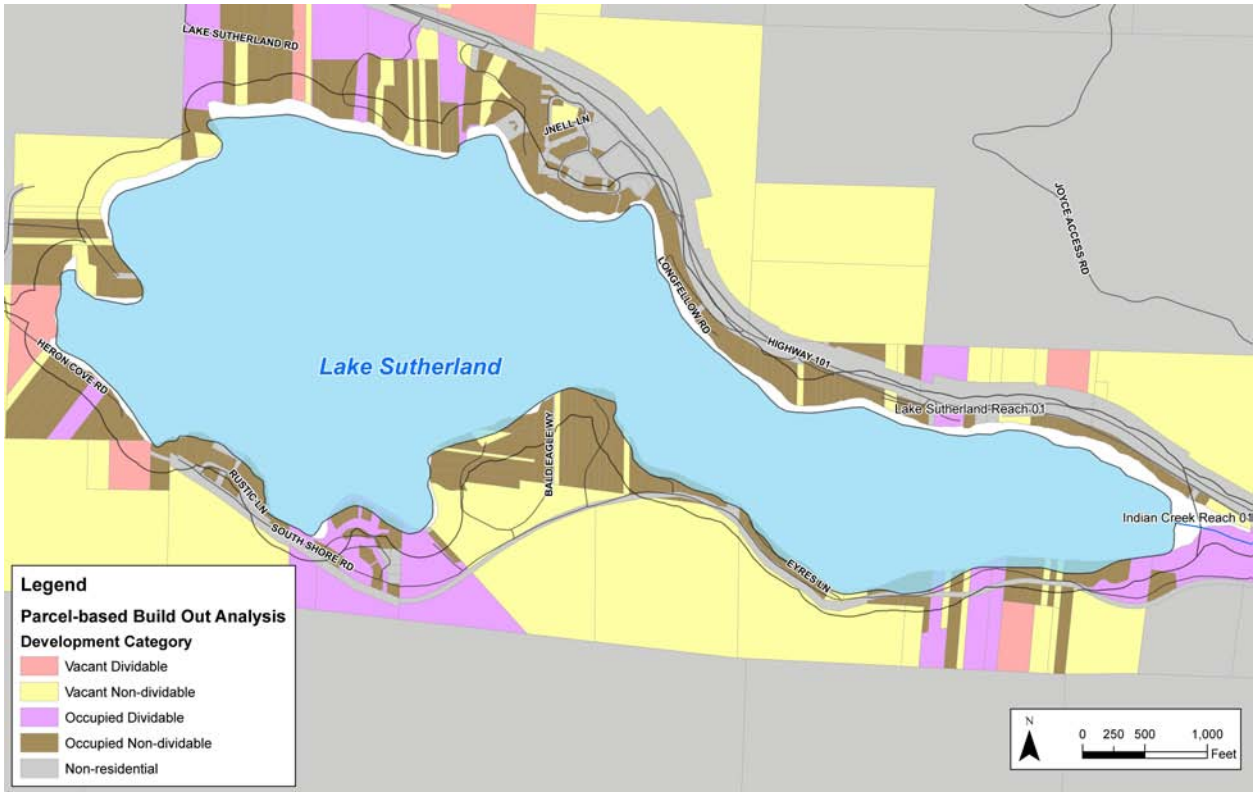


Figure 6-5. Existing and potential future development patters at Lake Sutherland. Brown and yellow parcels are not subdividable.

6.7.3 Management Issues and Opportunities

In general, there is limited development potential along Lake Sutherland and Indian Creek shorelands. The Lake Sutherland shoreline is already built out; new development would consist of infill residential development on the remaining undeveloped lots. A relatively low amount of

the Indian Creek riparian corridor has development potential, which would likely consist of large-lot rural residential development.

When the Elwha dams are moved, Lake Sutherland and Indian Creek have significant potential to provide high-quality habitat for anadromous salmonids. Future shoreline regulations for the area should consider the future presence of threatened salmonid stocks.

Key management recommendations for Lake Sutherland and Indian Creek include general provisions for retaining forest cover and setting back structures to reduce flood hazard. Specific management issues include:

- To improve water quality in Lake Sutherland and decrease the frequency of algal blooms, fix or replace failing septic systems.
- Removing the fish screen at the Lake Sutherland outlet will allow salmon access to the lake, once the Elwha dams are removed.
- To reduce the incidences of flooding in Lake Sutherland, develop strategies for maintaining the lake outlet that minimize potential impacts on fish species and habitat-forming processes.

6.8 *Salt Creek (Maps 1b to 6b in Appendix A)*

Salt Creek drains a series of low foothills of Olympic Mountains, and has a watershed area of approximately 19 square miles. The lower 4.8 miles of the creek is considered a "shoreline of the state," which is divided into two reach.

6.8.1 Summary of Baseline Conditions

Salt Creek is fairly short and has relatively little relief (McHenry, et al. 2004). Near its headwaters, the creek flows into a wide terrace where several of its tributaries join the creek's mainstem. Salt Creek then flows northwest into a narrow valley along the base of Striped Peak, through tidal emergent wetlands at the mouth, and into Crescent Bay approximately nine miles west of Port Angeles (Clallam County, 2008).

The upper watershed and riparian corridor of Salt Creek consist of almost entirely of forest habitat. Forest cover decreases downstream, as the river flows through tidal wetlands and salt marshes positioned on the broad, flat alluvial floodplain. The Salt Creek watershed supports habitat for breeding populations of bald eagle and band-tailed pigeon. Significant wetland and salt marsh habitat is present in the lower watershed, while emergent, scrub-shrub, and forested wetlands are scattered throughout the middle and upper subbasin (Clallam County 2008; NOPLE-TRG 2011).

Salt Creek and its tributaries provide important spawning and rearing habitat for coho salmon, and a smaller run of steelhead trout. Spawning habitat is available throughout the mainstem and its tributaries downstream of a passable dam at RM 6.5. Historically, the creek supported chum and Chinook salmon. However, in recent years, chum and Chinook salmon have not been documented in Salt Creek (NOPLE-TRG 2011).

Several fish barriers exist on the mainstem and tributary reaches of the Salt Creek basin. Salt Creek contains numerous older, undersized culverts, which may constitute partial barriers to fish passage (NOPLE-TRG 2011). In addition, a semi- fish-passable dam is located at RM 6.5 that limits upstream fish migration (Clallam County 2008). Since 2004, many of the identified barriers in the Salt Creek system have been identified and corrected, or funding has been obtained to correct the barriers (NOPLE-TRG 2011). The estuary of Salt Creek is bisected by a 100-year old dike, that acts as a significant fish passage barrier between the east and west portions of the estuary (Shaffer and Ritchie, 2008a).

Salt Creek has State impaired water quality listings for temperature and dissolved oxygen. Water quality of the creek is reported by Streamkeepers of Clallam County as "compromised" for both B-IBI and WQI.

The upper portion of Salt Creek within County SMA jurisdiction is primarily privately owned timber land, with a lesser amount of low-density residential development. The lower reach is largely undeveloped wetland habitat. Most of the lower reach lies within a tsunami hazard zone and FEMA-mapped flood hazard areas.

Public access to the Salt Creek estuary is available at the Salt Creek Recreational Area, and to customers of the Salt Creek resort.

6.8.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, approximately one-third of the stream corridor area within County SMA jurisdiction has potential for new residential development. Some of the large timber parcels of the upper portion of Salt Creek could be subdivided into 5-acre home sites. Undeveloped land near the estuary could be subdivided into 2-acre residential lots. However, the extensive wetland areas near the estuary likely preclude additional development in the area. Issues related to the conversion of timber land to residential development are those typical to the region (loss of forest cover, flood hazards, decreases in water quality, and shoreline armoring).

6.8.3 Management Issues and Opportunities

The Salt Creek watershed has significant restoration potential, particularly in the lower reaches, in segments where riparian vegetation has been altered. The primary goals for restoration outlined in the WRIA 19 Salmonid Restoration Plan (NOPLE-TRG 2011) are:

- Restore degraded estuarine habitat conditions, where they exist. For properties that provide particularly important estuarine processes and nearshore habitat, implement conservation easements or acquisitions with willing landowners.
- Study the potential of removing and/or adding fish passage to the dike that bisects the estuary.
- Replace undersized culverts throughout the watershed.
- Reforest unutilized pastures and other cleared areas.
- Limit future water withdrawals from the watershed.

- Implement large woody debris supplementation in wood-deficient zones.
- Protect and restore water quality.

6.9 *Lyre River and Boundary Creek (Maps 1b to 6b in Appendix A)*

The Lyre River originates from Lake Crescent, a natural lake located in the foothills of the Olympic Mountains in Olympic National Park. The Lyre River/Lack Crescent watershed encompass approximately 68 square miles. The Lyre River is classified as a "shoreline of the state", and the portion within County jurisdiction is divided into 2 reaches (5.3 miles total). The lower 1.1 miles of Boundary Creek, a tributary to the Lyre River, is also a shoreline of the state (1 reach).

6.9.1 Summary of Baseline Conditions

The Lyre River is a relatively short river that is situated in the steep terrain of the Olympic Mountains. Originating from Lake Crescent, the Lyre River flows north and west through valleys surrounded by steep mountain slopes (NOPLE-TRG 2011). Boundary Creek also flows through steep mountain valleys, and joins the Lyre River in the Olympic foothills. The lower Lyre River flows atop a glacial till terrace, and drains into the Strait of Juan de Fuca, just west of Low Point. The channel is rather steep at its confluence with the Straight, allowing tidal influence to extend only 400 feet upstream. The lower mile of the river channel has been channelized, and is armored along its west side.

The Lyre River and Boundary Creek watersheds consist almost entirely of forest habitat. This forest cover provides habitat for a wide variety of wildlife species, including breeding populations of bald eagle and band-tailed pigeon. The forest riparian corridors of the streams also helps maintain cool water temperatures, and provides organic inputs to the stream channel.

The lower reach of the Lyre River provides spawning and rearing habitat for chum salmon and steelhead trout. A natural fall line located at RM 2.7 bars salmon access to upstream reaches and tributaries. Salmonid use above the falls consists of resident cutthroat, rainbow, and Beardslee trout. Beardslee trout, a subspecies of rainbow trout, are found nowhere else and spawn in the Lyre River near the outlet of Lake Crescent

North of Highway 112, the lands bordering Boundary Creek and the Lyre River are primarily DNR-managed timber lands. South of Highway 112, land use along the Lyre is primarily low-density residential development and privately owned vacant land. Some of the properties near the mouth of the river lie within a tsunami hazard zone and a FEMA-mapped flood hazard area.

The Lyre River and Boundary Creek have a State impaired water quality listing for temperature. Alterations to the natural riparian habitat, water withdrawals from adjacent aquifers and increased rates of sedimentation contribute to rises in water temperature (NOPLE-TRG 2011). Water quality near the river mouth is reported by the Streamkeepers of Clallam County as "healthy" for WQI, but "impaired" for B-IBI.

Public access to the Lyre River south of Highway 112 is available at the Lyre River Campground. The upper portion of the Lyre is primarily public land, but no formal access areas are established.

6.9.2 Future Land Use and Potential Effects on Shoreline Ecology

The majority of the Lyre River riparian corridor, and the entire Boundary Creek corridor, are public timber lands that are not eligible for development. Developable parcels along the Lyre are located from just north of Highway 112 to the mouth of the river. Under current zoning regulations, these parcels could be subdivided into either 2 or 5 acre residential lots. In addition, a small amount of commercial-zoned land is present near the river's mouth.

6.9.3 Management Issues and Opportunities

The lower portion of the Lyre River has significant residential development potential, and associated management issues similar to those throughout the region. In addition to flood hazard reduction by avoiding development in the floodplain, limitations on shoreline armoring, and vegetation management, key management issues include water withdrawals from adjacent aquifers.

Restoration opportunities for the river include (NOPLE-TRG 2011):

- Restore degraded estuarine habitat conditions, where they exist.
- Identify and correct human-caused barriers to fish passage within the watershed.
- Place large woody debris in the lower 2 miles of the river, and replant disturbed riparian areas.
- Hydrologically reconnect the stream to its floodplain, where applicable.

There are relatively few existing public access areas on the Lyre. Significant potential for increasing public access on the Lyre, as well as Boundary Creek, is located on the DNR-managed public land south of Highway 112.

6.10 *East Twin River (Maps 1b to 6b in Appendix A)*

The East Twin River headwaters are in Olympic National Park and National Forest. The river is forked into three branches in the upper watershed: the west branch drains the steep slopes of Mount Muller and converges with the other two branches just south of a narrow and steep valley, emerging onto the foothills. The lower 4.4 miles of the East Twin River is classified as a "shoreline of the state" (1 reach).

6.10.1 Summary of Baseline Conditions

The East Twin River is a fairly short and narrow (3-9 yards average) river. Emerging from Olympic Mountain foothills, the river flows over moderately steep terrain before entering onto a terrace delta. The River enters the Strait of Juan de Fuca approximately 5.5 miles west of low point. The river channel profile at its confluence with the Strait is relatively steep, allowing tidal influence to only extend upstream approximately 150 meters (NOPLE-TRG 2011). Portions of

the lower river channel have been constrained by the construction of dikes composed of river sediments.

The watershed and riparian corridor of the East Twin River contains dense, contiguous forest habitat. This continuous forest cover provides habitat for a variety of wildlife species, including bald eagle. In addition, well-forested forested riparian corridor along the river helps maintain cool water temperatures and provide large woody debris inputs to the stream channel.

The East Twin River provides spawning and rearing habitat for chum and coho salmon, as well as steelhead, resident cutthroat, and rainbow trout. Coho spawning occurs below RM 3.4, but the watershed has never been a significant producer of chum (NOPLE-TRG 2011). Habitat distribution and utilization in the East Twin River subbasin is limited due to waterfalls, cascades, log jams, and steep gradients that limit access. A series of falls and cascades at RM 3.6 has been considered to be an impassible barrier for anadromous fish.

The upper portion of the river has a State impaired water quality listing for temperature. Water quality is reported by Streamkeepers of Clallam County as "compromised" for B-IBI and "healthy" for WQI.

Within County SMA jurisdiction, the majority of the land along the East Twin River is publically owned timber land, managed by DNR. Some privately owned commercial timber parcels are present in the lower portion of the river.

Informal public access to the upstream portion of the reach is available from East Twin River Road.

6.10.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, there is minimal potential for development along the East Twin River. Most of the riparian corridor is publically owned timber land, and the privately owned timber parcels near the river mouth are not eligible for subdivision.

6.10.3 Management Issues and Opportunities

There is currently minimal available public access to the river. Significant public access opportunities are present on the DNR-managed timber land.

Restoration opportunities for the river include (NOPLE-TRG 2011):

- Maintain and protect habitat connectivity.
- Conduct an inventory of potential human-created fish barriers in the watershed.

6.11 *West Twin River (Maps 1b to 6b in Appendix A)*

The West Twin River headwaters are in Olympic National Forest. The lower 5.3 miles of the river is classified as a "shoreline of the state" (1 reach).

6.11.1 Summary of Baseline Conditions

The West Twin River is a fairly short and narrow (3-9 yards wide) river that flows northeast from steep mountain slopes onto lower gradient hills (Clallam County 2008). Two tributaries join the river from the east and west in the upper watershed. The river reenters a narrow valley between two hillcrests to the east and west, before emerging onto a low-gradient terrace and delta.

The watershed and riparian corridor of the West Twin River contains dense, contiguous forest habitat. This continuous forest cover provides habitat for a variety of wildlife species, including bald eagle. In addition, well-forested forested riparian corridor along the river helps maintain cool water temperatures and provide organic debris inputs to the stream channel.

The West Twin River provides spawning and rearing habitat for coho salmon and steelhead, resident cutthroat, and rainbow trout. Anadromous fish distribution and habitat utilization in the West Twin River subbasin is limited by waterfalls, cascades, log jams, and steep gradients (NOPLE-TRG 2011). There are no documented fish barriers within the West Twin River watershed.

The river has no identified water quality issues. The Streamkeepers of Clallam County list water quality as "healthy" for both B-IBI and WQI.

The land along the upper half of the West Twin River is National Forest land. The lower half is predominately private timber land. There is no significant development within the watershed.

Informal public access to the publically owned portions of the river corridor is available off of West Twin River Road.

6.11.2 Future Land Use and Potential Effects on Shoreline Ecology

There is minimal potential for development along the West Twin River. Approximately half of the riparian corridor is publically owned timber land. The timber parcels along the lower half of the river are not eligible for subdivision, under current zoning regulations.

6.11.3 Management Issues and Restoration Opportunities

There is currently minimal available public access to the river. Significant public access opportunities are present on National Forest land, in the upstream portion of the river corridor.

Restoration opportunities for the river include (NOPLE-TRG 2011):

- Maintain and protect habitat connectivity.
- Conduct an inventory of potential human-created fish barriers in the watershed.

6.12 *Deep Creek (Maps 1c to 6c in Appendix A)*

The headwaters of the Deep Creek watershed are located in steep mountainsides of Olympic National Forest. The watershed area is approximately 18.2 square miles. Deep Creek is classified

as a "shoreline of the state" and the portion within County jurisdiction is 5.8 miles in length (1 reach).

6.12.1 Summary of Baseline Conditions

Deep Creek is a relatively short and narrow stream; its average stream width varies between 3 and 9 yards (Smith 2000). Gradient varies from moderate to steep throughout the watershed. The terrain of the middle and lower subbasin is continuously hilly through its entire course. Deep Creek empties into the Strait of Juan de Fuca approximately 5 miles east of Pillar Point.

The Deep Creek watershed is sensitive to mass wasting events (Smith 2000). Due to the steep nature of the watershed and accentuated by human activities (e.g., timber harvest and road construction), 134 mass wasting sites have been documented in the watershed between 1971 and 1992. Most of these flows have entered into the main channel and started debris flows. Five of the events have scoured the channel beds to bedrock. One particularly damaging flow in November 1990 resulted in a flood wave that scoured the mainstem to as much as 10 vertical feet from RM 12 to RM 2. Currently, the channel and floodplain of the Deep Creek watershed has been significantly degraded due to mass wasting events.

Extending downstream from the National Park boundary, the watershed and riparian corridor of Deep Creek contains dense, contiguous forest habitat. This continuous forest cover provides habitat for a variety of wildlife species, including bald eagle. In addition, the well-forested forested riparian corridor along the river helps maintain cool water temperatures and provide large woody debris inputs to the stream channel.

Deep Creek provides spawning and rearing habitat for coho and chum salmon, as well as steelhead, resident cutthroat, and rainbow trout. Fall Chinook runs have been extirpated from the basin (Smith, 2000). Declines in Deep Creek coho, chum, and steelhead have been documented in recent years.

Within County SMA jurisdiction, the land along the upper portion of Deep Creek is National Forest and DNR-managed timber land. Land along the lower portion of the creek is private timber land.

Portions of Deep Creek have an impaired water quality listing for dissolved oxygen, fine sediments, and temperature. In addition, Gibson Creek (tributary to Deep Creek) is listed with impaired water quality for temperature. Deep Creek water quality is reported by the Streamkeepers of Clallam County as "healthy" for WQI and "compromised" for B-IBI.

There is no readily available access to the publically owned lands bordering Deep Creek.

6.12.2 Future Land Use and Potential Effects on Shoreline Ecology

Under current zoning regulations, there is minimal potential for development along the Deep Creek. Much of the riparian corridor is publically owned timber land. There are several privately owned timber parcels along the lower portion of the creek, but most are not eligible for subdivision under current zoning regulations.

6.12.3 Management Issues and Opportunities

There is currently no public access to Deep Creek. Public access opportunities are present on the National Forest and DNR-managed lands along the upper portion of the creek.

There is significant restoration potential in the watershed, particularly in areas affected by mass wasting and channel incision. Over the past decade several restoration projects in the Deep Creek watershed have focused on creating pool/ripple habitat and the placement of LWD in the stream profile (NOPLE-TRG 2011). The primary restoration goals of the watershed, as outlined by the WRIA 19 Salmon Recovery Plan (NOPLE-TRG 2011) include:

- Restore and protect habitat connectivity.
- Identify and replace fish barrier culverts within the watershed.
- Eliminate road, culverts, or other land uses that cause mass wasting events.
- Reforest riparian and floodplain areas to increase stream bank integrity and reduce bank erosion.

6.13 *Pysht River and Tributaries (Maps 1c to 6c in Appendix A)*

The Pysht River headwaters are in the steep mountainsides of the Olympic National forest. The watershed area is approximately 54 square miles. The lower 14.3 miles (4 reaches) of the Pysht River is classified as a "shoreline of the state." Three of its tributaries are also shorelines of the state: the South Fork Pysht River (4.5 miles, 2 reaches), Salmonberry Creek (1.1 miles, 1 reach), and Green Creek (0.7 mile, 1 reach).

6.13.1 Summary of Baseline Conditions

The mainstem of the Pysht River is 16.5 miles in length with an elaborate system of tributaries that add an additional 35.6 miles of stream length (Smith 2000). The headwaters of the watershed are located in mountainous terrain and have a steep gradient. Downstream, the river flows through 11 miles of low gradient valley. The Pysht River enters into the Strait of Juan de Fuca east of Pillar Point. The Pysht River estuary complex includes the lower river, associated tidal marshes and estuarine channel complex, and a large unvegetated tidal flats. The Pysht River supports the largest tidal marsh system in WRIA 19 (NOPLE-TRG 2011).The lower river channel has been confined in places by log pilings, preventing the lateral movement and braiding of the river channel across its broad alluvial floodplain.

Upstream of the confluence with the South Fork Pysht River, the watershed and riparian corridor of the Pysht River and its tributaries consists almost entirely of forest habitat. Forest cover within the riparian corridor decreases somewhat downstream, as the river flows through wetland habitat and areas that have been cleared for low density residential development. Highway 112, which borders the lower Pysht, has also altered forest cover within the river's riparian corridor. Near the mouth, forested riparian cover varies from minimal in places to approximately 300 feet wide, as the river flows into wetlands and estuarine habitat.

The Pysht River watershed supports habitat for a wide variety of wildlife species, including breeding populations of bald eagle and waterfowl concentrations at the estuary. Significant wetland and estuarine habitat is present in the floodplain of the lower Pysht, however, large portions of wetland habitat have been impacted and/or isolated by the construction of roadways or stream bank armoring. Wetland areas are also present throughout the lower and middle watershed, but are less abundant in the upper, steeper reaches.

The Pysht River and its tributaries provide spawning and rearing habitat for Chinook, coho, and chum salmon, as well as steelhead, resident cutthroat, and rainbow trout. Chinook salmon are recorded as spawning in the mainstem and lower 6 miles of the South Fork Pysht Rivers (Smith 2000). However, Chinook are present in very low numbers, and the run may be functionally extinct. In all accessible areas between RM 3 and RM 12, coho and steelhead have been documented spawning in the mainstem and South Fork. Chum salmon spawning is between RM 4 and RM 10. Tributaries in the basin important for coho spawners include Reed Creek (to RM 3.1), Green Creek (to RM 2.2), Gold Creek (to RM 1), and Needham Creek (to RM 1.8). A few unnamed tributaries also support chum and coho salmon.

The Pysht River has a high degree of documented floodplain impacts per stream mile compared to other rivers in WRIA 19 (Clallam County 2008). The two greatest impacts are associated with Highway 112 (on the right bank RM 2 to RM 8.4) and a railroad grade (on the left bank in the lower reaches) (Figure 6-6). These two impediments increase channel instability by acting as dikes, contribute to sediment, and reduce access to juvenile rearing habitat. Further upstream the Crown Zellerbach Road impacts the floodplain from RM 9.8 to RM 11.5. As a result of road and railroad grades within the floodplain, side-channel habitat in the mainstem Pysht has been significantly impaired and poses a threat to continued production of anadromous fish within the watershed.

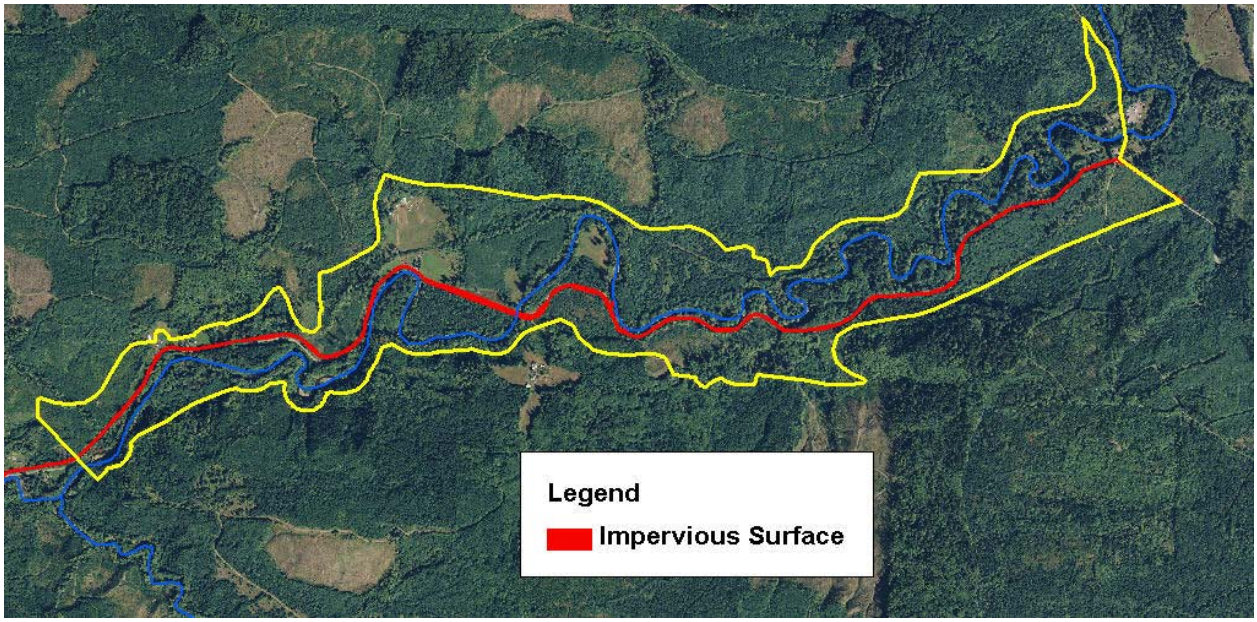


Figure 6-6. Impervious surface along the middle reach of the Pysht River

The upper reach of Pysht watershed (above confluence of South Fork) and its tributaries within the County (including the South Fork Pysht, Salmonberry Creek and Green Creek) are working timber lands that are primarily privately owned. In the lower reaches, adjacent land uses are predominately a timber lands, with a few low-density residential parcels. Some of these parcels lie within mapped floodplain and/or tsunami hazard zones.

Several reaches of the Pysht River and several associated tributaries have State impaired water quality listings for temperature. There are no Streamkeepers of Clallam County water quality data available for any of the streams within the watershed.

Nearly the entire Pysht watershed is privately owned, thus there is no public access available. However, Merrill & Ring timber company, the largest property owner in the watershed, offers recreational access to some areas of the watershed with the purchase of an annual access permit. Permits are limited to the first 150 applicants.

6.13.2 Future Land Use and Potential Effects on Shoreline Ecology

There is limited potential for increased residential development in the Pysht River watershed in the foreseeable future. Most of the lands bordering the Pysht River are zoned for timber production, and cannot be subdivided under current zoning regulations. With the exception of a few larger parcels that could be subdivided into 5-acre home sites, most of the residential-zoned land bordering the lower river is developed, and cannot be further subdivided. Conversation of forest areas to residential development would impacts shoreline ecology through the removal of forest cover, placement of structures in the floodplain and channel migration zone, and increased use of shoreline armoring.

6.13.3 Management Issues and Opportunities

Key management recommendations for the Pysht Rivers are:

- Limit construction of roads or levees along the river banks or in the floodplain of the river system. Roads act as barriers that impound and channelize the river, and may increase potential erosion downstream.

- Limit the removal of forest and other natural vegetation communities within the watershed, and particularly within the riparian corridor. Currently, there is very limited public access available in the Pysht watershed. The only viable option for increasing public access is the public acquisition of private lands.

There is significant restoration potential in the watershed, particularly focusing on abating sedimentation, reconnecting the river to its historic floodplain, and restoring natural vegetation to the riparian corridor. The primary restoration goals of the watershed, as outlined by the WRIA 19 Salmon Recovery Plan (NOPLE-TRG 2011) include:

- Remove dredge spoils and log sheet piling along the lower Pysht River.

- Replace fish barrier culverts throughout the watershed.

- Maintain and protect habitat connectivity.

- Remove old railroad grades to reconnect the river to its historic floodplain.
- Reforest unutilized pasture areas within the riparian corridor.

6.14 *Clallam River (Maps 1c to 6c in Appendix A)*

The Clallam River watershed headwaters are in the steep mountainsides of the Olympic Mountains. The watershed encompasses an area of approximately 36 square miles. The lower 11.5 miles of the Clallam River is classified as a "shoreline of the state", and is divided into 4 reaches. The lower 0.9 mile of Charley Creek, a tributary to the river, is also a shoreline of the state (1 reach).

6.14.1 Summary of Baseline Conditions

The Clallam River is approximately 14 miles long, with steep gradients in its headwaters and low gradients downstream (Clallam County 2008). The upper watershed drains a series of moderately steep, low elevation mountains. In the upper watershed (upstream of RM 7) of the river is confined in a narrow valley bound by steep hills and low elevation mountains. Stream gradient remains low to moderate up to RM 14.3, where the stream gradient reaches 13% in a short cascade segment. In the lower watershed, the river meanders through a low gradient unconstrained valley bound by low, gently sloping hills. The river drains into the middle portion of Clallam Bay just east of Slip Point. The Clallam River drains through several breached segments of a large gravel/sand spit, which blocks the river from Clallam Bay during low flow periods (Smith 2000).

Downstream from the confluence with Charley Creek, the watershed and riparian corridor of the Clallam River and its tributaries consists of a mixture of forest habitat and herb and shrub habitat. Within the lower reach (from the outlet to confluence of Charley Creek) portions of the riparian corridor have been cleared and developed for agriculture and low-density residential. Forest cover increases within the upper watershed (reaches above confluence with Charley Creek), as the river terrain becomes more steep.

The Clallam River watershed provides habitat for a wide variety of wildlife species, including breeding populations of bald eagle. Eagle habitat is primarily located in the lower watershed near the outlet of the river into Clallam Bay. Significant wetland habitat is present in the floodplain of the lower and middle reaches of the Clallam River, however much of the historic wetland habitat has been altered by human activities including logging and road construction. Wetland habitat is generally absent in the upper, steeper portion of the watershed.

The Clallam River and Charley Creek provide spawning and rearing habitat for coho and chum salmon, steelhead trout, and resident cutthroat trout. Coho spawning has been documented between RM 3.6 and 11.4 in the mainstem and the lower 1.7 miles of Charley Creek (Clallam County 2008). Winter steelhead have a similar distribution and have been documented from RM 2.8 to 11.4 in the mainstem, and up to RM 3 of Charley Creek. Moderate numbers of chum have been observed in the lower mainstem. Chinook salmon have not been observed in the Clallam River for many years.

There are several potential fish barriers within the Clallam watershed. A periodic obstruction to anadromous salmonid access occurs with periodic sandbar formation at the mouth of the Clallam River (Clallam County 2008). Another fish barrier is located on the mainstem at RM 2, where a culvert blocks approximately 3 acres of wetland habitat important for coho, steelhead, and cutthroat rearing. Highway 112 cuts through the Clallam River floodplain between RM 4.4 and 5.6, resulting in a loss of off-channel juvenile habitat that impacts fall Chinook, fall coho, and winter steelhead. It also reduces winter refuge habitat for fall coho and winter steelhead, and reduces incubation survival for all salmonid species.

Historically the Clallam River supported abundant salmon and steelhead runs. These runs have since declined with the settlement and utilization of resources from the basin. Most notably Chinook runs declined through the 1960s and 1970s and now are for all intensive purposes, extinct from the basin (WRIA 19 Limiting Factors, 2008).

Just upstream from Clallam Bay, the Clallam River watershed is primarily working timber lands, within both private and public (DNR) ownership. The riparian corridor of Charley Creek is also DNR-managed timber land. The estuary of the Clallam River is borders by dense residential and commercial urban development. Some of this development is located within mapped flooding and/or tsunami hazard areas.

The lower Clallam River has a State impaired water quality listing for temperature. Stream temperatures in the mainstream are significantly higher than in its tributaries, with temperature increasing in the downstream direction (Clallam County 2008). Clallam River water quality is reported by the Streamkeepers of Clallam County as “compromised” for both B-IBI and WQI.

The downstream end of the Clallam River can be accessed from Clallam Bay Spit Community Beach County Park. The upper Clallam River can be accessed from the Clallam River Campground, off of Highway 112. Informal access to Charley Creek and the lower river is available from Highway 112.

6.14.2 Future Land Use and Potential Effects on Shoreline Ecology

Upstream of the Charley Creek confluence, there is limited potential for increased residential development along the Clallam River in the foreseeable future. Most of the riparian corridor is within public ownership (DNR-managed timber land). Under current zoning regulations, the private timberland within the riparian corridor cannot be subdivided.

There are several parcels at and downstream from the confluence that could be subdivided into 5-acre home sites. Many of these parcels lie within FEMA-mapped flood hazard areas and mapped channel migration zones. Residential development on these parcels has several potential negative effects typical of the region from vegetation removal, flood hazard, and shoreline armoring.

6.14.3 Management Issues and Opportunities

There are relatively few existing public access areas on the Clallam River. Significant potential for increasing public access on the river is located on the DNR-managed public land, north of the Charley Creek confluence.

Restoration opportunities for the river include (NOPLE-TRG 2011):

- Explore possibility of habitat acquisition and/or easements to protect high quality riparian and floodplain estuarine habitats.
- Maintain and protect habitat connectivity.
- Identify and replace fish barriers throughout the watershed.
- Reforest unutilized pastures and degraded riparian/floodplain areas.
- Reconnect the river to its historical floodplain, where possible.
- Utilize large woody debris placement in wood-deficient zones to increase habitat quality and reduce channel incision problems.

6.15 *Hoko River (Maps 1c to 6c in Appendix A)*

The headwaters of the Hoko River lie within the foothills of the Olympic Mountains. The Hoko River is the largest watershed within WRIA 19 and encompasses approximately 71 square miles. Several major tributaries contribute to the Hoko River including Johnson, Cub, Bear, Ellis, and Herman Creeks, which drain into the main stem from the east, and Ossert and Brownes Creeks, which flow into the upper main stem from the west. The main tributary to the Hoko River is the Little Hoko River.

The Hoko River is classified as a "shoreline of the state, and is divided into 8 reaches. Five of its tributaries are also shorelines of the state: Bear Creek (2.8 miles, 1 reach), Ellis Creek (1.0 mile, 1 reach), Brownes Creek (0.2 mile, 1 reach), the Little Hoko River (4.6 miles, 1 reach), and (2 reaches) Herman Creek (3.1 miles, 2 reaches).

6.15.1 Summary of Baseline Conditions

The main stem of the Hoko River is approximately 25 miles long and lies within moderately steep terrain in the foothills of the Olympic Mountains. An additional 80 miles of tributaries enter into the main stem of the Hoko River along its course to the Strait of Juan de Fuca.

The upper Hoko watershed drains a precipitous, incised landscape (Clallam County, 2008). Several cascades exist, including Hoko Falls. The lower 10 miles of the Hoko River flow through a moderately steep terrain, and has a low gradient and plentiful gravels. The lower floodplain of the river supports a large estuary that extends into the river for more than a mile. The Little Hoko River is the major tributary in the lower basin and joins the Hoko at RM 6.8. The Little Hoko River flows through moderately steep terrain and has moderate to steep gradients above RM 3.5. Downstream the Little Hoko has a low gradient as it flows through a flat valley toward its confluence with the Hoko River.

Upstream from RM 6.8 (confluence with Little Hoko River), the watershed and riparian corridor of the Hoko River and its tributaries consists almost entirely of forest habitat. Forest habitat diminishes slightly through downstream reaches as portions of the floodplain have been

developed for agriculture and rural residential uses. Riparian habitat near the mouth of the river consists of estuary and wetland habitat.

Portions of the mainstream Hoko River are constrained by road and railroad grades, as well as dikes and channelization in the Little Hoko River (Clallam County 2008). These floodplain impacts have constrained the channel, reduced side-channel habitat, and reduced riparian vegetation and associated LWD recruitment. Culverts located on commercial lands throughout the basin have decreased access to side-channel habitat.

The Hoko River watershed provides habitat for a variety of wildlife species, including supports breeding populations of bald eagle and harlequin duck in the lower reaches. Significant wetland habitat is present in the floodplain of the lower Hoko River, with estuarine habitat extending up river nearly a mile. A significant portion of the lower watershed lies within a broad alluvial fan with multiple channels and wetland habitat. Wetland habitat is generally absent in the upper, steeper portions of the watershed.

The Hoko River and several of its tributaries provide spawning and rearing habitat for a variety of anadromous fish. The main stem Hoko provides spawning habitat for Chinook (up to RM 21.5), chum (up to RM 22), coho (up to RM 23.2), and winter steelhead (up to RM 23.4) (Clallam County 2008). Fall Chinook, coho salmon, winter steelhead, and chum salmon spawn in the Little Hoko River, with coho salmon and winter steelhead spawning up to RM 3.9 in the main stem and the lower 1.5 miles of Leyh Creek. Chum and Chinook salmon spawn up to RM 3 in the Little Hoko River. In high flow years, Chinook salmon have also spawned in Herman, Bear, and Brownes Creek. Ossert Creek and Brownes Creek provide spawning and rearing habitat for coho salmon and winter steelhead production (within the lower mile).

In the upper Hoko watershed, four major tributaries provide spawning and rearing habitat (Clallam County, 2008). These include Johnson Creek (spawning from RM 0-1), Herman Creek (RM 0-2.8 for coho and RM 1.6 for steelhead), Ellis (spawning from RM 0-1.3), Cub Creek (RM 0-1.5 for coho and RM 1.0 for steelhead) and Bear Creek (RM 0-1.5). Unnamed tributaries also support coho salmon and winter steelhead (Smith 2000). The Hoko and its tributaries also support cutthroat trout throughout the watershed.

A hatchery was built in 1984 on the Hoko River by the Makah Tribe. This facility has produced juveniles obtained from adults returning to the Hoko River (Clallam County 2008).

Within County SMA jurisdiction, approximately 95% of the land bordering the Hoko River and its tributaries is working timber land. Most of the timber land is privately owned, but there are some scattered publically owned parcels (managed by DNR). Some low-density residential development and agricultural lands are located adjacent to the river, near its estuary. Some of the homes along the lower Hoko are located within the tsunami hazard zone, the FEMA-mapped floodplain, and the channel migration zone of the river.

Several reaches of the Hoko River and several of its tributaries have an impaired water quality listing for temperature. Temperature problems are in part attributed to decreased levels of shade due to thinning of riparian cover (Clallam County, 2008). Hoko River water quality is reported by the Streamkeepers of Clallam County as “compromised” for both B-IBI and WQI.

Public access is available near the confluence of the Little Hoko River and the mainstem, at the undeveloped Hoko River State Park. The DNR-managed public parcels within the watershed are generally inaccessible.

6.15.2 Future Land Use and Potential Effects on Shoreline Ecology

Most of the riparian corridor areas of the Hoko River and its tributaries are commercial timber lands, and are not eligible for subdivision under current zoning regulations. However, there are a few scattered parcels adjacent to the lower Hoko that could be subdivided into 5-acre residential home sites. Most of the developable land is located the tsunami hazard zone, the FEMA-mapped floodplain, and/or the channel migration zone of the river. Residential development on these parcels has several potential negative effects typical of the region related to forest cover in the river corridor, structures in the floodplain, shoreline armoring, and flood hazard

6.15.3 Management Issues and Opportunities

There is generally no available public access to streams in the upper Hoko River watershed. There publically owned, DNR-managed timber parcels provide a significant opportunity for increasing public shoreline access.

As a whole, there is generally low development potential for the Hoko and its tributaries in the near term. However, there is some potential for increased residential development along the lower river. Key management recommendations are:

- Limit the removal of forest and other natural vegetation communities within the watershed, and particularly within the riparian corridor. Riparian vegetation helps stabilize eroding river banks, and provides habitat and shade for fish and wildlife.

- To protect structures, as well as human health and safety, avoid development within the Hoko River's floodplain and channel migration zone, if possible.

The primary restoration goals of the watershed, as outlined by the WRIA 19 Salmon Recovery Plan (NOPLE-TRG 2011) include:

- Remove hard shoreline armoring, where practical.

- Support natural process recovery through large woody debris supplementation.

- Identify willing sellers of parcels with natural shoreline for either permanent conservation or acquisition for protection.

- Maintain and protect habitat connectivity.

- Identify and repair fish barrier culverts throughout the watershed.

6.16 *Sekiu River (Maps 1c to 6c in Appendix A)*

The Sekiu River headwaters are located in the foothills of the Olympic Mountains. The watershed area is approximately 45 square miles. The Seiku River is 5.7 miles long (1 reach) and

considered a "shoreline of the state." Above RM 5.7, the river forks into two branches (South and North Forks). The lower 2.9 miles of the South Fork Seiku River and the lower 5.2 mile of the North Fork are also shorelines of the state (1 reach each).

6.16.1 Summary of Baseline Conditions

The Sekiu River watershed is characterized by its steep terrain. The river system flows over moderately steep foothills and through narrow valleys that extend northward toward the shoreline, before the mainstem flows into Neah Bay (Clallam County, 2008).

The majority of the watershed and riparian corridor of the Sekiu River and its tributaries consists of forest habitat. With the exception of logging roads and some low-density residential development near the Sekiu River mouth, riparian corridor alterations are minimal throughout the watershed. The forest cover provides habitat for a variety of wildlife species, including breeding populations of bald eagle located within the lower watershed (Figure 6-7).

Channelization has occurred in the Sekiu basin, however the main line logging road that parallels the mainstem is the greatest floodplain impact in the basin (Clallam County, 2008). This road constrains over 4.5 miles of the mainstem, resulting in increased channel instability and loss of off-channel salmonid rearing habitat.

The Sekiu River and its contributing tributaries support several fish species including Chinook, chum, and coho salmon, steelhead trout, and resident cutthroat trout. Historically the Sekiu River has provided spawning habitat for abundant runs of summer and fall Chinook, coho, and chum

Figure 6-7. Bald eagles are frequently seen along the Sekiu River

salmon and summer run steelhead trout. Declines in fish returns were documented during the 1960s and 1970s leading to a near extinction in fall Chinook populations (Clallam County, 2008). Sockeye salmon have also been found in the Sekiu River in limited numbers, but have generally been regarded as strays.

The majority of the Sekiu River watershed is working timber lands, primarily privately owned and managed. Downstream of the Carpenter Creek confluence, adjacent land uses are predominately low-density rural residential development. Some of the homes along the lower Sekiu River are located within the tsunami hazard zone and FEMA-mapped flood hazard areas.

The lower Sekiu River has an impaired water quality listing for temperature. Alterations to the riparian corridor and increased sedimentation rates from timber harvesting and road construction have resulted in impaired water temperature quality that which are harmful to endangered or threatened salmon populations. Streamkeepers of Clallam County has listed the water quality of the river as "compromised" for B-IBI, but "healthy" for WQI.

Public access opportunities in the watershed are very limited; nearly all the land along the Sekiu River system within County SMA jurisdiction is privately owned. Informal public access to a DNR-managed public parcel along the North Fork Sekiu River is available from Sekiu River Road.

6.16.2 Future Land Use and Potential Effects on Shoreline Ecology

Most of the land along the Sekiu River and its tributaries is zoned for timber production, and cannot be subdivided for residential development under current zoning regulations. There are a few parcels near the river mouth that could be subdivided into 2-acre residential home sites. Most of this land is located within the FEMA-mapped floodplain and/or a tsunami hazard zone. Residential development on these parcels has several potential negative effects typical of the region.

6.16.3 Management Issues and Opportunities

There is generally no available public access to the Sekiu River and its tributaries. There publically owned, DNR-manage timber parcel along the North Fork of the river is significant opportunity for increasing public shoreline access.

As a whole, there is generally low development potential along the Sekiu River and its tributaries in the foreseeable future.

The primary restoration goals of the watershed, as outlined by the WRIA 19 Salmon Recovery Plan (NOPLE-TRG 2011) include:

- Maintain and restore habitat connectivity.
- Inventory and replace fish barrier culverts throughout the watershed.
- Eliminate road/culvert related mass wasting events to fish-bearing waters.
- Restore large woody debris density throughout the watershed.

- Protect, maintain, and/or restore riparian habitat conditions.

6.17 *Bullman Creek (Maps 1c to 6c in Appendix A)*

The Bullman Creek watershed originates in the foothills of the Olympic Mountains, and drains approximately 18 acres. The lower 0.4 mile of the creek is considered a "shoreline of the state" (1 reach).

6.17.1 Summary of Baseline Conditions

Bullman Creek is a relatively short (less than 3.5 miles) independent drainage, with generally low relief. From its headwaters, Bullman Creek flows over moderately steep hills and through narrow valleys that extended northward to the shoreline (Clallam County 2008). Bullman Creek flows in a generally straight, well defined course, through narrow floodplains before emptying directly into the Strait of Juan de Fuca at Bullman Beach.

The Bullman Creek watershed contains extensive forest cover, although forest cover has been altered by residential development at the creek mouth. The forest provide habitat for a variety of wildlife species, including bald eagle.

Bullman Creek supports runs of fall Chinook and coho salmon, and winter runs of steelhead trout. However, excessive sedimentation from the development of roadways and the conversion of riparian habitat (i.e. timber harvest, logging roads, and rural residential encroachment) have adversely impacted fish habitat within watershed (Clallam County, 2008).

Bullman Creek has no State water quality impairment listings. However, the Streamkeepers of Clallam County list the water quality as "compromised" for WQI.

The portion of the riparian corridor within County SMA jurisdiction is primarily private forest land, with moderate-density residential development adjacent to Highway 112. Within County SMA jurisdiction, all of the lands bordering Bullman Creek are private. There is no available public shoreline access.

6.17.2 Future Land Use and Potential Effects on Shoreline Ecology

There is minimal potential for increased development along the SMA management area of Bullman Creek in the foreseeable future. Most of the riparian corridor is zoned for commercial timber uses, and cannot be subdivided for residential development. The residential-zoned areas at the creek mouth are already fully developed.

6.17.3 Management Issues and Opportunities

There are no identified management recommendations for Bullman Creek, or specific identified restoration opportunities. Programmatic restoration suggestions for the WRIA 19 independent drainages include (NOPLE-TRG 2011; Clallam County 2008):

- Increase large woody debris levels within the creek.

- Maintain and protect habitat connectivity.

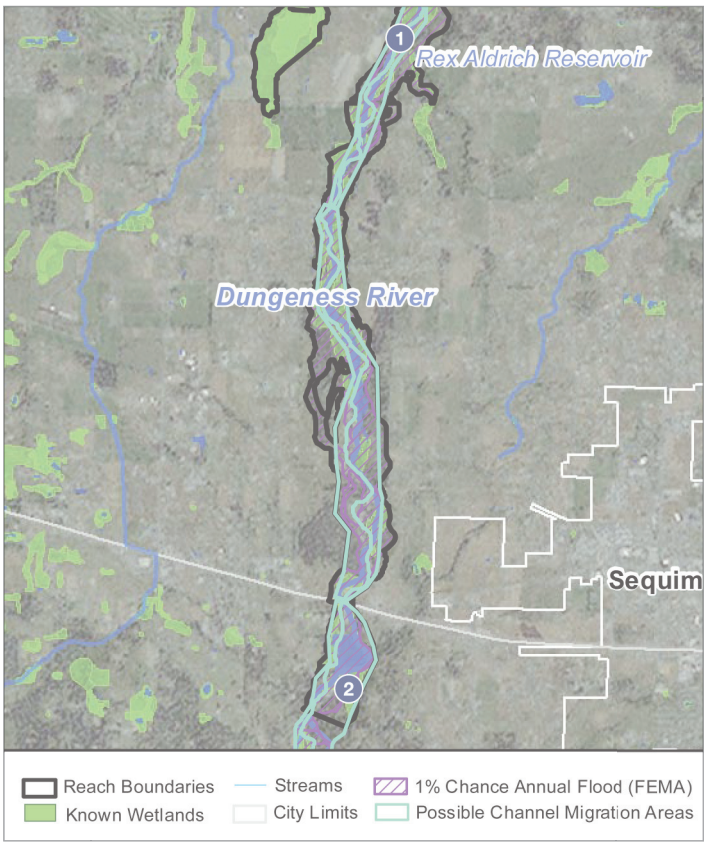
- Identify and repair fish barrier culverts.
- Reforest disturbed riparian areas.

Reach Sheet Data Descriptions and Sources

Freshwater Reach Sheet Explainer

REACH MAP

The reach maps show each "reach" or inventory segment—there are 63 freshwater reaches (encompassing 39 streams and 1 lake), which excludes incorporated areas and the Makah Reservation. Channel migration and flood hazard areas are also shown on the maps. Shoreline oblique photos taken by Ecology are provided (where available) to help orient the reader to key localities. The aerial photography is from 2009.



PHYSICAL

Channel Configuration

Configuration of the stream channel is described based upon information available in WRIA Plans (various sources). If channel data was not available, configuration was described based upon air photo interpretation.

Hazard Areas

This dataset contains information about geologic and river hazards, which include: areas of slope instability, landslide hazard areas, tsunami hazard areas, frequently flooded areas, channel migration zones, and erosion hazard areas (Data sources: Clallam County; Ecology; FEMA; Jamestown S'Klallam Tribe; NRCS; and WDNR). In general, these data show where hazards are likely to occur or where they are known to have occurred. Some data are missing in undeveloped areas (such as commercial forest-zoned lands) and/or the upper reaches of streams, particularly within Olympic National Forest. Hazards may still be present in areas where none are mapped.

Shoreline Oblique Photos (2006)

ECOLOGY

Riparian Vegetation

This information describes the vegetation cover classification of uplands and shorelands within 300 feet of the ordinary high water line. The Point-No-Point Treaty Council (PNPTC) (2011) identified areas of closed canopy forest, other natural vegetation, non-forest (areas with human influence such as roads, agriculture, houses lawns, etc…), freshwater, and areas known to be off-shore. This analysis was performed using aerial photography, repeatability analyses, and some field surveys. The consultants further annotated the PNPTC data into more detailed categories, such as agriculture, lawn/landscaping, and natural herbaceous habitat, through air photo interpretation.

Habitats and Species

This describes the location of state-designated priority habitats and species in upland and aquatic areas, as reported by the Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species Program and the Washington Department of Natural Resources (WDNR) Natural Heritage Program database. Priority habitat data are course-scale and based upon field biologist observations.

Information on the approximate location and extent of known wetlands and streams is based on data from the US Fish and Wildlife Service (USFWS) and Clallam County wetland inventories and the WDNR and Clallam County stream inventories. Wetland data are somewhat course-scale, and often do not depict small wetlands, slope wetlands or wetlands in dense forest stands. A field wetland determination would be required to accurately determine the presence or absence of wetland habitat in a particular area.

ECOLOGY (CONTINUED)

Water Quality

This dataset comes from the State of Washington's Water Quality Assessment (WQA) and list of impaired waterbodies. The State's WQA categories water quality into five categories, ranging from a Category I waterbodies which meets federal clean water standards to Category 5 waterbodies that are polluted and put on the EPA's impaired waterbodies (303(d)) list. Only Category 5 waterbodies are shown in the reach sheets. Data from Clallam County Streamkeepers monitoring (2010) is also reported. The Streamkeepers measured water quality using two different water quality indices: WQI and B-IBI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

These data describes the use and ownership (i.e., public, private, etc.) of lands immediately adjacent to freshwater shorelines. Ownership information includes reservation lands, areas within Olympic National Park, protected lands, National Wildlife Refuges, and aquatic parcels. Data sources: Clallam County, 2009-2010; WSDOT, 2009; WDNR, 2011; PSNERP, 2009; NPS, 2007; USFWS, 2009.

Zoning and Parcel Data

These data depict Clallam County zoning categories and development potential of land parcels within the reach. Data source: Clallam County, 2009-2010. Based upon this data, a qualitative estimate (i.e. high, moderate, and low) of development potential within the reach is provided.

Public Access

These data identify the existing public access sites on freshwater shorelines. The data includes the location of the existing Olympic Discovery Trail (data sources: Ecology (2010) and Clallam County). Some locally-known, unpublished public access areas may be absent. Public lands that are outside the jurisdiction of the shoreline master program are not included.

Impervious Surfaces

This dataset depicts estimated percentages of impervious surfaces (e.g., pavement, buildings, etc.) covering the land surface. Estimates are based on digital images (data source: NLCD, 2001). Smaller areas of impervious surface, particularly in areas with adjacent forest cover, may not be included in the data set.

Shoreline Modifications

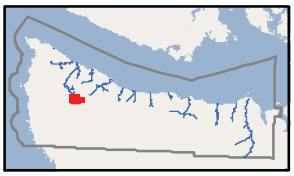
This dataset identifies locations of modifications to the shoreline environment including: bulkheads, levees, docks, piers, marinas, buildings, tidal barriers, dams, bridges, stream crossings, and fish passage barriers. Data are from a variety of sources including: WDNR, 2001 and 2009; PSNERP, 2009; Battelle, 2008; and Clallam County, 2009.

Contaminated Sites

This dataset contains the locations of regulated hazardous materials facilities, spill sites, and cleanup projects. The list of regulated facilities as well as past and on-going cleanup projects is maintained and updated by the Washington Department of Ecology. Environmental compliance and cleanup status is also listed. Data source: Ecology, 2009.

Cultural Resources

This dataset contains recorded historic and prehistoric cultural and archaeological sites (Source: Washington State Department of Archaeology and Historic Preservation, 2010. Due to federal and state laws which preclude the release of site location information, only the number and type of cultural resources sites recorded within a reach are shown on the reach sheets.



Bear Creek

SHORELINE LENGTH
2.8 Miles

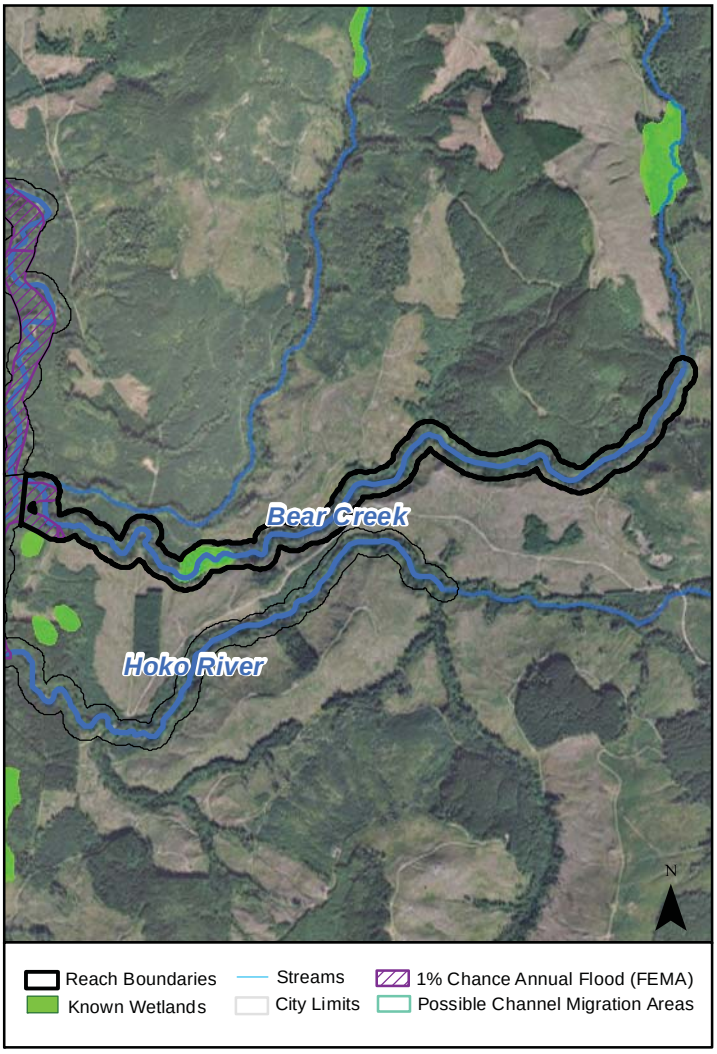
REACH AREA
140.09 Acres

REACH SUMMARY

The reach extends from the Hoko River confluence upstream approximately 2.8 miles. The reach meanders through moderately steep terrain, trending generally westward. Vegetative cover through the reach is primarily forest habitat, which provides shading and habitat for fish and wildlife. Bear Creek provides habitat for Chinook, chum, and coho salmon, and steelhead trout.

The reach consists of privately owned commercial timber lands. Erosion and landslides are prevalent throughout the middle and upper reach. The lower portion of the reach, near the Hoko River confluence, is within the FEMA 100-year floodplain.

All of the land within the reach is zoned for commercial timber. Under current zoning regulations, most of the parcels are subdividable and could be developed with residences, but at a density of no more than 1 dwelling per 80 acres. Developable lands are located within the FEMA 100-year floodplain and geologic hazard areas.



PHYSICAL

Channel Configuration

No data

Hazard Areas

Several stream banks and surrounding areas are unstable (37%) with potential for slides mapped in the northeast and central portions of the reach. Potential erosion areas are mapped in the northeast area of the reach as well as the central portion along the stream bank (25%). Most of the Bear Creek/Hoko River confluence areas lies within the FEMA 100-year floodplain (6%).

ECOLOGY

Riparian Vegetation

72% of the reach areas contains forest habitat, while contains natural herb and shrub habitat.

Habitats and Species

5% of the reach is mapped as wetland habitat. There are no priority wildlife habitats mapped within the reach.

This reach provides spawning habitat for steelhead trout (100% of reach total), and Chinook (87%) and coho salmon (100%). The presence of chum salmon is also identified in the reach.

Water Quality

The reach has no State impaired water quality listings. There are no Streamkeepers water quality data available for Bear Creek.

Bear Creek

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership is 100% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

No public access is available in this reach, the lands are privately owned.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

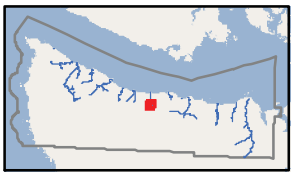
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Boundary Creek

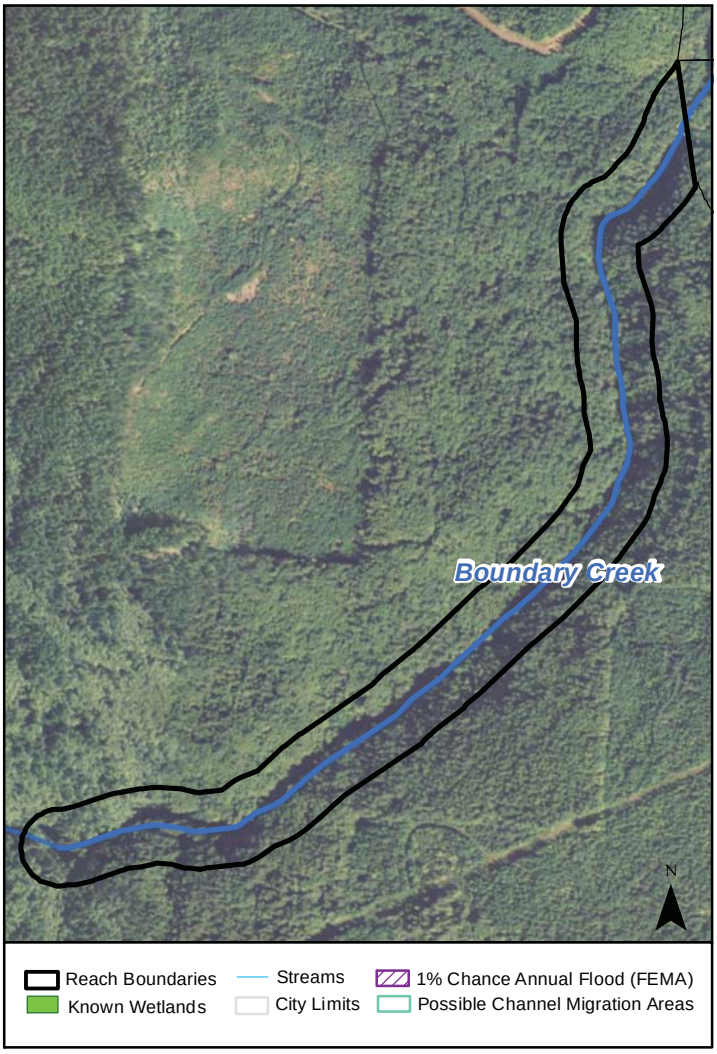
SHORELINE LENGTH
1.1 Miles

REACH AREA
54.42 Acres

REACH SUMMARY

The reach extends from the Lyre River confluence to approximately 1.2 miles upstream. The stream profile through the reach is generally straight, flowing east and northeast through steep mountain terrain and valleys. The channel is bordered by a narrow floodplain. Dense forest cover is present within the reach, providing significant shading and habitat for fish and wildlife. Boundary Creek provides habitat for resident cutthroat and rainbow trout populations.

The reach contains public timber lands managed by DNR. The majority of the reach is located in a geologic hazard area, susceptible to erosion.



PHYSICAL

Channel Configuration

The channel is relatively confined, and follows a mostly straight course bordered by a narrow floodplain.

Hazard Areas

Areas for potential erosion are mapped throughout the entire reach (95%) leading up to the confluence with Lyre River.

ECOLOGY

Riparian Vegetation

100% of the reach area contains continuous forest habitat.

Habitats and Species

There are no priority wildlife habitats mapped within the reach.

This reach provides habitat for resident cutthroat and rainbow trout.

Water Quality

The upstream portion of Boundary Creek within the reach has a State impaired water quality listing for temperature. There are no Streamkeepers data available for Boundary Creek.

Boundary Creek

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership is 100% public.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

100% of the shoreline in this reach is publically owned; however, there are no available public access areas.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

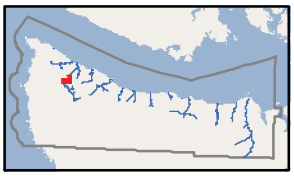
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Browns Creek

SHORELINE LENGTH
0.2 Miles

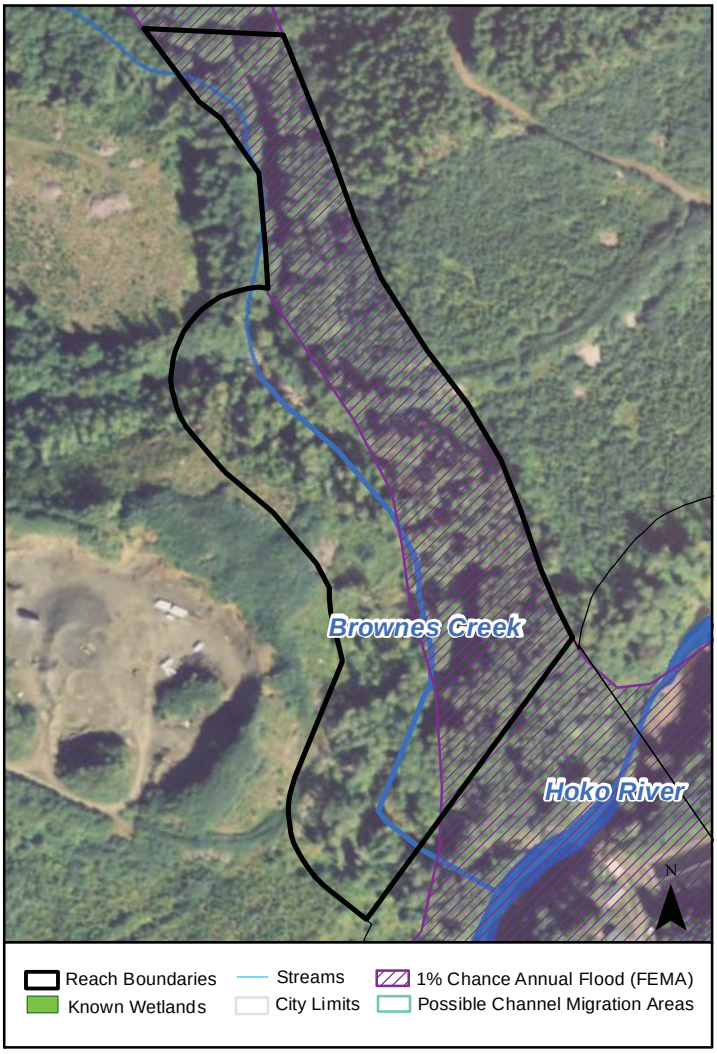
REACH AREA
18.01 Acres

REACH SUMMARY

The reach is relatively short and extends from the Hoko River confluence to approximately 0.5 miles upstream. Forest habitat borders the riparian corridor and extends outward through much of the reach, providing shade and habitat for fish and wildlife. The reach provides spawning and rearing habitat for Chinook, chum, and coho salmon, and steelhead trout. Resident cutthroat and rainbow trout are also present in the reach.

Commercial forestry and timber lands are located throughout the reach. Much of the eastern portion of the reach lies within the FEMA 100-year floodplain. The middle and upper portions of the reach are located in geologic hazard areas, and are susceptible to erosion and landslides. The lands within the reach are largely undeveloped.

Half of the reach area consists of a large subdividable commercial forestry parcel and under current zoning regulations, it could be developed with residences, but at a density no more than 1 dwelling per 80 acres. Most of the developable land is located with the FEMA 100-year floodplain and identified geologic hazard areas.



PHYSICAL

Channel Configuration
No data

Hazard Areas
Several stream banks and surrounding areas are unstable (37%) with potential for slides mapped in the northeast and central portions of the reach. Potential erosion areas are mapped in the southeast portion of the reach (29%). Most of the Browns Creek/Hoko River confluence area is in the FEMA 100-year floodplain (6%).

ECOLOGY

Riparian Vegetation
63% of the reach contains forest habitat while 21% contains natural herb and shrub habitat.

Habitats and Species
There are no priority wildlife habitast mapped within the reach.

This reach provides spawning habitat for steelhead trout (93%) and Chinook (100%) and coho salmon (100%). The presence of chum salmon is also identified in the reach.

Water Quality
The reach has no State impaired water quality listings. There are no Streamkeepers data available for Browns Creek.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (82%) and commercial (18%). The commercial land is generally concentrated in the southeast portion of the reach. Land ownership in the reach is 100% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

No public access is available in this reach, the lands are privately owned.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

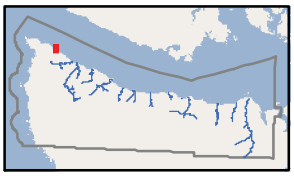
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Bullman Creek

SHORELINE LENGTH
0.4 Miles

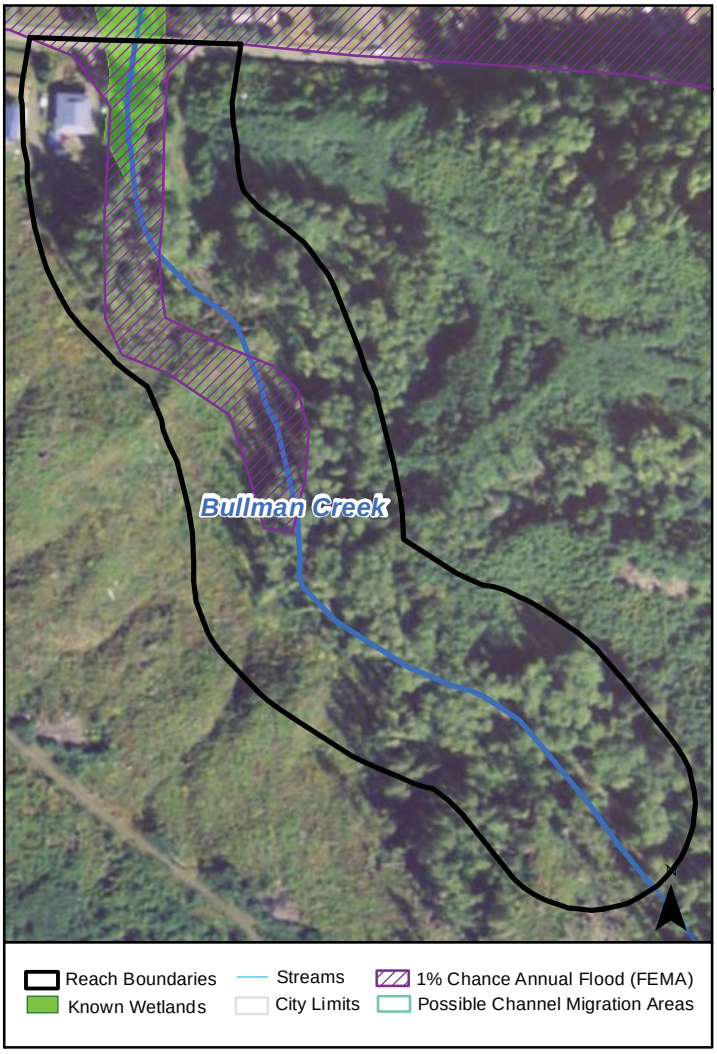
REACH AREA
18.27 Acres

REACH SUMMARY

The reach is relatively short and extends from Highway 112 upstream approximately 0.4 miles. The stream channel within the reach flows in a relatively straight, well-defined course. Vegetative cover in the reach is a combination of forest and herb and shrub habitat. Bullman Creek provides habitat for Chinook, chum, and coho salmon, and steelhead trout. Breeding populations of bald eagle are also located within the reach.

Moderate- to low-density residential development is located in the lower portion of the reach along Highway 112. Timber and commercial forest lands are located in the middle and upper portion of the reach. The lower portion of the reach lies within the tsunami hazard zone and FEMA 100-year floodplain, and the majority of the reach is located in a geologic hazard area for erosion. Residential developments in the lower reach are located within the tsunami hazard zone, FEMA 100-year floodplain, and/or geologic hazard areas.

There is minimal potential for increased development within the reach. Most of the developable parcels are zoned for commercial timber, and under current zoning regulations, could be developed with residences but at a density no more than 1 dwelling per 80 acres. The residential-zoned land within the reach is generally fully developed.



PHYSICAL

Channel Configuration

The stream channel within the reach flows in a relatively straight, well-defined course.

Hazard Areas

Areas for potential erosion are mapped through the central and southern portions of the reach (77%). Surrounding areas to the east of Bullman Creek have potential for slides (6%). Most of the northern portion of the reach is in a tsunami hazard zone (28%) and the FEMA 100-year floodplain (16%).

ECOLOGY

Riparian Vegetation

63% of the reach zone is characterized by forest habitat while 29% of the reach contains herb and shrub habitat. An additional 8% of the reach consists of lawn/landscaping and developed areas.

Habitats and Species

2% of the reach is mapped as wetland habitat, primarily along the northern boundary of the reach, near the Highway 112. Designated priority habitat mapped within the reach is bald eagle (13%).

This reach provides spawning habitat for steelhead trout (100%) and Coho salmon (90%). The presence of Chinook and chum salmon are also mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. Bullman Creek water quality is listed by Streamkeepers as "compromised" for WQI.

Bullman Creek

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (89%), residential (8%), and roads (3%). The residential land is located at the northern end of the reach. Land ownership is 100% private.

Zoning and Parcel Data

The reach is zoned for rural residential (11%) and commercial forestry (89%).

Under current zoning regulations there is low potential for significant new development within the reach. Most of the reach is zoned for commercial forestry.

Public Access

No public access is available in this reach. Lands adjacent to the reach are privately owned.

Impervious Surfaces

Approximately 5% of the reach is covered by impervious surfaces.

Shoreline Modifications

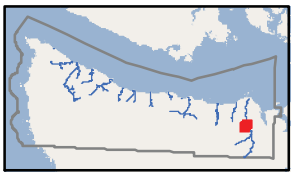
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Canyon Creek

SHORELINE LENGTH
1.7 Miles

REACH AREA
84.68 Acres

REACH SUMMARY

The reach extends from the Dungeness River confluence upstream to the confluence with Pals Creek. The stream meanders northeastward in a relatively straight path toward its confluence with the Dungeness River. Vegetative cover in the reach is primarily dense forest cover that extends from the surrounding foothills into the riparian corridor, providing stream shading and habitat for fish and wildlife. The reach provides habitat for resident cutthroat and rainbow trout. The reach supports breeding populations of elk and harlequin duck. A hatchery water intake dam located at RM 0.08 is a complete barrier to upstream fish passage.

The majority of the reach consists of public, DNR-managed forest lands. Some commercial forestry parcels are located in the lower and middle portions of the reach. The majority of the reach lies in a geologic hazard area for slides. Public access to trails in the reach is available from Forest Service Road 2870.

Under current zoning regulations, the reach is primarily public forest lands that cannot be subdivided. Actual development potential in the reach is low.

PHYSICAL

Channel Configuration

The stream meanders northeastward in a relatively straight path toward its confluence with the Dungeness River. The channel is fairly confined.

Hazard Areas

Most stream banks and surrounding areas are unstable (93%) with potential for slides mapped from the southwest to the northeast reach area, stopping just before the Dungeness Rive confluence. Potential erosion areas are mapped in the northeast area of the reach (1%).

ECOLOGY

Riparian Vegetation

97% of the reach area contains continuous forest habitat while 3% contains natural herb and shrub habitat.

Habitats and Species

Designated priority habitats mapped within the reach include elk (89%) and harlequin duck (6%).

The presence of resident cutthroat and rainbow trout is mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. There are no Streamkeepers data available for Canyon Creek.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (94%), commercial (4%), residential (2%), and roads (trace). The commercial and residential land is located at the northeast end of the reach. Land ownership in the reach is 29% private and 71% public.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

The reach can be accessed via trails from Forest Service Road 2870.

Impervious Surfaces

Approximately 1% of the reach is covered by impervious surfaced.

Shoreline Modifications

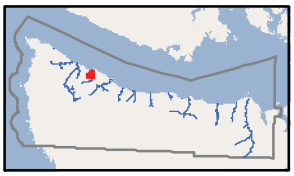
A hatchery water intake dam located at RM 0.08 is a complete barrier to upstream fish passage.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Charley Creek

SHORELINE LENGTH
0.9 Miles

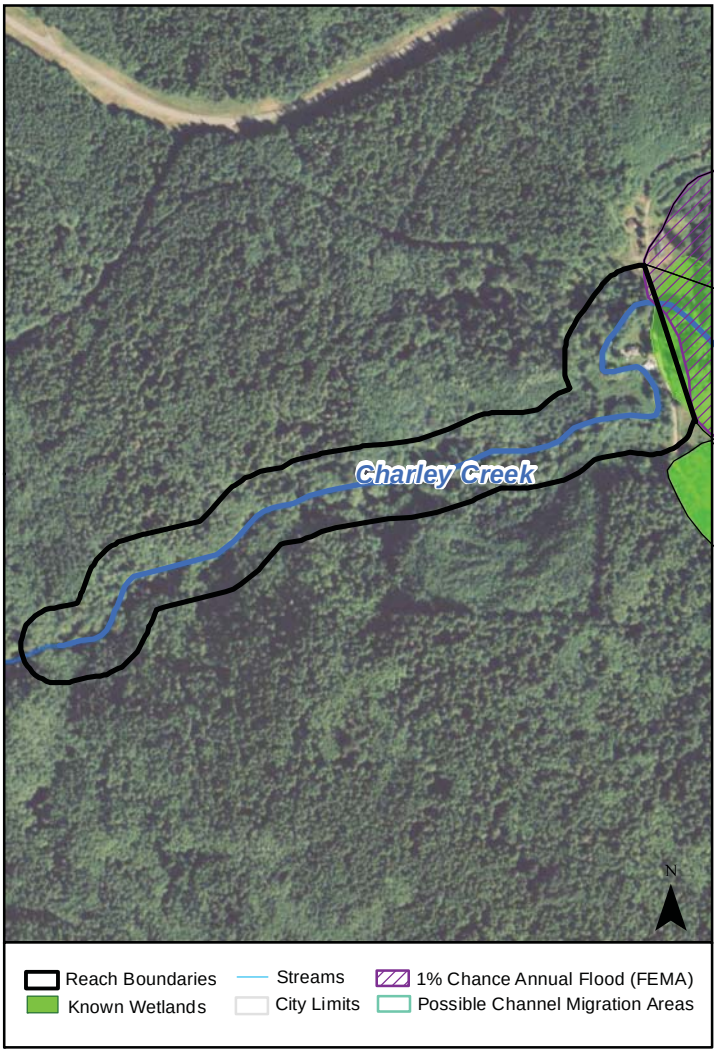
REACH AREA
41.82 Acres

REACH SUMMARY

The reach extends from the Charley Creek Rd crossing, upstream approximately 0.89 miles. The stream profile in the reach is typically straight with a few broad meanders in the lower portion of the reach. Forest cover is prevalent throughout the reach, extending from the surrounding hillside into the riparian corridor. Herb and shrub habitat is located in portions of the lower reach. Wetland habitat is located in the floodplain of the lower portion of the reach, adjacent to Charley Creek Rd. The reach provides spawning and rearing habitat for coho and chum salmon, in addition to steelhead and resident cutthroat trout.

Low-density rural residential development is located in the lower portion of the reach. Most of the reach area is DNR-managed public forest land. The upper and middle portions of the reach are located in a geologic hazard area for erosion. Slides areas are located in the upper portion of the reach along the southern reach boundary.

Under current zoning regulations, the majority of the reach area is not eligible for additional development.



PHYSICAL

Channel Configuration

The stream channel flow relatively straight, and is relatively confined.

Hazard Areas

Areas for potential erosion are mapped through the southwest to central portions of the reach (51%), and some surrounding areas have potential for slides (9%). The eastern end of the reach is located within a channel migration zone (19%).

ECOLOGY

Riparian Vegetation

89% of the reach zone contains continuous forest habitat, while 8% of the reach contains natural herb and shrub habitat. An additional 5% of the reach contains lawn/landscaping and developed areas.

Habitats and Species

3% of the reach is mapped as wetland habitat, located near the Clallam River confluence. There are no priority wildlife habitats mapped within the reach.

This reach provides spawning habitat for steelhead trout (100%) and coho salmon (100%). The presence of chum salmon and resident cutthroat are also mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. Charley Creek water quality is listed by Streamkeepers as "compromised" for WQI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (80%), vacant (10%), residential (9%), and roads (1%). The vacant and residential land is located at the east end of the reach. Land ownership in the reach is 20% private and 80% public.

Zoning and Parcel Data

The reach is zoned for rural residential (20%) and commercial forestry (80%).

Under current zoning regulations there is low potential for significant new development within the reach. Most of the reach is zoned for commercial forestry.

Public Access

Most of the lands within the reach are publically owned. However, no formal public access is available for this reach.

Impervious Surfaces

Approximately 1% of the reach is covered by impervious surfaces.

Shoreline Modifications

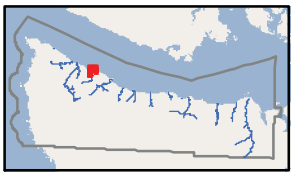
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

Remnants of a timber RR trestle at upstream end of reach is inventoried for historic significance, but not listed.



Clallam River: Reach 1

SHORELINE LENGTH
2.3 Miles

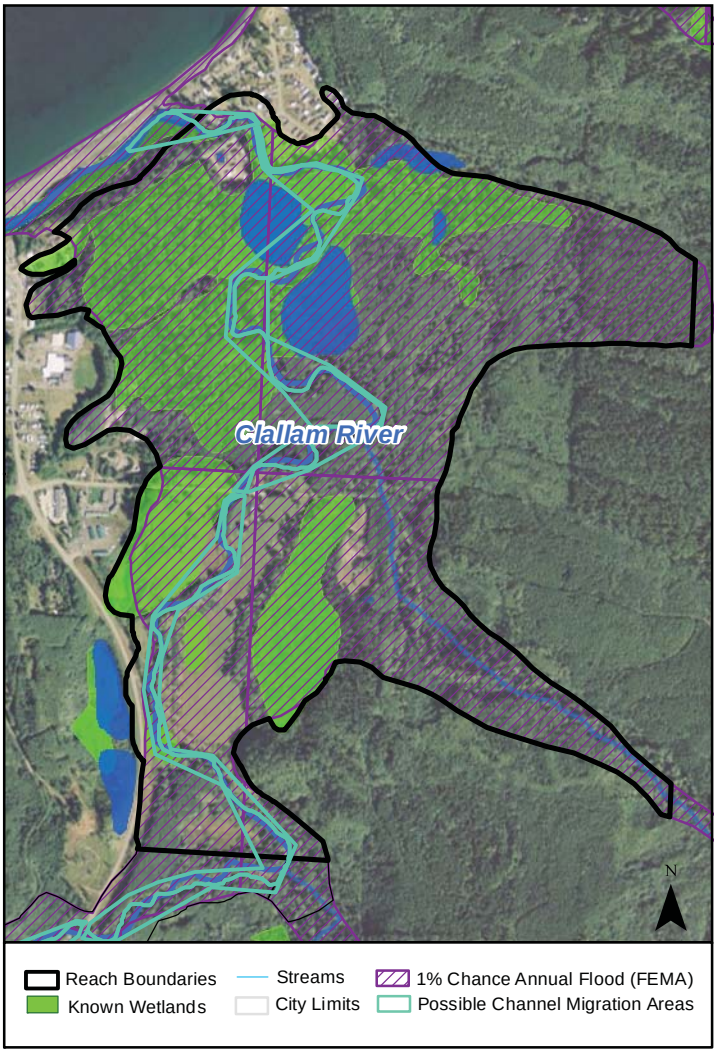
REACH AREA
462.48 Acres

REACH SUMMARY

Reach 1 of the Clallam River extends from near Frontier Street upstream approximately 1.85 miles, and encompasses the large, flat alluvial fan complex of the river. The channel profile through this reach is highly sinuous supporting several large meander bends that move laterally across the broad low-gradient floodplain. Tributary streams braid and join the river in the lower portion of the reach. Patches of herb and shrub habitat, as well as forest habitat, are located in portions of the reach that have not been cleared for agriculture. Wetland habitat extends across the floodplain in several locations. The reach provides habitat for coho and chum salmon,as well as steelhead and resident cutthroat trout. The reach supports breeding populations of bald eagle.

The majority of the reach contains moderate- to-low density residential development and agriculture. Approximately a third of the reach is zoned for commercial forestry. The majority of the reach lies within the tsunami hazard zone, the FEMA 100-year floodplain, and/or channel migration area. The upper portion of the reach lies in a geologic hazard area for erosion.

Under current zoning regulations, approximately two-thirds of the reach has the potential for new residential development. Parcel boundaries vary in size and shape, but many have the potential to be subdivided into 5 acre residential lots. Most of this developable land is located within the tsunami, flood, and/or channel migration area. The significant presence of wetland habitat within the reach may preclude development on some undeveloped parcels.



PHYSICAL

Channel Configuration

The lower reach of the Clallam River is defined by a frequent series of meanders that move laterally across a broad low-gradient floodplain.

Hazard Areas

Identified hazard areas within the reach include a channel migration zone (69%), tsunami hazard zone (22%), and the FEMA 100-year floodplain (76%). Potential erosion areas are mapped in the southeast area of the reach (1%).

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 19% of the reach zone contains forest habitat, 7% contains herb and shrub habitat, and 7% of the reach is agricultural crops. Outlying the stream corridor vegetation is mostly comprised of forest habitat intermixed with herb and shrub habitat.

Habitats and Species

37% of the reach is identified as wetland habitat, primarily adjacent to the Clallam River. The designated priority habitat within the reach is bald eagle (9%).

This reach provides spawning habitat for steelhead trout (64%) and coho salmon (28%) and juvenile habitat for coho salmon (72%). The presence of resident cutthroat and chum salmon are also mapped within the reach.

Water Quality

The portion of the Clallam River within the reach has a State impaired water quality listing for temperature. River water quality within the reach is listed by Streamkeepers as "compromised" for WQI and B-IBI.

Clallam River: Reach 1

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within this reach is timber (58%), vacant (30%), agriculture (4%), residential (2%), roads (2%), open space (2%), utilities (1%), commercial (trace), and unknown (trace). The timber land is located throughout the east half of the reach. Land ownership in the reach is 99% private and 1% public.

Zoning and Parcel Data

The reach is zoned for rural residential (40%), urban residential (9%), commercial forestry (50%), and parks / public land (1%).

Under current zoning regulations there is moderate potential for new residential development within the reach. Most of the reach is undeveloped, but wetland habitat may limit development potential.

Public Access

The northern end of the reach is accessible from Clallam Bay Spit Community Beach County Park.

Impervious Surfaces

Approximately 3% of the reach is covered by impervious surfaces.

Shoreline Modifications

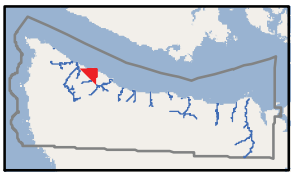
This reach contains three identified shoreline modifications. River road crossings are present at Frontier Street and Weel Road. Additionally, a dam is located on a tributary to the river, in the southwestern portion of the reach.

Contaminated Sites

A hazardous waste enforcement action was issued to the Clallam Bay Sewage Treatment Plant (located in the northern portion of the reach) in January 2011.

Cultural Resources

There are no inventoried sites within the reach.



Clallam River: Reach 2

SHORELINE LENGTH
0.6 Miles

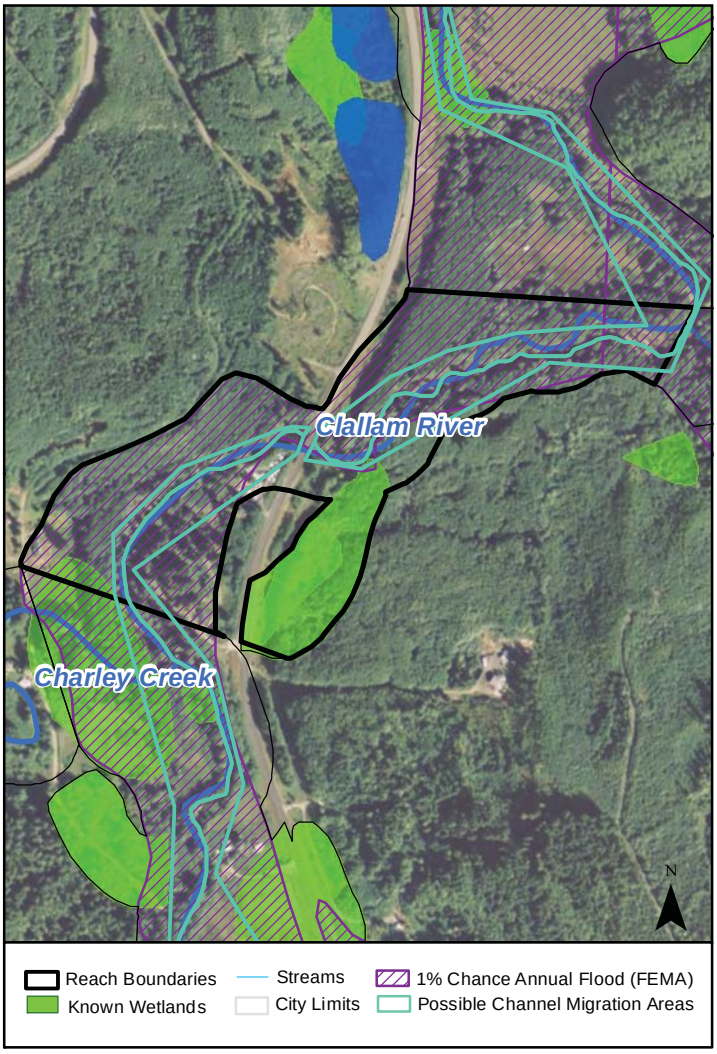
REACH AREA
45.42 Acres

REACH SUMMARY

Reach 2 of the Clallam River extends from the Last Creek confluence to approximately 0.6 miles upstream, just below the Charley Creek confluence. The river profile in this reach is characterized by stretches of relatively straight channel segments followed by gentle sweeping meanders. Vegetation adjacent to the stream corridor is a mixture of dense forest cover and natural shrub and herb habitat. Highway 112 corridor runs perpendicular to the stream course through the central portion of the reach, potentially limiting access to floodplain and side-channel habitat. Wetland habitat extends through the southeastern portion of the reach. The reach provides spawning and rearing habitat for coho and chum salmon, steelhead, and cutthroat trout.

The reach contains low-density commercial and residential development. The majority of the reach lies in the FEMA 100-year floodplain and/or in the channel migration zone. A geologic hazard area for erosion is present in the southeast portion of the reach. Some residences are located within the flooding and/or channel migration areas.

Under current zoning regulations, two-thirds of the reach has potential for new, rural residential development (1 dwelling per 5 acres). Much of the developable land is located in the flood and/or channel migration area. Wetland habitat in portions of the reach may limit development on some parcels.



PHYSICAL

Channel Configuration

The channel within the reach is defined predominantly by a series of long stretches of relatively straight channel segments followed by gentle meanders.

Hazard Areas

Potential erosion areas are mapped in the northwest and southeast portions of the reach (10%). Most the the reach is located within a channel migration zone (90%) and in FEMA 100-year floodplain (76%).

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 49% of the reach zone contains forest habitat, 24% contains herb and shrub habitat, and 9% is lawn/landscaping. Outlying the stream corridor vegetation is mostly comprised of forest habitat intermixed by herb and shrub habitat.

Habitats and Species

16% of the reach is identified as wetland habitat, primarily located in the southeast portion of the reach. There are no priority wildlife habitats mapped within the reach.

This reach provides spawning habitat for steelhead trout (100%) and coho salmon (100%). The presence of resident cutthroat and chum salmon are also mapped within the reach.

Water Quality

The portion of the Clallam River within the reach has a State impaired water quality listing for temperature. River water quality within the reach is listed by Streamkeepers as "compromised" for WQI.

Clallam River: Reach 2

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within this reach is vacant (49%), residential (35%), timber (11%), and roads (4%). The residential land is located in the southeast portion of the reach. Land ownership in the reach is 100% private.

Zoning and Parcel Data

The reach is zoned for rural residential (86%), urban residential (5%), and commercial forestry (9%).

Under current zoning regulations there is moderate potential for significant new residential development within the reach. Most of the reach is undeveloped, but wetland habitat may limit development potential.

Public Access

No public access is available to shorelines within this reach. The land adjacent to the shoreline is privately owned.

Impervious Surfaces

Approximately 5% of the reach is covered by impervious surfaces.

Shoreline Modifications

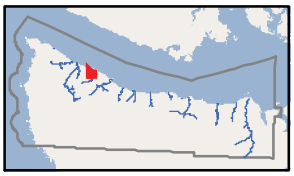
Highway 112 crosses the river near the center of the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There is 1 inventoried pre-contact site in the reach.



Clallam River: Reach 3

SHORELINE LENGTH
1.8 Miles

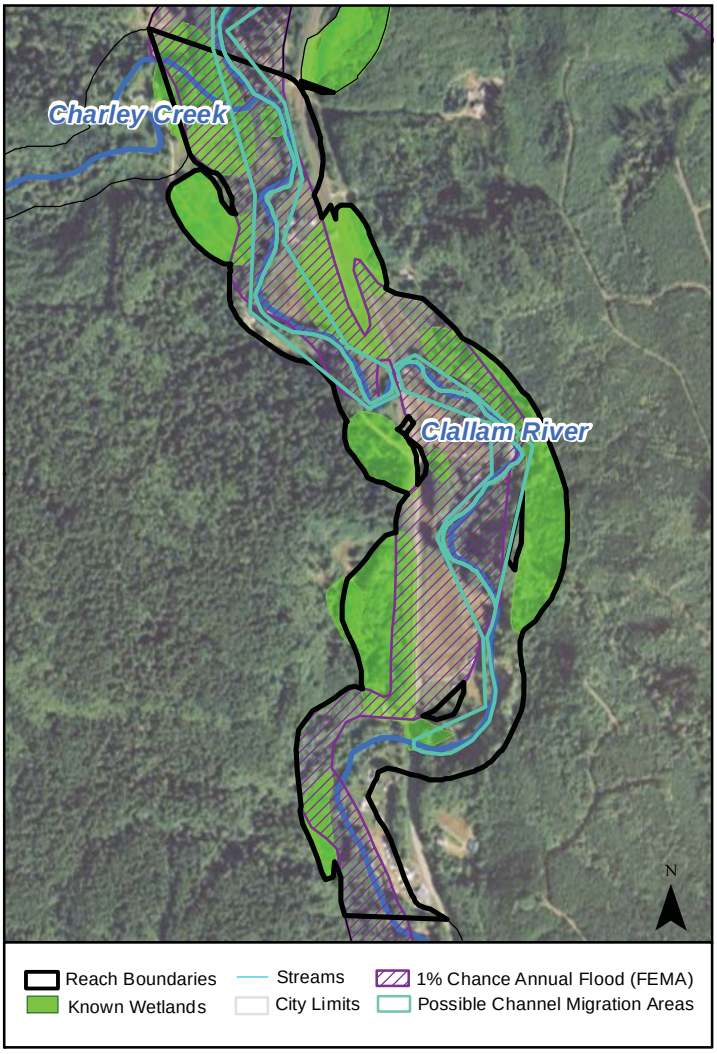
REACH AREA
140.06 Acres

REACH SUMMARY

Reach 3 of the Clallam River extends from the Charley Creek confluence upstream approximately 1.6 miles. The reach is characterized by a sinuous river channel containing several meanders throughout a broad and relatively flat floodplain. Highway 112 parallels the river through much of the reach, and which constitutes a lateral barrier between the river and portions of its natural floodplain. Two bridge crossings are located in the middle and upper portion of the reach. Much of the reach contains forest habitat, although a significant portion of the reach has been cleared for agriculture and/or rural residential development. Wetland habitat is present throughout the reach. The reach provides spawning and rearing habitat for coho and chum salmon, in addition to steelhead and resident cutthroat trout. The reach also supports breeding populations of bald eagle.

Low-density residential development and agriculture is prevalent in the reach. The majority of the reach lies in the FEMA 100-year floodplain and/or in channel migration area. Geologic hazard areas for slides and erosion are located in the east and west, respectively. Several existing residences are located within flood and/or channel migration hazard areas.

Under current zoning regulations, approximately two-thirds of the reach has the potential for new development. Existing parcel boundaries in the reach vary in size and shape, but many have the potential to be subdivided into 2 or 5 acre homesites. Much of the developable land is located in the 100-year floodplain and/or channel migration zone. Wetland habitat may preclude development in portions of the reach.



PHYSICAL

Channel Configuration

Channel configuration through this reach is defined predominantly by a series of long stretches of relatively straight channel segments followed by gentle meanders. The stream gradient is relatively low.

Hazard Areas

Several stream banks and surrounding areas are unstable (9%) with potential for slides mapped in the eastern portion of the reach. Potential erosion areas are mapped along the western portion of the reach (13%). Most of the reach is located within a channel migration zone (79%) and in the FEMA 100-year floodplain (60%).

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 39% of the reach zone contains forest habitat, 16% contains herb and shrub habitat, while 20% is lawn/landscaping and developed areas. Outlying the stream corridor vegetation is comprised mostly of forest habitat intermixed with herb and shrub habitat and lawn/landscaping.

Habitats and Species

40% of the reach is mapped as wetland habitat. The designated priority habitat within the reach is bald eagle (18%).

This reach provides spawning habitat for steelhead trout (100%), and coho (100%) and chum salmon (55%). The presence of resident cutthroat are also mapped within the reach.

Water Quality

The downstream portion of the Clallam River within the reach has a State impaired water quality listing for temperature. River water quality within the reach is listed by Streamkeepers as "compromised" for WQI.

Clallam River: Reach 3

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is residential (49%), timber (24%), roads (14%), vacant (10%), and commercial (2%). The residential land is located throughout the northern half of the reach. Land ownership in the reach is 96% private and 4% public.

Zoning and Parcel Data

The reach is zoned for rural residential (71%), rural commercial (2%), and commercial forestry (17%).

Under current zoning regulations there is moderate potential for significant new residential development within the reach. Most of the reach is undeveloped, but wetland habitat may limit development potential.

Public Access

No public access is available to shorelines within this reach. The land adjacent to the shoreline is privately owned.

Impervious Surfaces

Approximately 15% of the reach is covered by impervious surfaces.

Shoreline Modifications

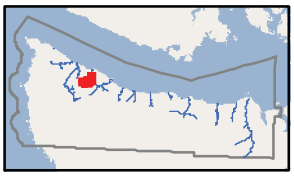
Highway 112 runs parallel to the stream corridor before crossing in two locations in the central and south central portions of this reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Clallam River: Reach 4

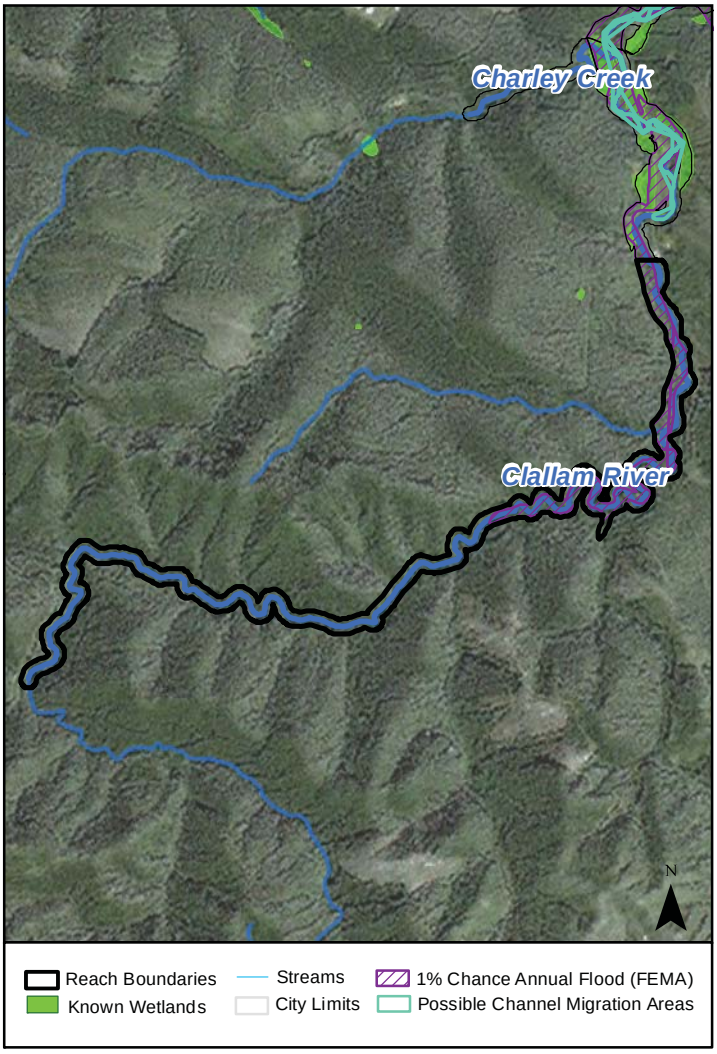
SHORELINE LENGTH
6.7 Miles

REACH AREA
341.44 Acres

REACH SUMMARY

Reach 4 of the Clallam River extends from the upper end of Reach 3 to approximately 6.7 miles upstream. The channel is throughout the reach is confined within a narrow floodplain. Dense, contiguous forest habitat covers the majority of the reach, which provides shade and habitat for fish and wildlife. The reach provides spawning and rearing habitat for coho and chum salmon, in addition to steelhead and resident cutthroat trout.

The majority of the reach contains public forest lands managed by DNR. The Clallam River Campground, a popular recreation area, is located in the lower portion of the reach. Undeveloped/informal public access to shorelines is available from Highway 112 throughout the reach. Approximately one half of the reach lies within the FEMA 100-year floodplain. Geologic hazard areas for slides and erosion are located throughout the reach. The majority of the floodplain supports dense forest cover and natural vegetation.



PHYSICAL

Channel Configuration

The channel profile of the upper Clallam River is confined to a narrow floodplain through most of the reach.

Hazard Areas

Many stream banks and surrounding areas are unstable (75%) with potential for slides mapped from the southwestern to eastern portions of the reach. Potential erosion areas are mapped in the eastern portion of the reach (9%). Most the northwestern portion of the reach is in the FEMA 100-year floodplain (29%) and a channel migration zone (20%).

ECOLOGY

Riparian Vegetation

95% of the reach zone contains forest habitat, while 3% of the reach contains herb and shrub habitat.

Habitats and Species

There are no priority wildlife habitats mapped within the reach.

This reach provides spawning habitat for steelhead trout (99%) and coho (99%) and chum salmon (4%). The presence of resident cutthroat is also mapped within the reach.

Water Quality

The downstream portion of the Clallam River within the reach has a State impaired water quality listing for temperature. River water quality within the reach is listed by Streamkeepers as "compromised" for B-IBI.

Clallam River: Reach 4

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (97%), commercial (1%), and roads (1%). Timber is located through the entire length of the reach. Land ownership is 96% public and 4% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

Public shoreline can be accessed directly from the Clallam River Campground. Undeveloped and informal access to the shoreline is also available along Highway 112.

Impervious Surfaces

Approximately 1% of the reach is covered by impervious surfaces.

Shoreline Modifications

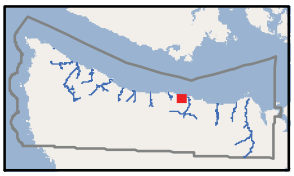
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

Remnants of a logging railroad within the reach is inventoried for historic significance but not listed.



Coville Creek

SHORELINE LENGTH
0.3 Miles

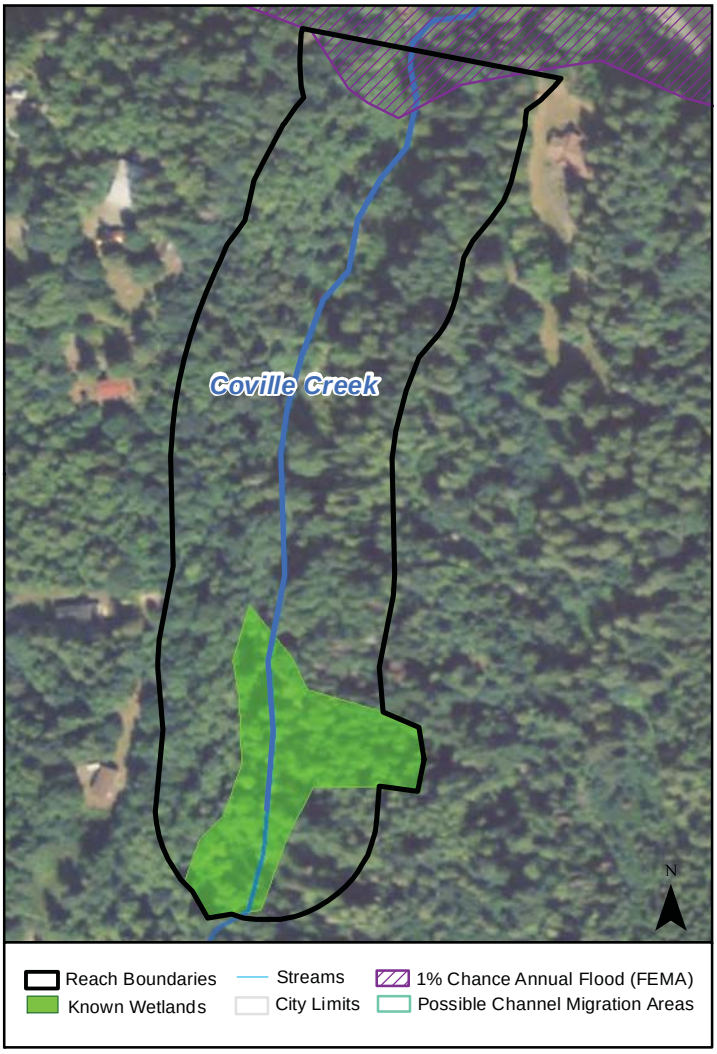
REACH AREA
14.88 Acres

REACH SUMMARY

The reach is relatively short, extending from near the stream mouth to approximately 0.3 mile upstream. The portion of Coville Creek within the reach trends generally northwest, along a straight channel length that flows across a wide terrace. The reach contains dense forest cover. The stream provides habitat for coho and chum salmon, and resident cutthroat trout. The reach provides habitat for breeding populations of bald eagle.

The majority of the reach contains low density residential and forest lands. Existing homes are generally located 200 feet from the stream channel. The lower half of the reach lies within a tsunami hazard area and the FEMA 100-year floodplain. The entire reach lies within a geologic hazard area for slides.

Under current zoning regulations, the majority of the parcels within the reach cannot be subdivided. Development potential in the reach is low.



PHYSICAL

Channel Configuration

The stream channel within the reach is relatively straight, and flows across a wide terrace.

Hazard Areas

Many stream banks and surrounding areas are unstable (100%) with potential for slides mapped from the southern to northern extent eastern of the reach. Most of the northern portion of the reach is in the tsunami hazard zone (28%) and the FEMA 100-year floodplain (4%).

ECOLOGY

Riparian Vegetation

100% of the reach zone contains continuous forest habitat.

Habitats and Species

15% of the reach is mapped as wetland habitat, located in the upstream portion. The designated priority habitat mapped within the reach is bald eagle (62%).

This reach provides spawning habitat for coho (100%) salmon. The presence of resident cutthroat, steelhead trout, and chum salmon is also mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. Coville Creek water quality is listed by Streamkeepers as "healthy" for WQI.

Coville Creek

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is residential (53%), timber (30%), and vacant (17%). Residential and vacant lands are located in the eastern half of the reach, while timber lands are located through the western half. Land ownership is 100% private.

Zoning and Parcel Data

The reach is zoned for rural mixed use (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

No public access is available to shorelines within this reach. The land adjacent to the shoreline is privately owned.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

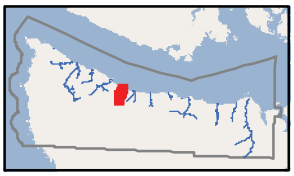
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Deep Creek

SHORELINE LENGTH
5.8 Miles

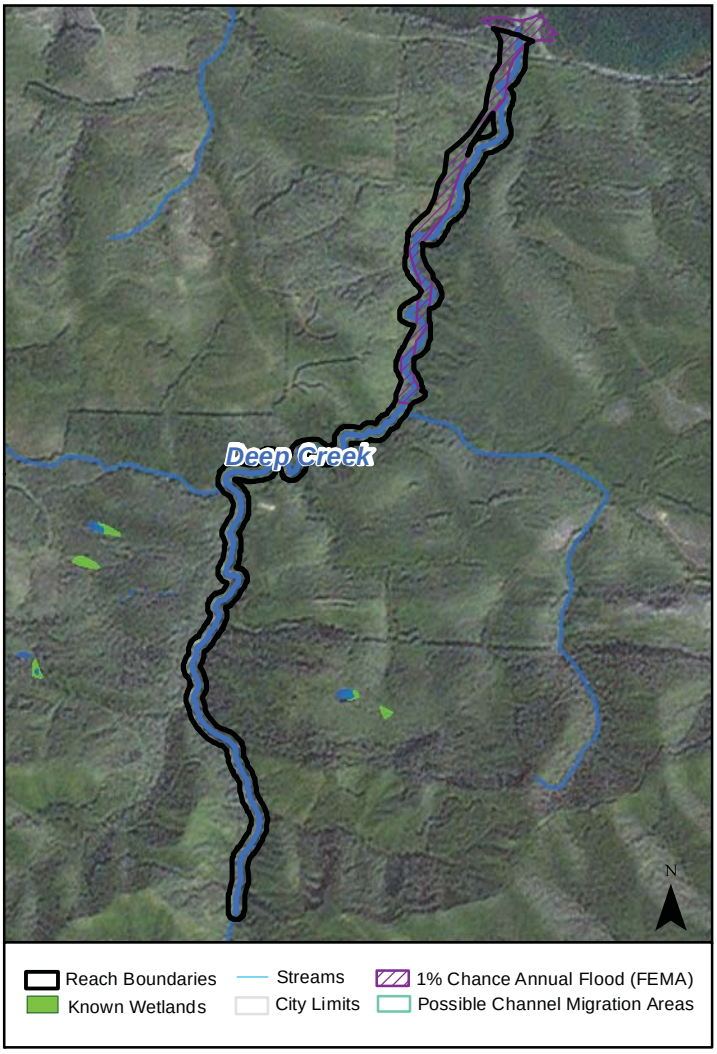
REACH AREA
317.36 Acres

REACH SUMMARY

The reach extends from near the mouth (adjacent to Highway 112) to approximately 5.8 miles upstream. The reach is characterized by steep terrain. The channel profile through the reach is fairly sinuous as it meanders through low to moderate gradient stream segments. A bridge structure for State Highway 112 crosses the channel in the lower reach, potentially impacting stream morphology. The reach contains dense forest cover, intermixed with herb and shrub communities. The reach provides spawning and rearing habitat for coho and chum salmon, and also provides habitat for steelhead trout and resident cutthroat trout. The lower portion of the reach supports breeding populations of bald eagle.

Public (DNR-managed) and private timber lands are located throughout the reach. The lower portion of the reach is located within a tsunami hazard area and the FEMA 100-year floodplain. Geologic hazard areas for slides and erosion are located in the upper and middleportions of the reach. Some existing residences in the lower portion of the reach are located within flood and tsunami hazard areas.

Under current zoning regulations, approximately one-third of the reach area has potential for new residential development. However, much of this land is zoned for commercial forestry and cannot be developed at a density greater than 1 residence per 80 acres. Actual development potential in the reach is low.



PHYSICAL

Channel Configuration

The Deep Creek reach is characterized by a sinuous, meandering stream corridor bordered by steep hillsides and a narrow floodplain.

Hazard Areas

Several stream banks and surrounding areas are unstable (32%) with potential for slides mapped in the central portion of the reach. Areas for potential erosion are mapped through the southwest to central portions of the reach (16%) Most of the northern portion of the reach is in the tsunami hazard zone (7%), the channel migration zone (26%), and the FEMA 100-year floodplain (26%).

ECOLOGY

Riparian Vegetation

84% of the reach area contains forest habitat while 9% natural contains herb and shrub vegetation.

Habitats and Species

The designated priority habitat mapped within the reach is bald eagle (2%).

This reach provides spawning habitat for steelhead trout (87%), and coho (93%) and chum salmon (96%). The presence of resident cutthroat is also mapped within the reach.

Water Quality

The portion of Deep Creek within the reach has State impaired water quality listings for dissolved oxygen, fine sediment, and temperature. In addition, Gibson Creek (tributary to Deep Creek) is listed for temperature. Deep Creek water quality is listed b

Deep Creek

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (94%), vacant (5%), and roads (1%). Timber lands are located through the entire length of the reach. Land ownership in the reach is 68% private and 32% public.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

There is no available public access to the publically owned lands bordering the reach.

Impervious Surfaces

Approximately 1% of the reach is covered by impervious surfaces.

Shoreline Modifications

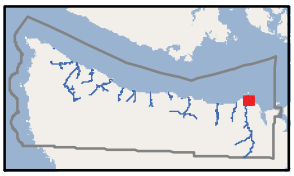
Highway 112 crosses Deep Creek at the north end of the reach, and the stream channel was historically denuded of large woody debris.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

The SR 112 bridge over Deep Creek is inventoried for historic significance but not listed.



Dungeness River: Reach 1

SHORELINE LENGTH
0.9 Miles

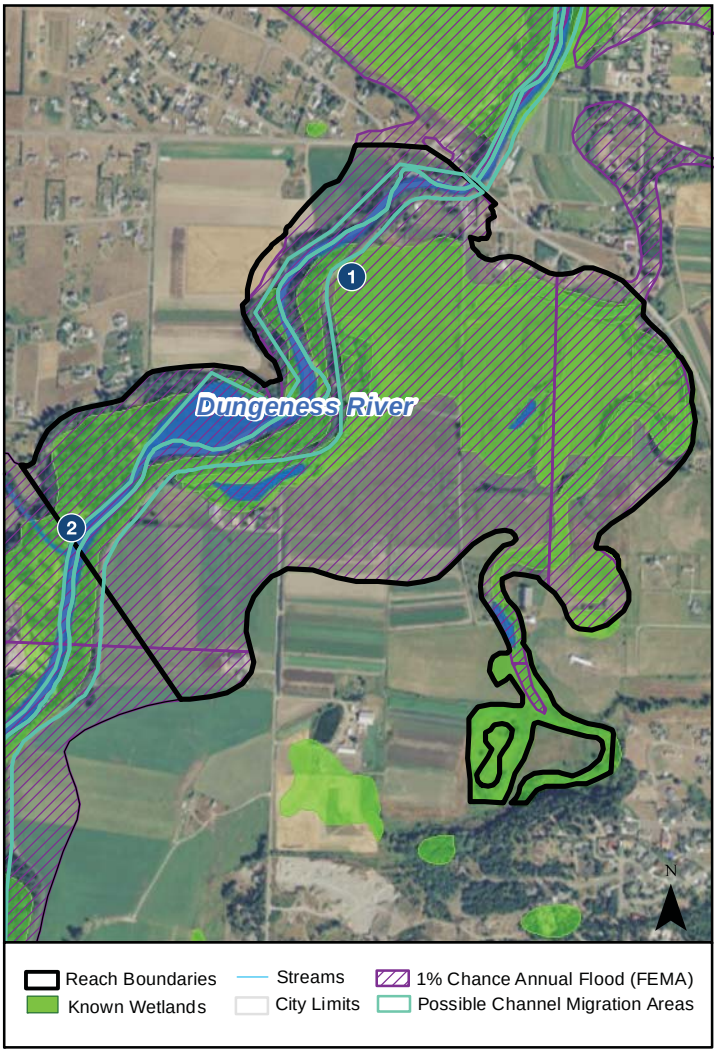
REACH AREA
280.27 Acres

REACH SUMMARY

Reach 1 of the Dungeness River extends from Schoolhouse Bridge to the confluence of Matriotti Creek. The reach consists of the broad alluvial floodplain of the lower Dungeness. Within the reach, the river channel is constrained by levees along its entire east bank and a portion of the west bank. The river channel within the reach has a relatively narrow forested riparian corridor; the surrounding floodplain is utilized for agriculture. Wetland habitat is located throughout the reach, adjacent to the stream course. The reach provides habitat for Chinook, chum, coho, and pink salmon, in addition to steelhead, bull, and resident cutthroat trout. The reach also provides priority habitat for bald eagle, harlequin duck, peregrine falcon, and waterfowl.

The majority of the reach contains rural low-density residential and agricultural lands. The lower portion of the reach lies within a tsunami hazard zone, as well as the FEMA 100-year floodplain and channel migration zone. Geologic hazard areas for slides is located in the northwestern portion of the reach. Existing residential and agricultural development is located within the tsunami, flood and/or channel migration areas.

Under current zoning regulations, the majority of the reach has been zoned for agricultural production. Existing parcel boundaries vary in size and shape, but many are located in or adjacent to the stream shoreline. Most of the land in the reach is designated for agricultural conservation; therefore, actual development potential in the reach is low. Properties behind the ACOE levee on the east bank have been purchased for a potential levee setback project.



PHYSICAL

Channel Configuration

The stream channel has low relief, and flows through a broad floodplain. The channel is largely constrained by dikes within the reach.

Hazard Areas

Several slides are mapped within the northwestern portion of the reach (3%). Most of the central portion of the reach lies within the active channel migration area (16%). The eastern portion of the reach is in the tsunami hazard zone (25%), and the majority of the reach is within the FEMA 100-year floodplain (95%).

Shoreline Oblique Photos (2006)

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 14% of the reach contains forest habitat, 4% is natural herb and shrub habitat, and 9% is agriculture. Outlying the stream corridor vegetation is mostly comprised of agricultural crops.

Habitats and Species

49% of the reach is identified as wetland habitat, extending southwest to northeast along the Dungeness River. Designated priority habitats mapped within the reach include bald eagle (43%), harlequin duck (55%), peregrine falcon (42%), and waterfowl conc

This reach provides spawning habitat for steelhead trout (22% of reach total) and Chinook (100%), chum (100%), coho (45%), and pink salmon (82%), and juvenile rearing habitat for pink (17%) and coho salmon (5%). The presence of bull trout and resident cu

Water Quality

The portion of the Dungeness River within the reach has State impaired water quality listings for temperature and fecal coliform. In addition, two tributaries to the Dungeness within the reach are listed for fecal coliform. Dungeness River water quality

Dungeness River: Reach 1

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is residential (27%), timber (25%), agriculture (21%), vacant (20%), open space (5%), roads (1%), and commercial (trace). Agricultural lands are located in the southern portion of the reach while residential land is located in the northeast. The timber and vacant lands are located in the western half of the reach. Land ownership in the reach is 100% private.

Zoning and Parcel Data

The reach is zoned for rural residential (11%) and agriculture (89%).

Under current zoning regulations there is low potential for significant new development in the reach. Most of the land is designated for agricultural protection.

Public Access

No public access is available to shorelines within this reach. The land adjacent to the shoreline is privately owned.

Impervious Surfaces

Approximately 3% of the reach is covered by impervious surfaces.

Shoreline Modifications

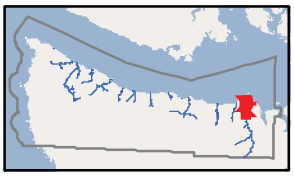
This reach contains several shoreline modifications. The Dungeness River is constrained by levees along its entire east bank and a portion of the west bank, which have disconnected the river from its floodplain. Two culverts are present under East Ander

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are 5 inventoried historic sites and 3 inventoried pre-contact sites / isolates within the reach.



Dungeness River: Reach 2

SHORELINE LENGTH
5.4 Miles

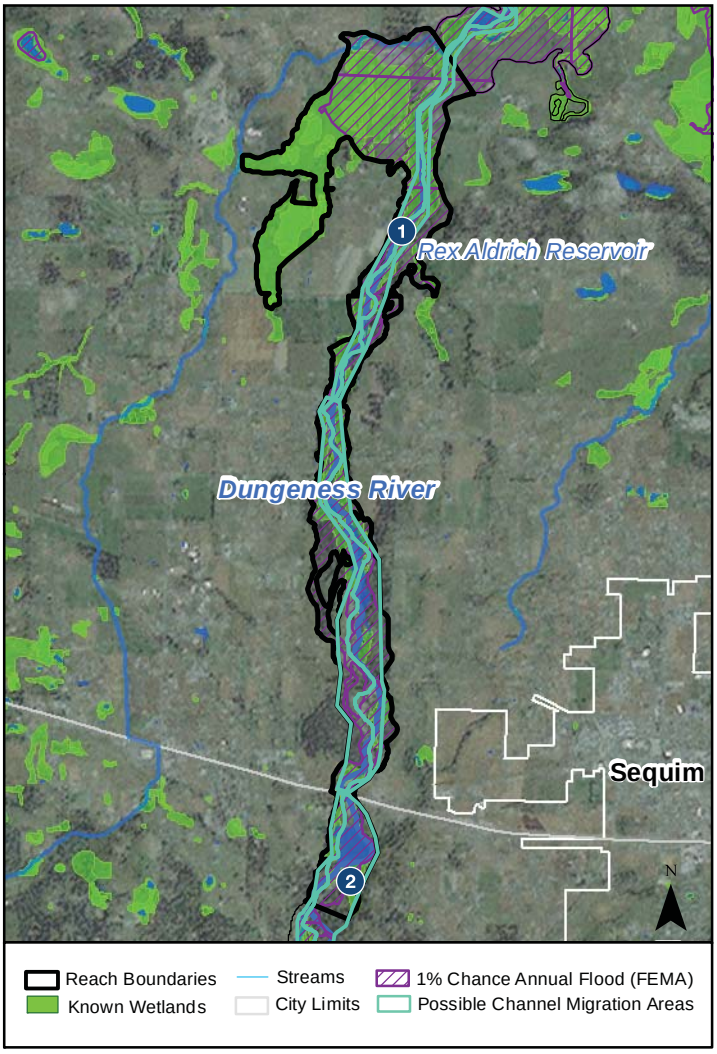
REACH AREA
1053.37

REACH SUMMARY

Reach 2 of the Dungeness River extends from the confluence of Matriotti Creek upstream approximately 5.6 miles (from RM 2 to RM 7). The channel profile through the reach is dynamic, supporting a high degree of sinuosity and braiding. The reach contains four road crossings in the upper, middle, and lower portion of the reach. The Hurd Creek Fish Hatchery is located in the western portion of the reach. The reach contains some forest and herb and shrub habitat, but much of the area has been converted to agriculture. A significant portion of the reach contains wetland habitat. The reach provides spawning and rearing habitat for Chinook, chum, coho, and pink salmon, in addition to steelhead, bull, and resident cutthroat trout. Sockeye salmon have also been documented in the reach. The reach also provides habitat for bald eagle, harlequin duck, peregrine falcon, and waterfowl concentrations.

The reach contains moderate- to low-density residential development and agricultural lands. The Mary Lukes Wheeler County Park provides public access to shorelines in this reach. Additionally, the Olympic Discovery Trail crosses in the northern portion of the reach. Most of the reach, including developed areas, are located in the FEMA 100-year floodplain and/or the channel migration zone.

Under current zoning regulations, approximately 20% of the reach has the potential for new rural residential development. Existing parcel boundaries vary in size and shape, but many are located directly adjacent to the river in flood and/or channel migration hazard areas. The significant presence of wetland habitat throughout the reach may preclude development in some areas.



PHYSICAL

Channel Configuration

The channel profile through the reach is dynamic, supporting a high degree of sinuosity and braiding.

Hazard Areas

Much of the reach is located within the channel migration zone (57%), and the FEMA 100-year floodplain (74%).

Shoreline Oblique Photos (2006)

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 27% of the reach zone is forest habitat, 11% is herb and shrub habitat, and 5% is agricultural crops. Outlying the stream corridor vegetation is comprised mostly of agricultural lands intermixed with patches of forest and herb and shrub habitat.

Habitats and Species

49% of the reach is mapped as wetland habitat. Designated priority habitats mapped within the reach include bald eagle (6%), harlequin duck (91%), peregrine falcon (83%), and waterfowl concentrations (10%).

This reach provides spawning habitat for steelhead trout (40% of reach total) and Chinook (97%), chum (70%), coho (65%), and pink salmon (79%). The presence of bull trout and resident cutthroat are also mapped within the reach.

Water Quality

The portion of the Dungeness River within the reach has a State impaired water quality listing for fecal coliform. In addition, Hurd Creek (tributary to the Dungeness River) is listed for fecal coliform. Dungeness water quality within the reach is listed

Dungeness River: Reach 2

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is residential (38%), open space (30%), vacant (15%), agriculture (8%), tribe (4%), timber (3%), commercial (2%), roads (trace), and unknown (trace). Residential lands are located in the north and in central portions of the reach. Open space is located in isolated pockets throughout the reach. Land ownership is 95% private, 4% tribe, and 1% public.

Zoning and Parcel Data

The reach is zoned for rural residential (54%), parks / public land (trace), and agriculture (46%).

Under current zoning regulations there is moderate potential for significant new residential development within the reach. The presence of wetland habitat may limit development in some areas.

Public Access

Public shoreline access is available at Mary Lukes Wheeler County Park, located on Ward Road, north of Woodcock Road. In addition, the Olympic Discovery Trail crosses the river within this reach.

Impervious Surfaces

Approximately 3% of the reach is covered by impervious surfaces.

Shoreline Modifications

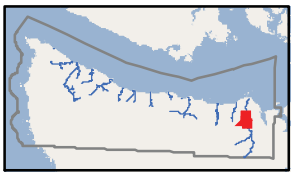
Four road crossings are located within the reach. The Hurd Creek Fish Hatchery is located in the western portion of the reach. South of Woodcock Road, most of the east side of the river is constrained by levees.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Dungeness River: Reach 3

SHORELINE LENGTH
3.6 Miles

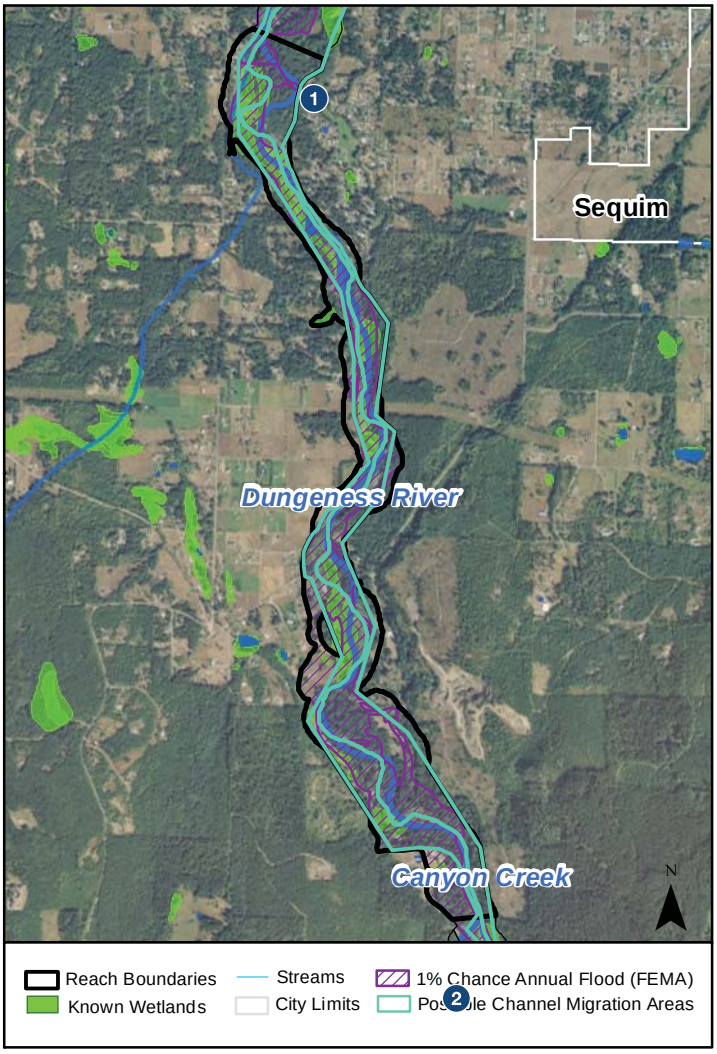
REACH AREA
366.52 Acres

REACH SUMMARY

Reach 3 of the Dungeness River extends from the Bear Creek confluence upstream to the Canyon Creek confluence (RM 7 to RM 11). The stream profile through the reach is sinuous, meandering and braiding across its floodplain. The reach contains two shoreline modifications; the Sequim Fish Hatchery in the southeast and the Morse Creek Acclimation Ponds in the southwest. Vegetative cover in the reach is a mixture of forest cover and herb and shrub habitat. Portions of the stream corridor and floodplain have been cleared for agricultural uses and residential development. The reach provides spawning and rearing habitat for Chinook, chum, coho, and pink salmon, in addition to steelhead, bull, and cutthroat trout. Sockeye salmon have also been observed within the reach. Additionally, the reach provides habitat for bald eagle harlequin duck.

The reach contains moderate- to low-density residential development and agricultural lands. Undeveloped/informal public access is available through several publically owned side roads that allow access to shorelines within the reach. Additionally, the river can be accessed at the fish hatchery near the Canyon Creek confluence. Most of the reach lies within channel migration and FEMA 100-year floodplain hazard areas. Geologic hazard areas for erosion are located in the southern portion of the reach. Many existing residences are located within flood and/or channel migration hazard areas.

Under current zoning regulations, approximately 20% of the reach has the potential for new rural residential development. Existing parcels (particularly in the lower reach) vary in size and shape, but many of the lots have narrow water frontages, which could lead to dense shoreline development in these areas. Much of the developable land is located within flood and/or channel migration hazard areas.



PHYSICAL

Channel Configuration

The stream profile through the reach is sinuous, meandering and braiding across its floodplain.

Hazard Areas

Potential erosion areas are mapped in the southeast and southwest portions of the reach (3%). Most of the reach lies within a channel migration zone (90%) and the FEMA 100-year floodplain (64%).

Shoreline Oblique Photos (2006)

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 46% of the reach zone contains forest habitat,17% contains herb and shrub habitat, and 15% is lawn/landscaping or agriculture. Outlying the stream corridor vegetation is comprised mostly of forest habitat intermixed with herb and shrub habitat.

Habitats and Species

14% of the reach is identified as wetland habitat. Designated priority habitats mapped within the reach include bald eagle (4%) and harlequin duck (145%).

This reach provides spawning habitat for steelhead trout (48% of reach total) and Chinook (100%), chum (100%), coho (90%), and pink salmon (100%), and juvenile rearing habitat for bull trout (3%). The presence of bull trout and resident cutthroat are also

Water Quality

The reach has no State impaired water quality listings. Dungeness water quality within the reach is listed by Streamkeepers as "compromised" for B-IBI.

Dungeness River: Reach 3

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is residential (39%), open space (18%), vacant (18%), timber (16%), commercial (5%), agriculture (3%), roads (2%), and utilities (trace). Residential land is located throughout the reach, while timber lands and open space are located in isolated pockets in the north and southern portions of the reach. Land ownership is 89% private and 11% public.

Zoning and Parcel Data

The reach is zoned for rural residential (83%), commercial forestry (15%), and parks/public land (2%).

Under current zoning regulations there is moderate potential for significant new residential development within the reach.

Public Access

River Road provides access to several side roads that are publically owned and provide access to the Dungeness River. The river can also be accessed at the fish hatchery just downstream from the Canyon Creek confluence.

Impervious Surfaces

Approximately 6% of the reach is covered by impervious surfaces.

Shoreline Modifications

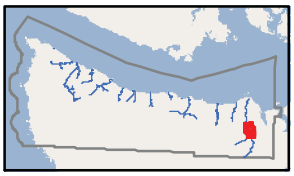
Several levee sections are located within the reach. In addition, the Sequim Fish Hatcheryis located in south eastern portion of the reach, and the Morse Creek Acclimation ponds are located in the southwest.

Contaminated Sites

A voluntary hazardous waste cleanup site is located in the northern portion of this reach, west of Ward Road.

Cultural Resources

There are no inventoried sites within the reach.



Dungeness River: Reach 4

SHORELINE LENGTH
5.1 Miles

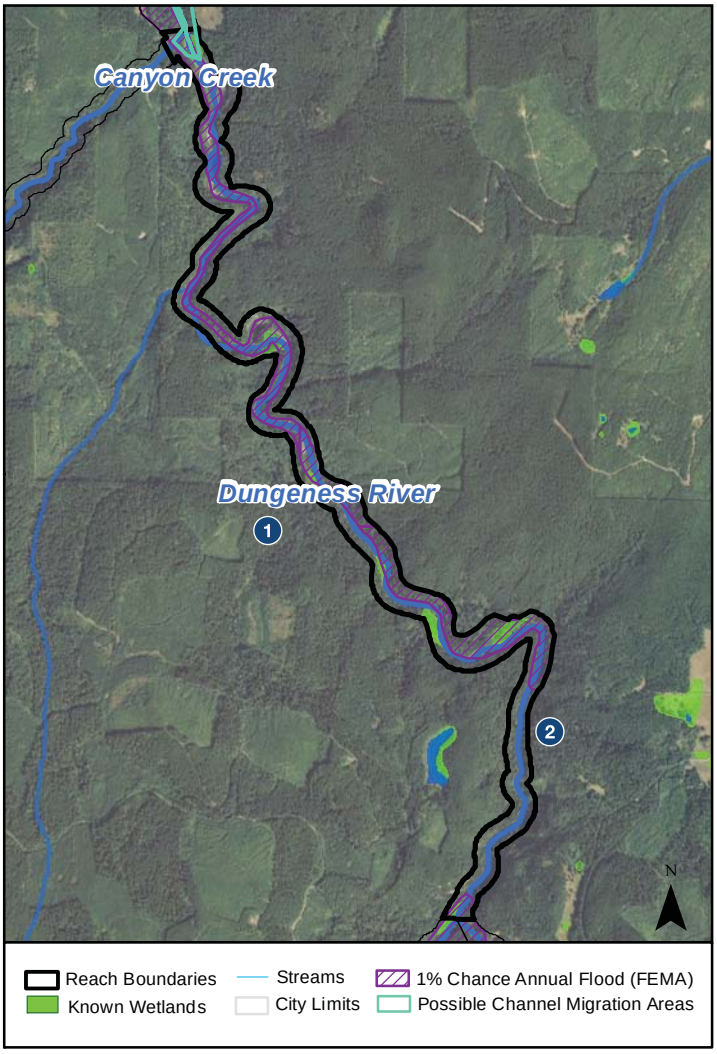
REACH AREA
339.05 Acres

REACH SUMMARY

Reach 4 of the Dungeness River extends from the Canyon Creek confluence to the Gray Wolf River confluence. The stream channel within the reach is relatively confined and meandering. Vegetative cover in the reach is consists primarily of forest habitat. The reach provides spawning and rearing habitat for Chinook, coho, chum, and pink salmon, in addition to steelhead, bull, and cutthroat trout. Additionally, the reach provides habitat for elk and harlequin duck populations.

The reach is primarily public forest land (DNR and Olympic National Forest). Much of the reach lies within flood hazard areas, and the central portion of the reach lies in a geologic hazard area for slides. Portions of the lower reach lie in a geologic hazard area for erosion.

The lands within the reach are primarily public timber land; overall development potential within the reach is low.



PHYSICAL

Channel Configuration

The stream channel within the reach is relatively confined and meandering.

Hazard Areas

Several stream banks and surrounding areas have potential for slides (20%). Areas for potential erosion are mapped within the northern portion of the reach (10%). 40% of the reach lies within the FEMA 100-year floodplain (40%).

Shoreline Oblique Photos (2006)

ECOLOGY

Riparian Vegetation

78% of the reach zone is consists of forest habitat while 10% of the reach contains herb and shrub habitat.

Habitats and Species

5% of the reach is mapped as wetland habitat. Designated priority habitats mapped within the reach include elk (94%) and harlequin duck (41%).

This reach provides spawning habitat for steelhead trout (49% of reach total) and Chinook (100%), chum (100%), coho (98%), and pink salmon (98%), and juvenile rearing habitat for bull trout (98%). The presence of bull trout and resident cutthroat are also

Water Quality

The reach has no State impaired water quality listings. Dungeness water quality within the reach is listed by Streamkeepers as "compromised" for B-IBI but "healthy" for WQI.

Dungeness River: Reach 4

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (94%), commercial (6%), roads (trace), and utilities (trace). Land ownership in the reach is 89% public and 11% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

The upstream portion of the reach can be accessed via trail from Forest Service Road 2870

Impervious Surfaces

Approximately 1% of the reach is covered by impervious surfaces.

Shoreline Modifications

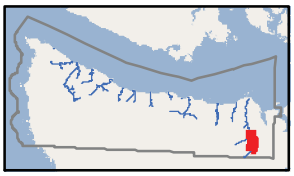
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Dungeness River: Reach 5

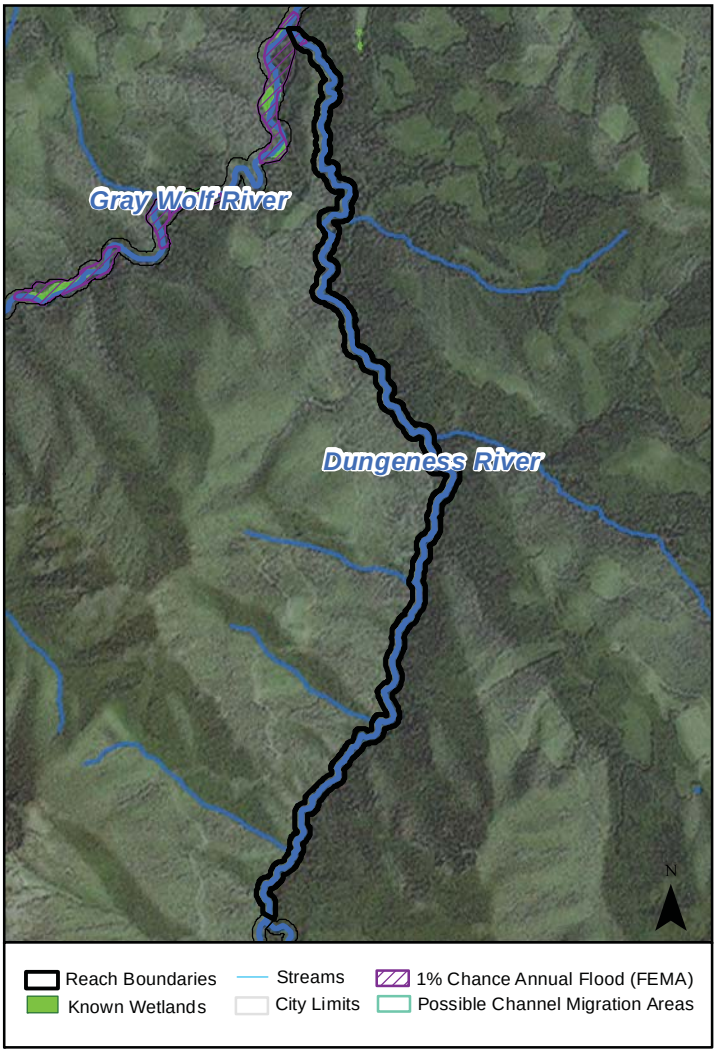
SHORELINE LENGTH
7.1 Miles

REACH AREA
339.31 Acres

REACH SUMMARY

Reach 5 of the Dungeness River extends from the confluence of the Gray Wolf River, upstream to the Silver Creek confluence (RM 16 to RM 22). The channel profile through the reach is fairly sinuous, confined, and contains several meanders along its generally north trending route. Vegetative cover in the reach consists primarily of forest habitat. The reach supports spawning and rearing habitat for Chinook, coho, chum and pink salmon, in addition to steelhead, bull, cutthroat, and rainbow trout.

The reach is located in the Olympic National Forest. Public access to the reach is accessible through Forest Service Road 2870.



PHYSICAL

Channel Configuration

The channel profile through the reach is fairly sinuous, confined, and contains several meanders along its generally north trending route.

Hazard Areas

Potential erosion areas are mapped in the northeastern portion of the reach (3%). A marginal portion of the reach is located within the FEMA 100-year floodplain (1%). No potential slide areas or channel migration zones are mapped within the reach.

ECOLOGY

Riparian Vegetation

86% of the reach zone contains forest habitat, while 13% of contains herb and shrub habitat.

Habitats and Species

The designated priority habitat mapped within the reach is harlequin duck (7%).

This reach provides spawning habitat for steelhead trout (28% of reach total) and Chinook (100%), chum (100%), coho (93%), and pink salmon (93%), and juvenile rearing habitat for bull trout. The presence of bull trout and resident cutthroat are also mappe

Water Quality

The reach has no State impaired water quality listings. There are no Streamkeepers data available for this reach.

Dungeness River: Reach 5

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (98%) and vacant (2%). Timber lands are located through the entirety of the reach. Land ownership is 99% public and 1% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

The river can be accessed via trail from Forest Service Road 2870

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

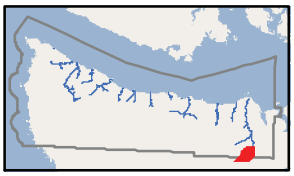
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

Two structures, including the Dungeness Forks Shelter (built in the 1930s), are inventoried for historic significance but not listed.



Dungeness River: Reach 6

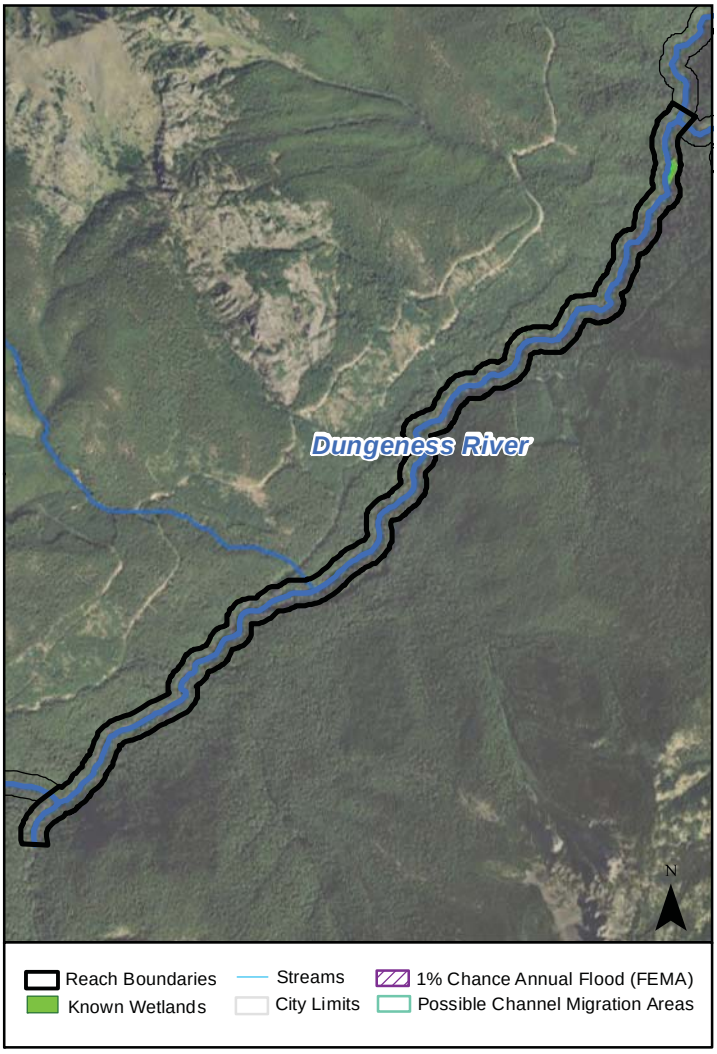
SHORELINE LENGTH
3.5 Miles

REACH AREA
163.27 Acres

REACH SUMMARY

Reach 6 of the Dungeness River extends from the Silver Creek confluence to the Jefferson County limits (RM 22 to approximately RM 25). The channel profile through the reach contains small meanders that are constrained to a relatively narrow floodplain. Vegetative cover in the reach consists predominantly of dense stands of forest cover. The reach provides habitat for bull, cutthroat, and rainbow trout.

The reach is located in Olympic National Forest. Public access to the reach is available from the Upper Dungeness River Trail and off of Forest Service Road 2870.



PHYSICAL

Channel Configuration

The channel profile through the reach contains small meanders that are constrained to a relatively narrow floodplain.

Hazard Areas

No potential erosion or slide areas are mapped within the reach.

ECOLOGY

Riparian Vegetation

82% of the reach zone contains forest habitat, while 15% of the reach contains herb and shrub habitat.

Habitats and Species

1% of the reach is identified as wetland habitat. There are no priority specie habitats mapped within the reach.

This reach provides habitat for bull trout, resident cutthroat, and rainbow trout.

Water Quality

The reach has no State impaired water quality listings. There are no Streamkeepers data available for this reach.

Dungeness River: Reach 6

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (85%) and unknown (15%). Land ownership in the reach is 100% public.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

The Upper Dungeness River Trail borders this reach. The reach can also be accessed from Forest Service Road 2870

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

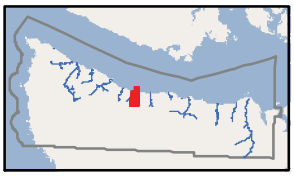
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are 2 inventoried historic sites within the reach.



East Twin River

SHORELINE LENGTH
4.4 Miles

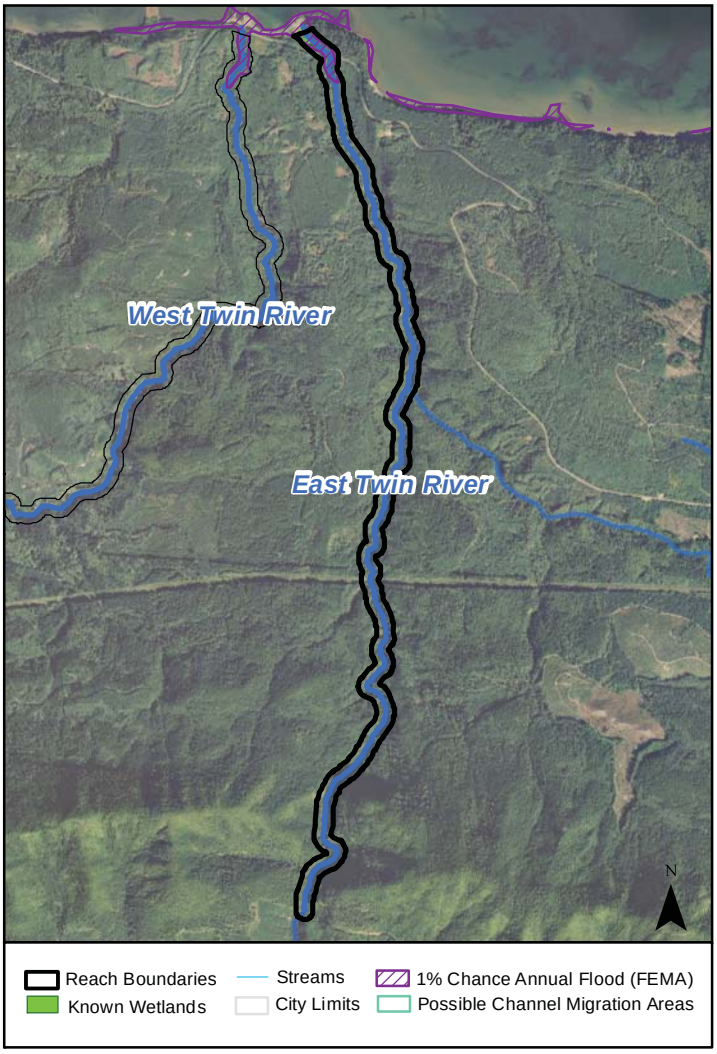
REACH AREA
215.64 Acres

REACH SUMMARY

The reach extends from near the river mouth to approximately 4.5 miles upstream. The river channel trends generally straight, accentuated by a few, tight meanders as the river flows through a steep valley. Vegetation within the reach is predominantly contiguous forest cover. The reach provides spawning and rearing habitat for chum and coho salmon, as well as steelhead trout. Natural cascades and waterfalls located at RM 3.6 block upstream passage. Populations of bald eagle are supported in the lower portion of the reach.

Private timber lands are located in the lower third of the reach while public forest lands(DNR and Olympic National Forest) are located throughout the upper portion of the reach.

Under current zoning regulations, approximately one-third of the reach contains privately owned timber parcels which are not eligiblefor new development. Overall development potential within the reach is low.



PHYSICAL

Channel Configuration

The East Twin River meanders northward through steep valleys and hillcrests, before exiting directly into the Strait of Juan de Fuca. The channel profile of the East Twin River is generally narrow and confined.

Hazard Areas

Several river banks and surrounding areas are unstable (47%) with potential for slides mapped in the central portion of the reach. Areas for potential erosion are also mapped within the reach (27%). The nothern end of the reach lies within a tsunami hazard zone (4%), the FEMA 100-year floodplain (4%), and a channel migration zone (9%).

ECOLOGY

Riparian Vegetation

96% of the reach zone contains forest habitat, while 2% contains natural herb and shrub habitat.

Habitats and Species

The designated priority habitat mapped within the reach isbald eagle (5%).

This reach provides spawning habitat for steelhead trout (34% of reach total), and chum (97%) and coho salmon (100%).

Water Quality

The upstream portion of the East Twin River within the reach has a State impaired water quality listing for temperature. Water quality is listed by Streamkeepers as “compromised” for B-IBI but “healthy” for WQI.

East Twin River

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (75%), residential (16%), open space (5%), vacant (4%), and roads (1%). Timber lands are located through the majority of the reach while residential lands are isolated in the north. Land ownership is 68% public and 32% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

Informal access to the north portion of the reach is available from East Twin River Road.

Impervious Surfaces

Approximately 1% of the reach is covered by impervious surfaces.

Shoreline Modifications

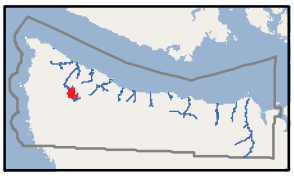
Portions of the lower river channel have been constrained by the construction of dikes composed of river sediments, and the channel was historically denuded of large woody debris.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

Two historic sites related to early Anglo-American settlement are inventoried but not listed.



Ellis Creek

SHORELINE LENGTH
1.0 Miles

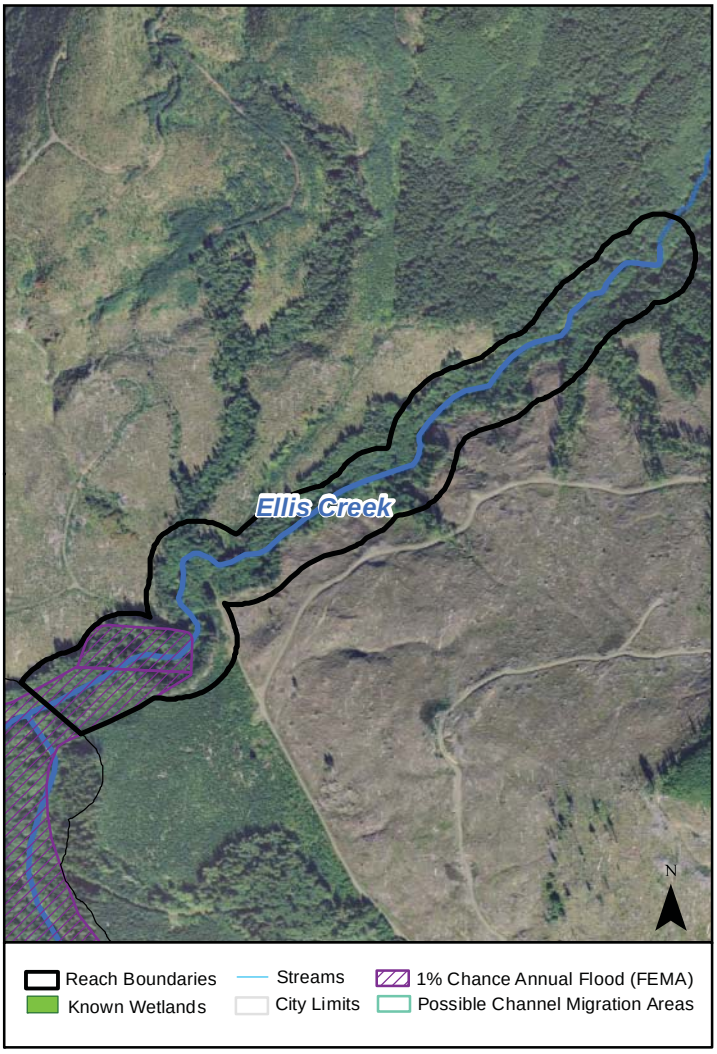
REACH AREA
50.00 Acres

REACH SUMMARY

The reach extends from the Hoko River confluence to approximately approximately 1 miles upstream. The reach is covered primarily by dense forest. The reach provides spawning and rearing habitat for Chinook and coho salmon, in addition to steelhead and cutthroat trout.

The majority of the reach contains commercial forest lands. The lower portion of the reach is located within the FEMA 100-year floodplain. Geologic hazard areas for erosion and slides are located throughout the reach.

Under current zoning regulations, most of the reach is eligible for new residential development. However, most of the land is zoned for commercial timber, and cannot be developed at a density greater than 1 residence per 80 acres. Actual development potential within the reach is low.



PHYSICAL

Channel Configuration

The Ellis Creek reach displays a low level of sinuosity as it trends in a generally straight southwestward pattern toward its confluence with the Hoko River. The channel profile is narrow and bordered by moderately steep foothills.

Hazard Areas

Several stream banks and surrounding areas are unstable (58%) with potential for slides mapped in the northwestern portion of the reach. Potential erosion areas are mapped along the northwest and northeast portions of the reach (13%). Most of the Hoko River confluence area lies within the FEMA 100-year floodplain (76%) and a channel migration zone (3%).

ECOLOGY

Riparian Vegetation

71% of the reach is contains forest habitat while 29% of the reach contains natural herb and shrub habitat.

Habitats and Species

There is no priority wildlife habitats mapped within the reach.

This reach provides spawning habitat for steelhead trout (100% of reach total) and Chinook (96%) and coho salmon (96%). The presence of resident cutthroat and chum salmon are also mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. There are no Streamkeepers data available for Ellis Creek.

Ellis Creek

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership is 83% private and 17% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

Public lands are located within the reach, but no public access areas are available.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

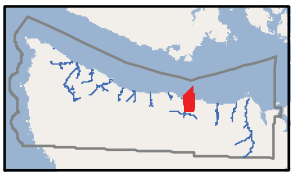
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Elwha River: Reach 1

SHORELINE LENGTH
4.4 Miles

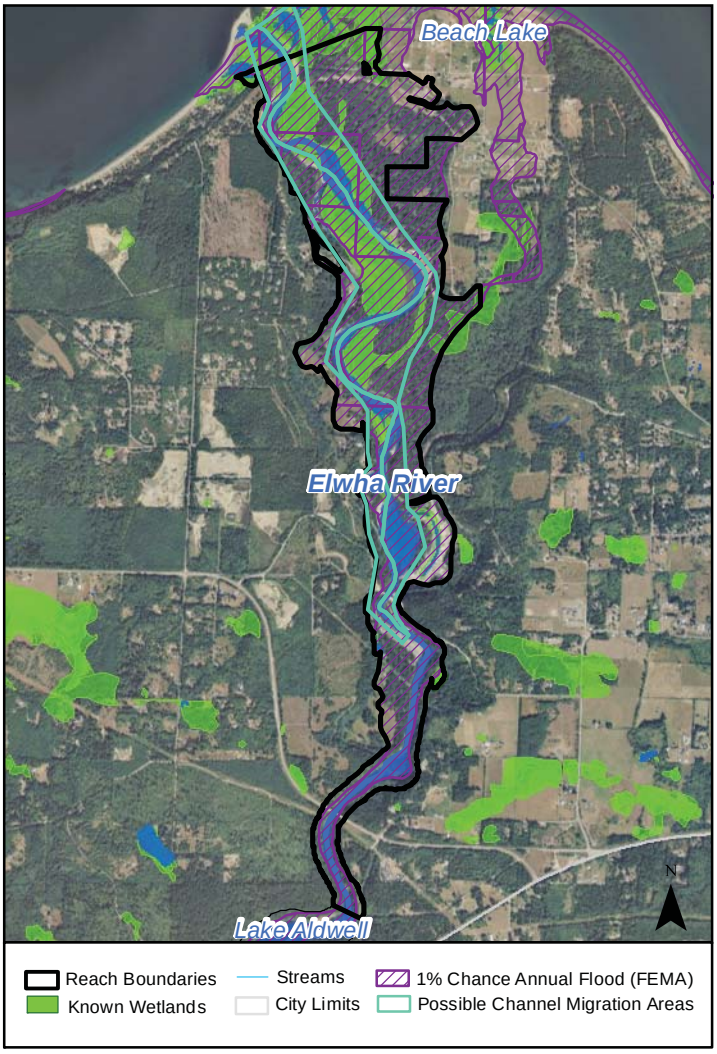
REACH AREA
786.25 Acres

REACH SUMMARY

Reach 1 of the Elwha River extends from near the river mouth to just downstream of the Elwha River Dam. The stream channel within the upper portion of the reach is constrained by the steep bedrock walls of the Elwha Canyon, while the channel floodway widens in the lower portion of the reach and supports significant wetland habitat. In the lower reach, levees are present along the eastern border of the reach. The reach consists primarily of forest habitat, although forest cover has been removed in some areas. Within the reach, the river provides habitat for bull trout, resident cutthroat, and steelhead trout, and Chinook, chum, pink, and coho salmon. The reach also provides habitat for bald eagle.

Reach 1 of the Elwha is largely undeveloped, with the exception of the City of Port Angeles water facility. The northern portion of the reach lies within mapped channel migration, tsunami, and flood hazard zones.

There is minimal potential for increased development within the reach; most of the land is publically owned. However, there is some potential for increased rural residential development near Highway 101 and Highway 112. The upcoming removal of the Elwha dams will substantially alter habitat conditions and the physical condition of the stream channel in the lower river.



PHYSICAL

Channel Configuration

The stream channel within the upper portion of the reach is constrained by the steep bedrock walls of the Elwha Canyon, while the channel floodway widens and the river meanders in the lower portion of the reach.

Hazard Areas

Several river banks and surrounding areas are unstable (7%) with potential for slides mapped in western portions of the reach. Potential erosion areas are mapped in the southern portion of the reach (3%). The nothern portion of the reach is located within a channel migration zone (45%), tsunami hazard zone (14%), and the FEMA 100-year floodplain (89%).

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 29% of the reach contains forest habitat, 17% contains herb and shrub habitat, and 3% is lawn/landscaping and developed areas. Outlying the stream corridor vegetation is comprised mostly of forest habitat intermixed with herb and shrub habitat.

Habitats and Species

22% of the reach is identified as wetland habitat, primarily concentrated in the northern portion of the reach. The designated priority habitat mapped within the reach is bald eagle (31%).

The reach provides spawning habitat for bull trout (41%), steelhead trout (43%), and Chinook (43%), chum (50%), coho (77%), and pink (82%) salmon, and rearing habitat for Chinook (5%) and coho (1%) salmon. The presence of residential cutthroat and rainbo

Water Quality

The portion of the Elwha River within the reach has State impaired water quality listings for temperature and PCB. Temperature impairments are located within the lower portion of this reach while PCB impairments are located in upstream segments. Elwha Riv

Elwha River: Reach 1

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is tribe (33%), timber (20%), open space (20%), utilities (9%), vacant (9%), residential (7%), unknown (2%), commercial (trace), and roads (trace). Tribe lands are located in the north eastportion of the reach while open space and timber is located in the northwest. Residential lands are located in the south. Land ownership in the reach is 92% public, 7% tribe, and 2% private.

Zoning and Parcel Data

The reach is zoned for rural residential (65%), commercial forestry (3%), and tribes (32%).

Under current zoning regulations there is moderate potential for significant new residential development in the reach, particularily near Highway 101.

Public Access

The river mouth can be accessed directly from the north end of Elwha Dike Road. In addition, the Olympic Discovery Trail is adjacent to the Elwha throughout the reach.

Impervious Surfaces

Approximately 1% of the reach is covered by impervious surfaces.

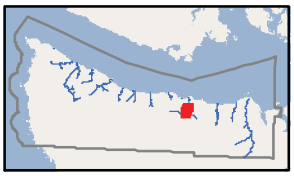
Shoreline Modifications

Elwha River Road and Granite Road cross the stream corridor in the central and south central portions of the reach, respectively. Levee sections are present throughout the lower portion of the reach, and a levee is present along the entire east side of th

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources



Elwha River: Reach 2

SHORELINE LENGTH
3.0 Miles

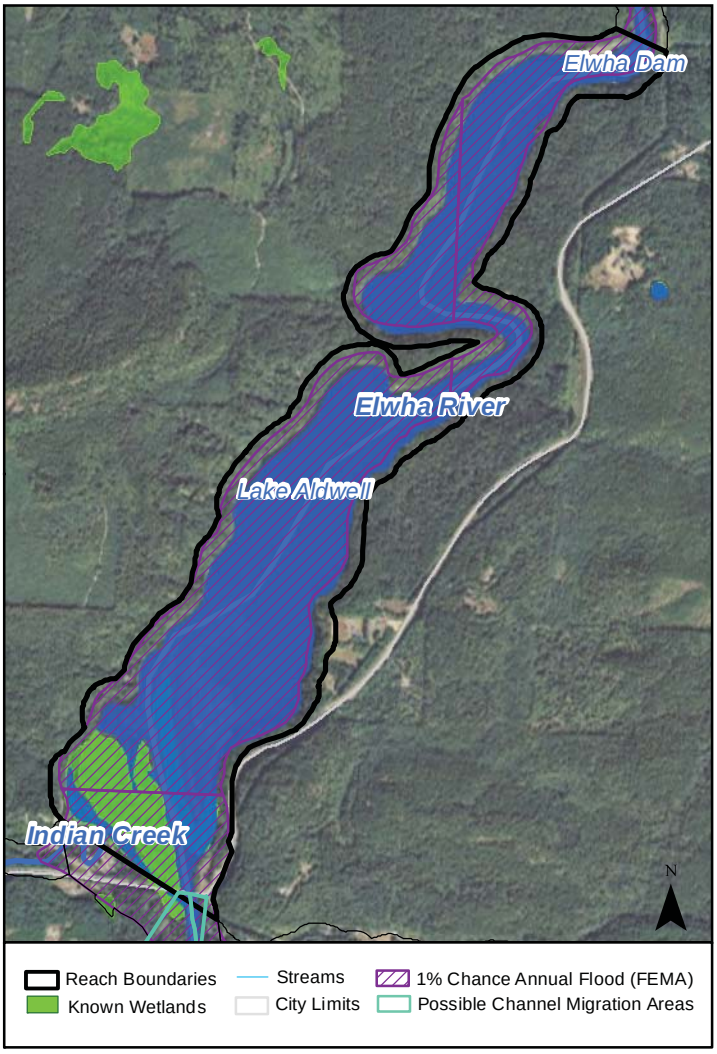
REACH AREA
489.89 Acres

REACH SUMMARY

Reach 2 of the Elwha River consists of Lake Aldwell, from the Elwha River Dam to the Highway 101 bridge. The reach area consists primarily of forest habitat. Lake Aldwell provides habitat for rainbow trout, resident cutthroat trout, and bull trout; the Elwha River Dam blocks anadromous fish access to the reach. Bald eagle and trumpeter swan habitat is mapped throughout the reach.

The upper portion of the reach lies within Olympic National Forest. The remainder of the reach area consists of forest land, both publically (DNR managed) and privately owned.

Most of the reach consists of public forest land; therefore, the potential for new residential development within the reach is low. The upcoming removal of the Elwha River Dam will drain the Lake Aldwell reservoir. The restoration of the Elwha River will substantially alter habitat conditions and the physical condition of the reach.



PHYSICAL

Channel Configuration
Not applicable

Hazard Areas
Some lake shore areas are unstable (14%) with potential for slides mapped primarily in western and southeastern portions along Lake Aldwell. Potential erosion areas are mapped in the north and east portions of the reach (15%). The Indian Creek confluence area lies within the FEMA 100-year floodplain (89%).

ECOLOGY

Riparian Vegetation
84% of the reach zone contains forest habitat while 5% of the reach contains non-forest land. An additional 3% of the reach contains herb and shrub habitat.

Habitats and Species
22% of the reach is identified as wetland habitat, primarily concentrated in the southeast near the confluence of Indian Creek with the Elwha River. Designated priority habitats mapped within the reach include bald eagle (76%) and trumpeter swan (42%).

This reach provides habitat for bull trout, resident cutthroat, and rainbow trout.

Water Quality
The portion of the Elwha River within the reach has a State impaired water quality listing for temperature. There are no Streamkeepers data available for this reach.

Elwha River: Reach 2

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (93%), roads (4%), lodging (2%), and vacant (trace). Timber land is located throughout the reach. Land ownership in the reach is 100% public.

Zoning and Parcel Data

The reach is zoned for rural residential (3%), rural commercial (1%), and commercial forestry (96%).

Under current zoning regulations there is low potential for significant new development within the reach. Most of the reach is zoned for commercial forestry.

Public Access

Public access to the reach is available off of Highway 101.

Impervious Surfaces

Approximately 4% of the reach is covered by impervious surfaces.

Shoreline Modifications

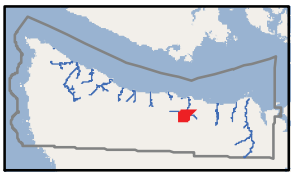
The Elwha River Dam is located at the downstream end of the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

Bordering Elwha River reaches 2 and 3, the Lower Elwha River Hydroelectric Facility (built 1912 - 1914) is listed on the state and national historic registries; the dam and facility is currently being demolished. Two other historic sites, including a hist



Elwha River: Reach 3

SHORELINE LENGTH
2.1 Miles

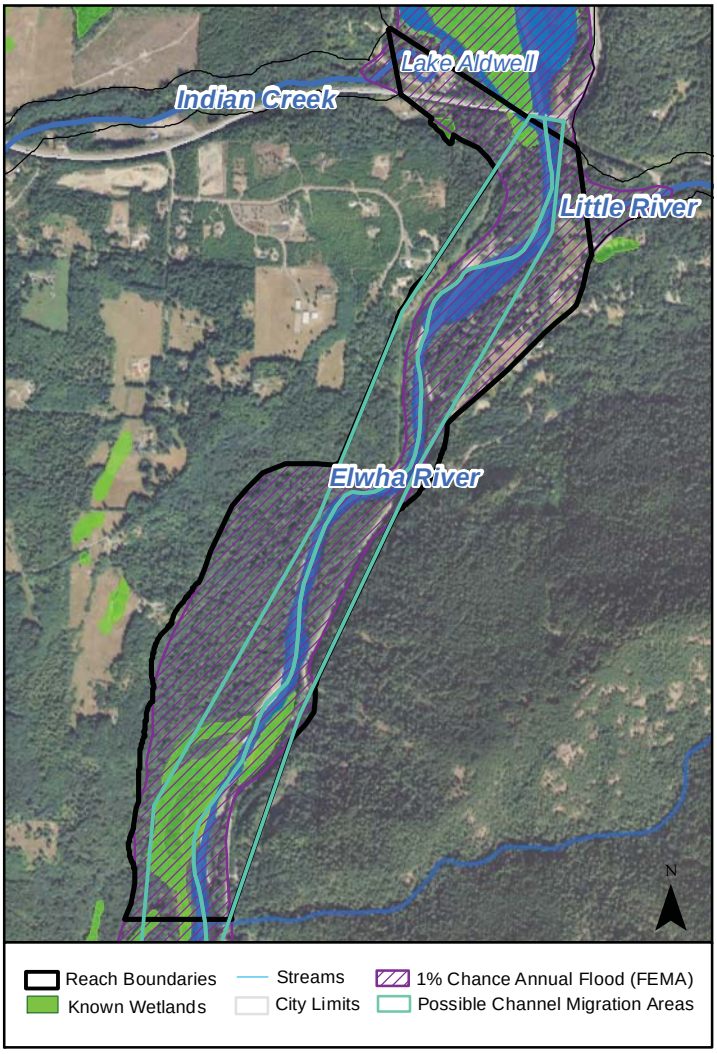
REACH AREA
298.86 Acres

REACH SUMMARY

Reach 3 of the Elwha River extends from the Highway 101 bridge to the Olympic National Park boundary. The stream channel is relatively confined throughout the reach, and consists of a relatively straight single channel. Most of the reach contains dense forest cover. However, Olympic Hot Spring Road borders the river within the reach, which has permanently removed some forest habitat. The reach provides habitat for rainbow trout, resident cutthroat trout, and bull trout; the Elwha River Dam blocks anadromous fish access to the reach.

The reach contains a mix of commercial forest land and low-density residential development. The majority of the reach lies within mapped channel migration and flood hazard zones.

Under current zoning regulations, approximately one-quarter of the reach has potential for new low-density residential development. The upcoming removal of the Glines Canyon Dam (located in Olympic National Park) will likely substantially alter habitat conditions and the physical condition of the reach.



PHYSICAL

Channel Configuration

The river is relatively sinuous throughout the reach, and contains multiple channels in some locations.

Hazard Areas

Several river banks and surrounding areas are unstable (7%) with potential for slides mapped in the southeast portion of the reach. Potential erosion areas are mapped in the northwest portion of the reach (10%). Much of the reach lies within an identified channel migration zone (61%) and the FEMA 100-year floodplain (85%).

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 54% of the reach zone contains forest habitat, 10% is herb and shrub habitat, and 4% is lawn/landscaping. Outlying the stream corridor vegetation is primarily forest habitat with some sparse patches of herb and shrub habitat.

Habitats and Species

9% of the reach is identified as wetland habitat. There are no priority wildlife habitats mapped within the reach.

This reach provides habitat for bull trout, resident cutthroat, and rainbow trout.

Water Quality

The upstream and downstream portions of the Elwha River within the reach have State impaired water quality listings for temperature. Elwha River water quality within the reach is listed by Streamkeepers as "healthy" for WQI.

Elwha River: Reach 3

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (60%), residential (19%), roads (8%), open space (6%), vacant (6%), and lodging (2%). Timber lands and open space are located in through the southeast and northwest portion of the reach. Residential land is located in the north east. Land ownership in the reach is 100% public.

Zoning and Parcel Data

The reach is zoned for rural residential (45%), rural commercial, (2%), commercial forestry (50%), and parks/public land (3%).

Under current zoning regulations there is moderate potential for significant new residential development in the reach.

Public Access

Public access to this reach is available off of Olympic Hot Springs Road.

Impervious Surfaces

Approximately 8% of the reach is covered by impervious surfaces.

Shoreline Modifications

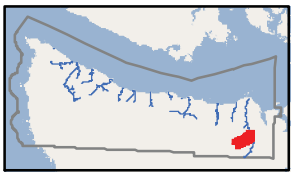
Olympic Hot Springs Road generally runs parallel to the Elwha within the reach, which blocks access to portions of its natural floodplain.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

Three historic sites associated with early Anglo-American settlement are inventoried but not listed.



Gray Wolf River

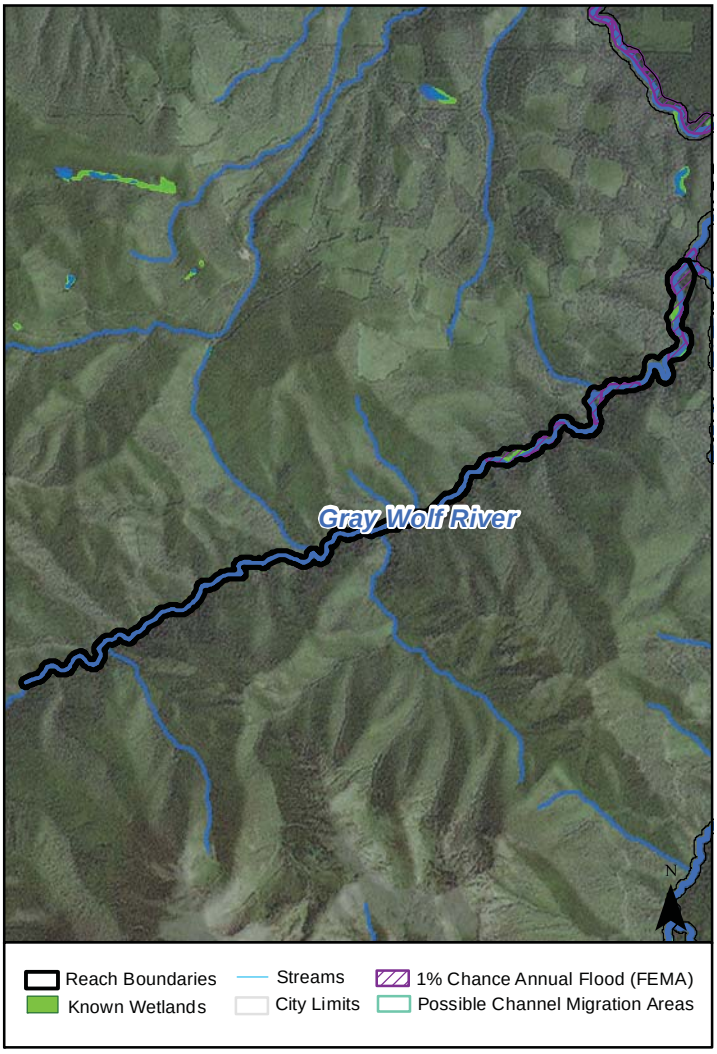
SHORELINE LENGTH
8.3 Miles

REACH AREA
444.91 Acres

REACH SUMMARY

The reach extends from the Dungeness River confluence to approximately 8.0 miles upstream. Forest cover is present throughout most of the reach. The Gray Wolf River provides habitat for Chinook, coho, chum, sockeye, and pink salmon, in addition to steelhead, bull, and resident cutthroat trout. The reach also supports populations of elk and harlequin duck.

The Gray Wolf River is located within Olympic National Forest, portions of which are designated wilderness areas. The Lower Gray Wolf Trail is located within the reach, which is a popular hiking and camping area. Forest Service Road 2870 also provides public access to the reach.



PHYSICAL

Channel Configuration
No data

Hazard Areas
Many of the stream banks and surrounding areas are located within the FEMA 100-year floodplain (28%).

ECOLOGY

Riparian Vegetation
77% of the reach contains continuous forest habitat, while 13% contains herb and shrub habitat.

Habitats and Species
7% of the reach is mapped as wetland habitat. Designated priority habitats mapped within the reach include elk (24%) and harlequin duck (5%).

This reach provides spawning habitat for steelhead trout (35% of reach total) and bull trout (11%), as well as Chinook (25%), chum (100%), coho (99%), pink (100%), and sockeye salmon (25%), and juvenile rearing habitat for bull trout (10%). The presence o

Water Quality
The reach has no State impaired water quality listings. Gray Wolf River water quality is listed by Streamkeepers as "healthy" for B-IBI.

Gray Wolf River

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (99%) and open space (1%). Land ownership is 99% public and 1% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

The Lower Gray Wolf Trail, accessed from Forest Service Road 2870, provides public access to the reach.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

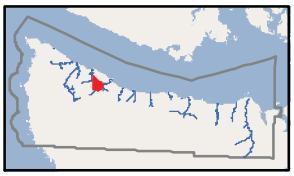
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

The Three Forks Shelter, located just upstream of shoreline jurisdiction, is listed on the national and state registries (trail shelter built around 1930).



Green Creek

SHORELINE LENGTH
0.7 Miles

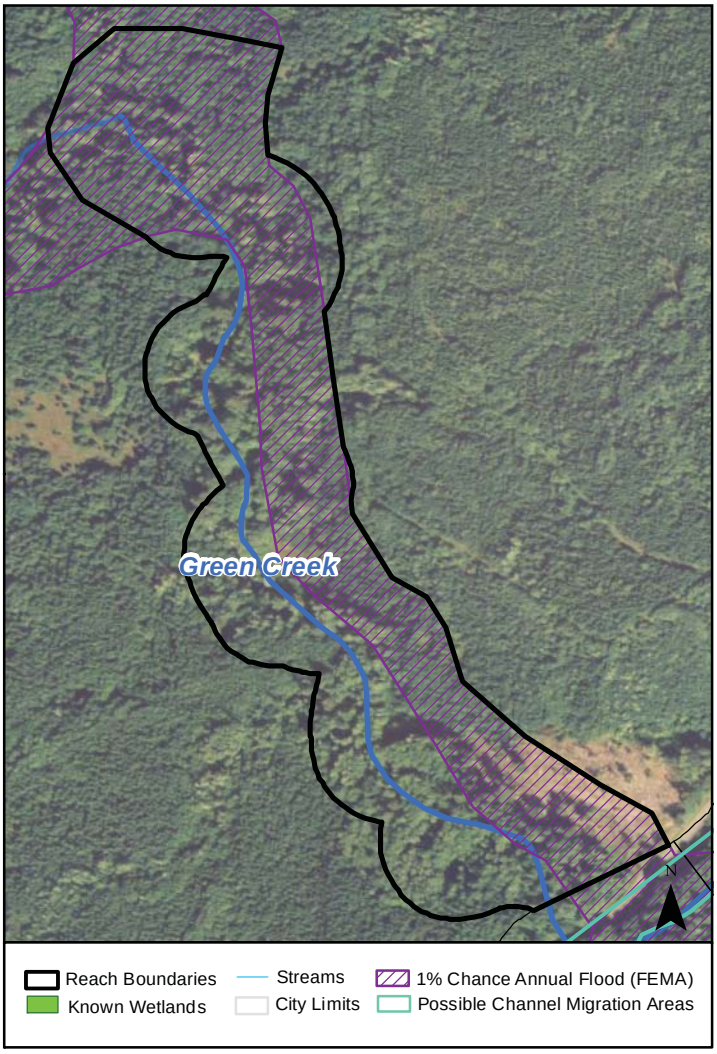
REACH AREA
52.23 Acres

REACH SUMMARY

The reach extends from the Pysht River confluence to approximately 0.7 miles upstream. The reach is covered primarily by dense forest habitat. This reach provides spawning habitat for chum and coho salmon, and juvenile rearing habitat for steelhead trout. The presence of resident cutthroat is also mapped within the reach.

The reach contains privately owned commercial forest lands. The majority of the reach is situated within the FEMA 100-year floodplain. Geologic hazard areas for erosion and slides are located in the eastern half of the reach.

Under current zoning regulations, the reach is zoned for commercial forestry and cannot be subdivided.



PHYSICAL

Channel Configuration
No data

Hazard Areas
Potential erosion areas are mapped in the northeast and southeast portions of the reach (19%). Most of the southeast portion of the reach has potential for slides (14%). Much of the reach banks and surrounding areas are within the FEMA 100-year floodplain (58%).

ECOLOGY

Riparian Vegetation
88% of the reach contains continuous forest habitat, while 8% contains herb and shrub habitat.

Habitats and Species
There is no priority wildlife habitat mapped within the reach.

This reach provides spawning habitat for chum (69%) and coho salmon (100%), and juvenile rearing habitat for steelhead trout (93%). The presence of resident cutthroat are also mapped within the reach.

Water Quality
The portion of the Green Creek within the reach has a State impaired water quality listing for temperature. Green Creek water quality is listed by Streamkeepers as "healthy" for WQI.

Green Creek

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership is 100% private.

Zoning and Parcel Data

The reach is zoned for rural residential (25%) and commercial forestry (75%).

Under current zoning regulations there is low potential for significant new development within the reach. Most of the reach is zoned for commercial forestry.

Public Access

No public access is available in this reach. Lands adjacent to the reach are privately owned.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

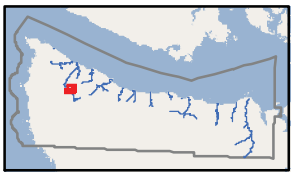
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Herman Creek: Reach 1

SHORELINE LENGTH
1.9 Miles

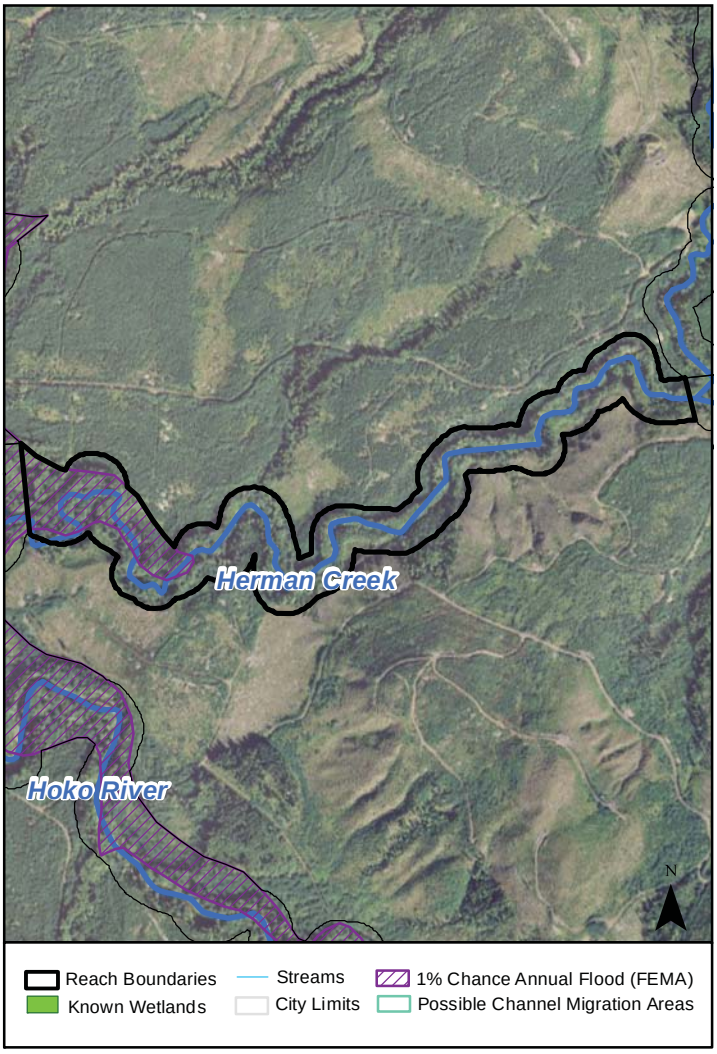
REACH AREA
95.22 Acres

REACH SUMMARY

Reach 1 of Herman Creek extends from the Hoko River confluence to the North Branch Herman Creek confluence. Dense forest cover extends throughout much of the reach. The reach provides spawning and rearing habitat for steelhead and chinook and coho salmon, in addition to resident cutthroat.

The reach contains commercial forest lands. The lower portion of the reach is situated in the FEMA 100-year floodplain. Geologic hazard areas for erosion and land slide are located in the middle and upper portions of the reach.

Under current zoning regulations, approximately three-quarters of the reach area has the potential for residential development. However, much of this land is zoned for commercial forestry and cannot be developed at a density greater than 1 dwelling per 80 acres. Actual development potential in the reach is low.



PHYSICAL

Channel Configuration

Channel configuration through the reach is defined by a series of meanders and straight stretches. The channel course flows through a series of moderately steep foothills that confine the channel to a narrow floodplain.

Hazard Areas

Several stream banks and surrounding areas are unstable (22%) with potential for slides mapped in the south to northeast portions of the reach. Potential erosion areas are mapped in the northeast portion of the reach (15%). Most of the Hoko River confluence area lies within the FEMA 100-year floodplain (19%) and channel migration zone (83%).

ECOLOGY

Riparian Vegetation

79% of the reach zone contains forest habitat, while 21% of contains herb and shrub habitat.

Habitats and Species

There is no priority wildlife habitat mapped within the reach.

This reach provides spawning habitat for steelhead trout (100% of reach total) and Chinook (70%), and coho salmon (100%), and juvenile rearing habitat for Chinook salmon (30%). The presence of resident cutthroat are also mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. There are no Streamkeepers water quality data available for Herman Creek.

Herman Creek: Reach 1

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership is 100% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

No public access is available in this reach. Lands adjacent to the reach are privately owned.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

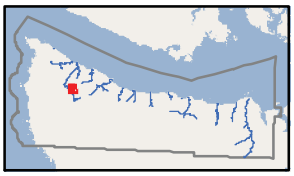
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Herman Creek: Reach 2

SHORELINE LENGTH
1.2 Miles

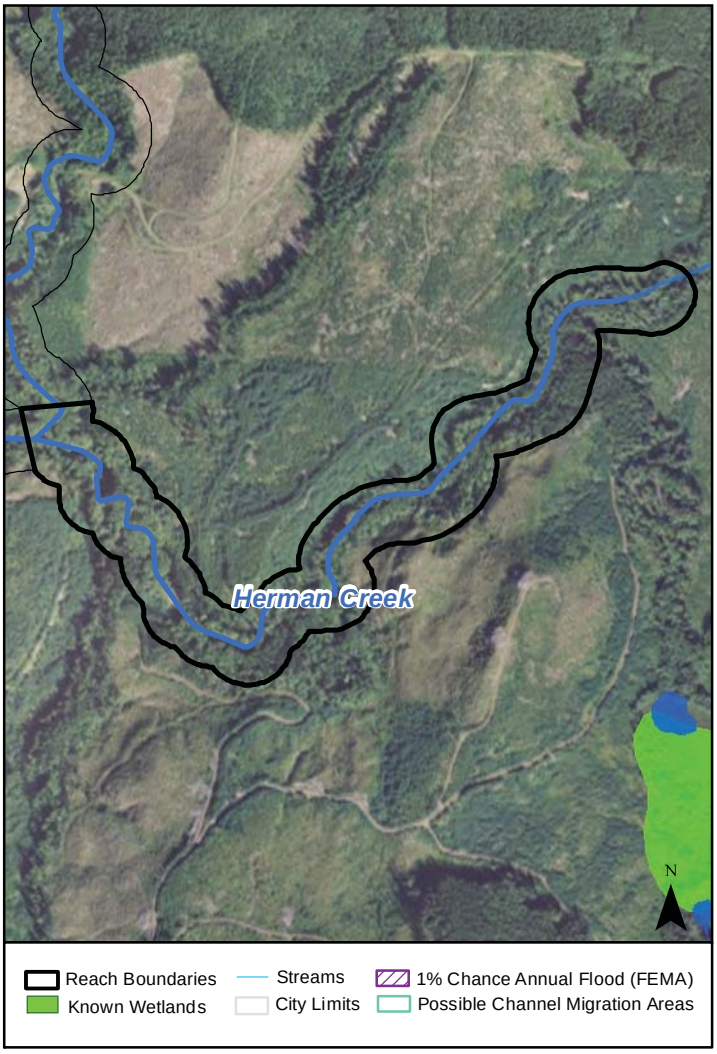
REACH AREA
61.84 Acres

REACH SUMMARY

Reach 2 of Herman Creek extends from the North Branch Herman Creek confluence to the East Branch Herman Creek confluence. Dense forest cover is present throughout most of the reach. The reach provides spawning and rearing habitat for coho salmon and steelhead trout. Resident cutthroat trout are also present within the reach.

The reach contains commercial forest lands. Geologic hazard areas for erosion and land slides are present throughout the entire reach.

Under current zoning regulations, approximately one-half of the reach area has the potential for new residential development. However, much of this land is zoned for commercial forestry and cannot be developed at a density greater than 1 dwelling per 80 acres. Actual development potential in the reach is low.



PHYSICAL

Channel Configuration

Channel configuration through the reach is defined by a series of meanders and straight stretches. The channel course flows through a series of moderately steep foothills that confine the channel to a narrow floodplain.

Hazard Areas

Several stream banks and surrounding areas are unstable (23%) with potential for slides mapped in the northeast portion of the reach. Potential erosion areas (93%) and a channel migration zone (46%) are mapped throughout most of the reach.

ECOLOGY

Riparian Vegetation

85% of the reach zone contains continuous forest habitat, while 15% is herb and shrub habitat.

Habitats and Species

There is no priority wildlife habitat mapped within the reach.

This reach provides spawning habitat for steelhead trout (97% of reach total) and coho salmon (100%). The presence of resident cutthroat are also mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. There are no Streamkeepers water quality data available for Herman Creek.

Herman Creek: Reach 2

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership is 100% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

No public access is available in this reach. Lands adjacent to the reach are privately owned.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.

Hoko River: Reach 1

SHORELINE LENGTH
0.9 Miles

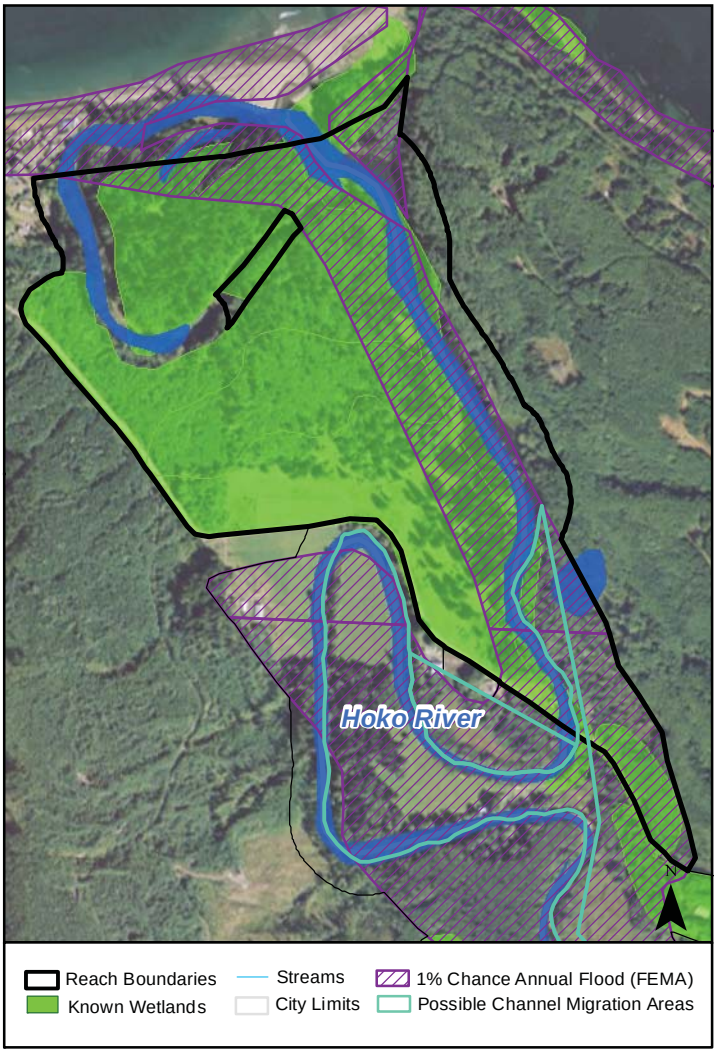
REACH AREA
210.26 Acres

REACH SUMMARY

Reach 1 of the Hoko River extends from near the river's mouth to approximately 1 mile upstream, near the Highway 112 bridge crossing. The reach encompasses a large and flat alluvial floodplain. Dense forest cover extends throughout much of the reach. Wetland and estuarine habitat also extends through the majority of the reach. This reach provides spawning habitat for Chinook, chum, and coho salmon, and the presence of resident cutthroat and steelhead trout is also mapped within the reach. The reach supports breeding populations of bald eagle.

Much of the lower portion of the reach is undeveloped park land (Hoko River State Park). Agricultural lands are located in the upper portion of the reach. Most of the reach lies within a tsunami hazard area, the FEMA 100-year floodplain and/or a channel migration areas. Geologic hazard areas for erosion and slides are located in the northeastern portion of the reach.

Under current zoning regulations, most of the reach area is not eligible for additional development.



PHYSICAL

Channel Configuration

The lower Hoko River is characterized by large channel that flows northward across a broad low-gradient alluvial fan. The estuarine zone extends over a mile upstream from the mouth.

Hazard Areas

Several river banks and surrounding areas are unstable (1%) with potential for slides mapped in the northeastern portions of the reach. Potential erosion areas are mapped in the western portion of the reach (3%). The reach lies within a channel migration zone (94%), tsunami hazard zone (80%), and the FEMA 100-year floodplain (41%).

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 37% of the reach zone contains forest habitat, 6% contains herb and shrub habitat, and an additional 3% of the reach contains lawn/landscaping. Outlying the stream corridor vegetation is primarily comprised of forest habitat intermixed with herb and shrub habitat and lawn/landscaping.

Habitats and Species

76% of the reach is mapped as wetland habitat. The designated priority habitats mapped within the reach are bald eagle (36%) and estuarine habitat (2%).

This reach provides spawning habitat for Chinook (58%), chum (60%) and coho salmon (60%). The presence of resident cutthroat and steelhead trout are also mapped within the reach.

Water Quality

The upstream portion of the Hoko River within the reach has a State impaired water quality listing for temperature. River water quality within the reach is listed by Streamkeepers as "compromised" for B-IBI but "healthy" for WQI.

Hoko River: Reach 1

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is open space (46%), timber (26%), agriculture (22%), roads (2%), residential (2%), and vacant (2%). Open space and timber is located through the northern and eastern portion of the reach, while agriculture is located in the south. Land ownership in the reach is 99.6% private and 0.4% public.

Zoning and Parcel Data

The reach is zoned for rural residential (93%) and parks / public land (7%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

Informal public access to the reach is available at the undeveloped Hoko River State Park.

Impervious Surfaces

Approximately 2% of the reach is covered by impervious surfaces.

Shoreline Modifications

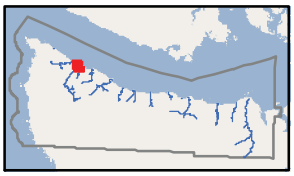
Highway 112 crosses the stream corridor at the upstream end of the reach.

Contaminated Sites

No identified contaminated sites are located within the reach.

Cultural Resources

There are 3 historic sites (dating to the late 1800s) and 2 pre-contact sites that are inventoried, but not listed.



Hoko River: Reach 2

SHORELINE LENGTH
2.4 Miles

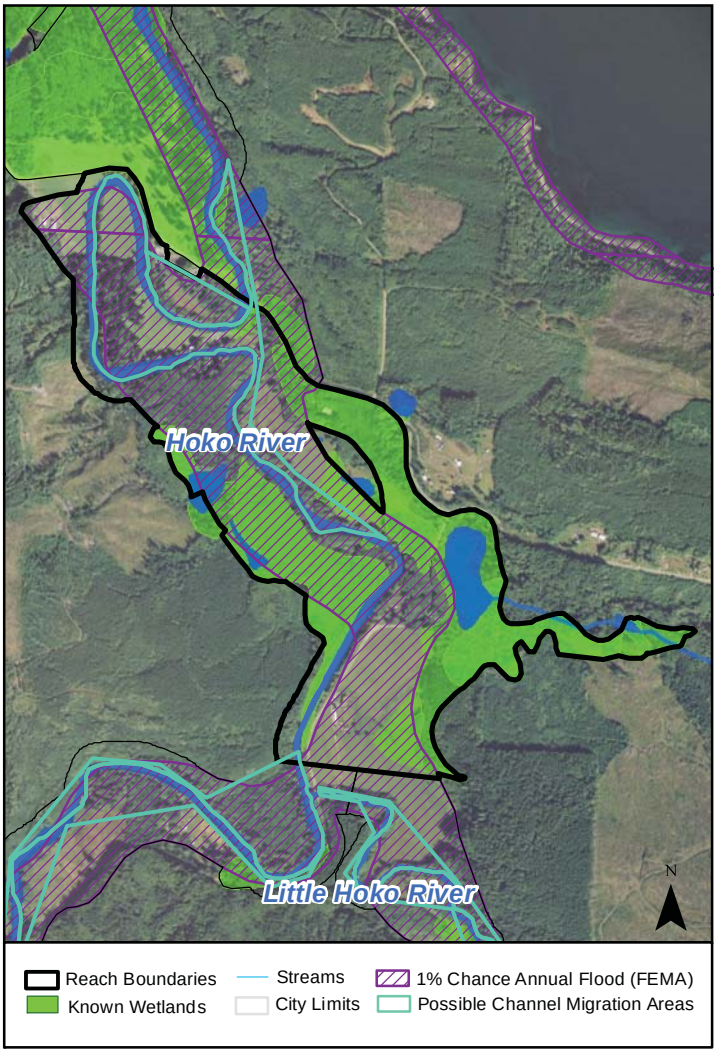
REACH AREA
336.74 Acres

REACH SUMMARY

Reach 2 of the Hoko River extends from the Highway 112 bridge to just below the Little Hoko River confluence. The river channel within the reach contains a series of well defined braids and meanders, moving laterally across a broad floodplain. The Hoko-Ozette Road runs parallel to the river through much of the reach, acting as a lateral barrier between the river and its natural floodplain. The majority of the reach has been cleared for agriculture and rural residential development, leaving sparse residual forest cover and herb and shrub habitat along the stream. Wetland habitat is located in the floodplain of the river throughout much of the reach. The reach supports spawning and rearing habitat for Chinook, coho, and chum salmon, in addition to steelhead and cutthroat trout.

Approximately one-third of the reach contains low-density residential development. The other two-thirds of the reach area is commercial timberland. The majority of the reach lies within mapped flooding and/or channel migration hazard areas. The northern portion of the reach lies within the undeveloped Hoko River State Park, andt he Hoko-Ozette Road provides additional informal public access to shorelines in the reach.

Under current zoning regulations, approximately one-third of the reach area has the potential for low-density residential development. Developable lands are located within flood hazard areas. The presence of wetlands may preclude development in portions of the reach.



PHYSICAL

Channel Configuration

The channel consists of a series of large sweeping meanders that move laterally across a broad alluvial floodplain.

Hazard Areas

Several river banks and surrounding areas are unstable (1%) with potential for slides mapped in the north and southwestern portions of the reach. Potential erosion areas are mapped in the west and southeastern portions of the reach (2%). Most of the reach lies within a channel migration zone (92%), tsunami hazard zone (57%), and the FEMA 100-year floodplain (68%).

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 28% of the reach zone consists of forest habitat, 14% of the reach contains lawn/landscaping, and 4% of the reach contains herb and shrub habitat. Outlying the stream corridor vegetation is primarily forest habitat intermixed with herb and shrub habitat and some lawn/landscaping.

Habitats and Species

43% of the reach is identified as wetland habitat. There are no priority wildlife habitats mapped within the reach.

This reach provides spawning habitat for steelhead trout (41%), and Chinook (93%), chum (93%) and coho salmon (93%). The presence of resident cutthroat are also mapped within the reach.

Water Quality

The portion of the Hoko River within the reach has a State impaired water quality listing for temperature. River water quality within the reach is listed by Streamkeepers as "compromised" for B-IBI but "healthy" for WQI.

Hoko River: Reach 2

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (46%), residential (20%), open space (20%), vacant (12%), and roads (1%). Timber and open space lands are located within the southern half of the reach. Residential lands are located west and north. Land ownership is 84% private and 16% public.

Zoning and Parcel Data

The reach is zoned for rural residential (61%), commercial forestry 23%), and parks/public land (6%).

Under current zoning regulations there is moderate potential for new residential development within the reach. Wetland habitat may limit development potential in some areas.

Public Access

Public lands are located in the southern portion of this reach. Informal access to public shorelines along the Hoko River are available from Hoko-Ozette Road.

Impervious Surfaces

Approximately 2% of the reach is covered by impervious surfaces.

Shoreline Modifications

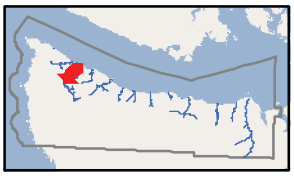
Highway 112 crosses the stream corridor at the downstream end of the reach.

Contaminated Sites

A state cleanup site, Car Crushing, is located along the Hoko River in the northeastern portion of the reach. The Hoko Logging Camp, located in the southeastern portion of the reach, is a voluntary cleanup site.

Cultural Resources

The George Lamb Barn (built in 1900 on the Cowan Ranch) is listed on the State Registry of Heritage Barns.



Hoko River: Reach 3

SHORELINE LENGTH
6.6 Miles

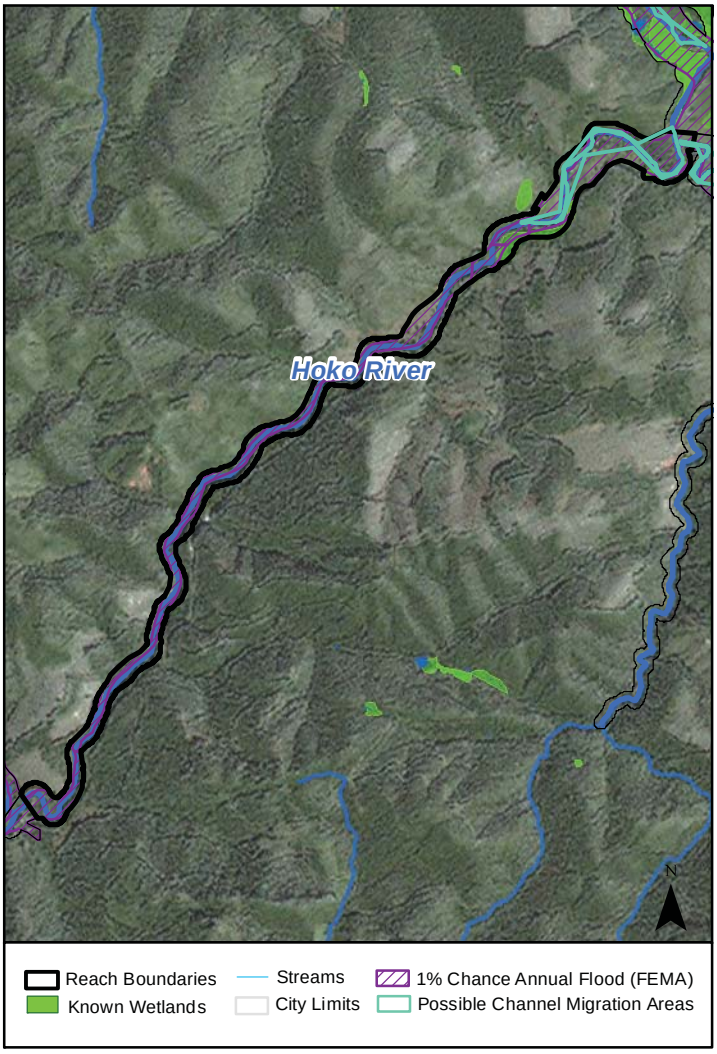
REACH AREA
457.93 Acres

REACH SUMMARY

Reach 3 of the Hoko River extends from the Little Hoko River confluence to the Browns Creek confluence. Channel configuration through the reach is a series of relatively straight stream segments followed by several tight meanders. The Hoko-Ozette Road runs parallel to the river through much of the reach, acting as a lateral barrier between the river and its natural floodplain. Forest cover borders the stream throughout much of the reach area. The reach supports spawning and rearing habitat for Chinook, coho, and chum salmon, in addition to steelhead and cutthroat trout. Bald eagle and harlequin duck populations are also present within the reach.

Approximately two-thirds of the reach contains commercial forest lands. Low-density residential development is limited to the lower portion of the reach. Much of the reach area is located within FEMA 100-year floodplain and/or channel migration areas. Additionally, geologic hazard areas for erosion and land slide extend through much of the reach. The Hoko-Ozette Road provides informal public access to shorelines in the reach.

Under current zoning regulations, approximately one-quarter of the reach area has the potential for low-density residential development. Developable lands are located within the flood and/or geologic hazard areas. The remaining three-quarters of the watershed are zoned for commercial forestry and are not eligible for subdivision.



PHYSICAL

Channel Configuration

Channel configuration through this reach is characterized by a narrow stream profile that is confined by several moderately steep foothills. Portions of the reach are deeply incised.

Hazard Areas

Several river banks and surrounding areas are unstable (53%) with potential for slides mapped in the southwestern and central portions of the reach. Areas for potential erosion are mapped in the northeast portion of the reach (3%). Most of the reach lies within a channel migration zone (87%) and the FEMA 100-year floodplain (64%).

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 69% of the reach zone contains forest habitat, 8% is herb and shrub habitat, and 5% of the reach is lawn/landscaping. Outlying the stream corridor vegetation is comprised mostly of forest habitat with some herb and shrub habitat.

Habitats and Species

6% of the reach is identified as wetland habitat, located primarily in the northeast portion of the reach. Designated priority habitats mapped within the reach include bald eagle (14%) and harlequin duck (6%).

This reach provides spawning habitat for steelhead trout (98%), and Chinook (99%), chum (99%) and coho salmon (99%). The presence of resident cutthroat is also mapped within the reach.

Water Quality

The upstream and downstream portions of the Hoko River within the reach has State impaired water quality listings for temperature. River water quality within the reach is listed by Streamkeepers as "compromised" for B-IBI.

Hoko River: Reach 3

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (58%), open space (25%), vacant (6%), residential (5%), commercial (4%), utilities (2%), and roads (trace). Timber lands are located in the west end of the reach while open space is located in the east. Land ownership in the reach is 77% private and 23% public.

Zoning and Parcel Data

The reach is zoned for rural residential (12%), commercial forestry (67%), and parks/public land (21%).

Under current zoning regulations there is low potential for significant new development within the reach. Most of the reach is zoned for commercial forestry.

Public Access

The northern portion of the reach lies within the undeveloped Hoko River State Park. In addition, Informal access to the Hoko River is available along Hoko-Ozette Road.

Impervious Surfaces

Approximately 1% of the reach is covered by impervious surfaces.

Shoreline Modifications

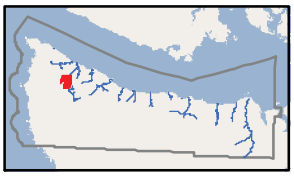
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Hoko River: Reach 4

SHORELINE LENGTH
2.1 Miles

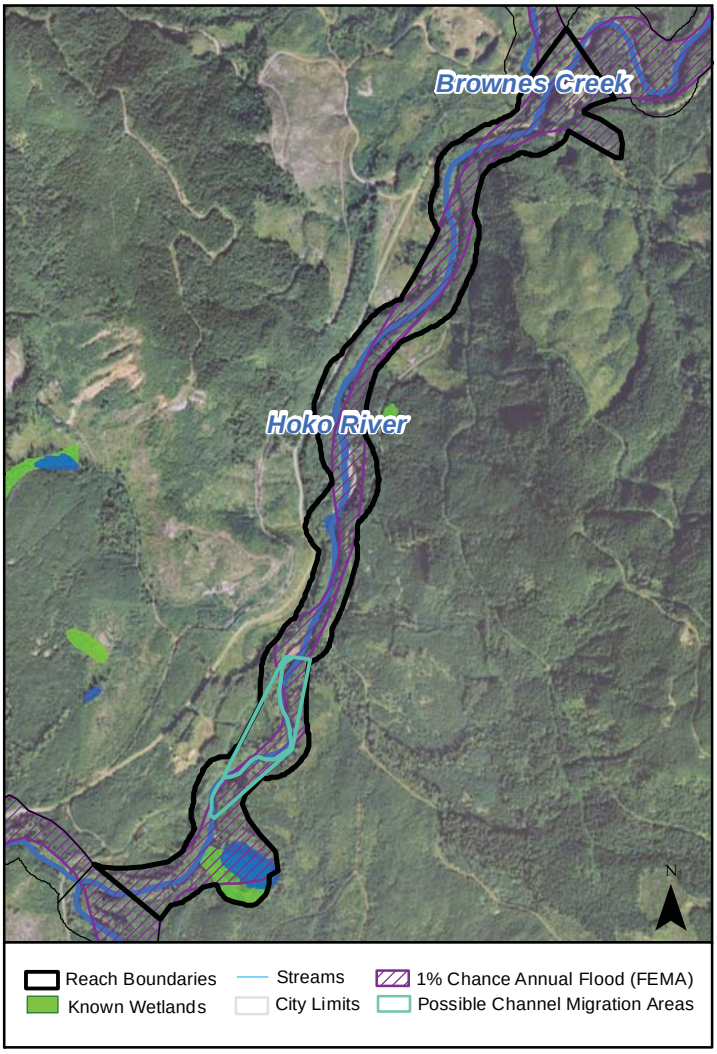
REACH AREA
132.20 Acres

REACH SUMMARY

Reach 4 of the Hoko River extends from the Browns Creek confluence to the Old Royal Creek confluence. The Hoko-Ozette Road crosses the stream in the lower reach. The majority of the reach areas contains dense forest cover. The reach supports spawning and rearing habitat for Chinook, coho, and chum salmon, in addition to steelhead and cutthroat trout. Harlequin duck populations also utilize the reach.

The majority of the reach contains private commercial forest lands. Much of the reach is situated in the FEMA 100-year floodplain and/or channel migration area. Geologic hazard areas for erosion and land slides are prevalent through the upper and middle portion of the reach.

Under current zoning regulations, approximately two-thirds of the reach area is commercial timber land that has the potential for new residential development, but at a density no greater than 1 dwelling per 80 acres. Actual development potential in the reach is low.



PHYSICAL

Channel Configuration

The channel is moderately confined, and flows fairly straight

Hazard Areas

Several river banks and surrounding areas are unstable (45%) with potential for slides mapped in the southwestern and central portions of the reach. Areas for potential erosion are mapped in the northeast portion of the reach (21%). Most of the reach lies within the FEMA 100-year floodplain (62%) and a channel migration zone (74%).

ECOLOGY

Riparian Vegetation

66% of the reach area contains forest habitat, while 15% of contains herb and shrub habitat.

Habitats and Species

5% of the reach is mapped as wetland habitat, primarily concentrated in the southeast portion of the reach. The designated priority habitat mapped within the reach is harlequin duck (18%).

This reach provides spawning habitat for steelhead trout (100%) and Chinook (100%), chum (3%) and coho salmon (100%). The presence of resident cutthroat are also mapped within the reach.

Water Quality

The downstream portion of the Hoko River within the reach has a State impaired water quality listing for temperature. River water quality within the reach is listed by Streamkeepers as "compromised" for B-IBI.

Hoko River: Reach 4

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (86%), commercial (13%), and roads (1%). Timber lands are located throughout the reach while commercial lands are located in the northeast portion. Land ownership within the reach is 100% private.

Zoning and Parcel Data

The reach is zoned for rural residential (14%) and commercial forestry (86%).

Under current zoning regulations there is low potential for significant new development within the reach. Most of the reach is zoned for commercial forestry.

Public Access

No public access is available in this reach. Lands adjacent to the river are privately owned.

Impervious Surfaces

Approximately 1% of the reach is covered by impervious surfaces.

Shoreline Modifications

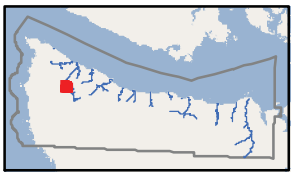
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Hoko River: Reach 5

SHORELINE LENGTH
3.8 Miles

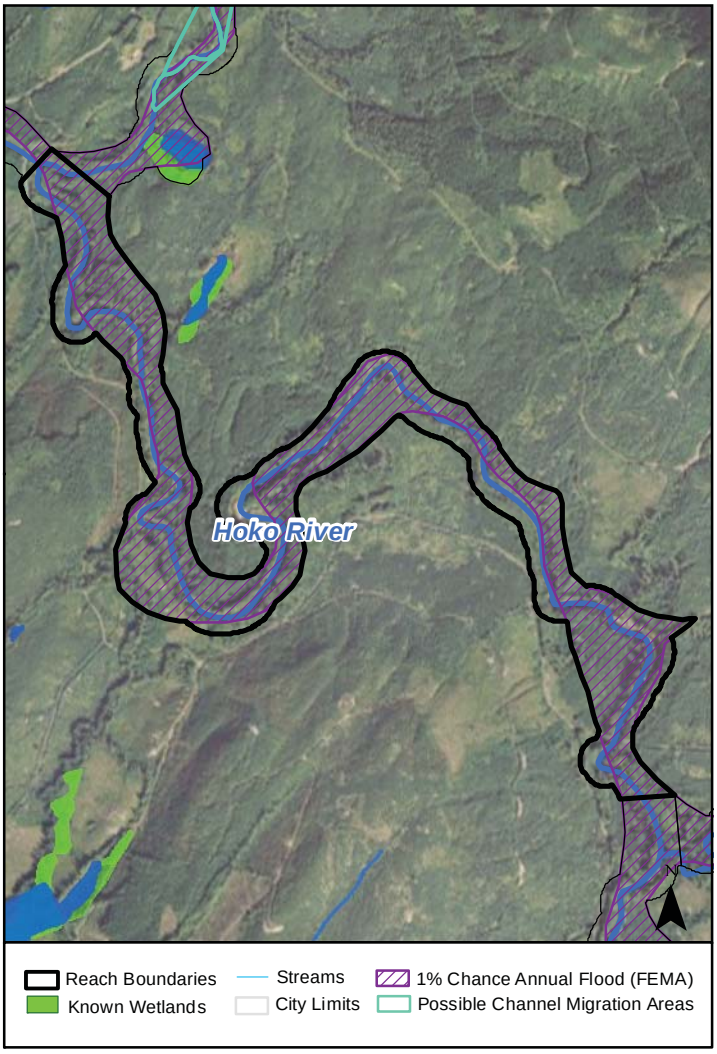
REACH AREA
246.40 Acres

REACH SUMMARY

Reach 5 of the Hoko River is located between the Old Royal Creek confluence and the Herman Creek confluence. The channel is fairly sinuous through the reach and contains several meanders and segments of braided channel. The reach contains dense forest cover. The reach supports spawning and rearing habitat for Chinook, coho, and chum salmon, in addition to steelhead and cutthroat trout.

The majority of the reach contains commercial forest lands. Geologic hazard areas for land slides are located in the lower one-third of the reach.

Under current zoning regulations, approximately one-third of the reach area has the potential for new development. However, much of this land is currently zoned for commercial forestry, which limits new residential development to 1 home per 80 acres. Actual development potential in the reach is low.



PHYSICAL

Channel Configuration

The channel is fairly sinuous through the reach, and contains multiple channels within an active floodplain.

Hazard Areas

Several river banks and surrounding areas are unstable (25%) with potential for slides mapped near the Old Royal Creek confluence and the central portion of the reach. Most of the reach lies within the FEMA 100-year floodplain (78%) and a channel migration zone (79%).

ECOLOGY

Riparian Vegetation

75% of the reach area contains forest habitat, while 7% contains herb and shrub habitat.

Habitats and Species

There is no priority wildlife habitat mapped within the reach.

The reach provides spawning habitat for steelhead trout (100%), and Chinook (100%) and coho salmon (100%). The presence of resident cutthroat and chum salmon are also mapped within the reach.

Water Quality

The upstream and downstream portions of the Hoko River within the reach has State impaired water quality listings for temperature. River water quality within the reach is listed by Streamkeepers as "compromised" for B-IBI.

Hoko River: Reach 5

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership is 100% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

No public access is available in this reach. Lands adjacent to the reach are privately owned.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

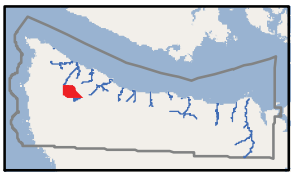
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Hoko River: Reach 6

SHORELINE LENGTH
3.2 Miles

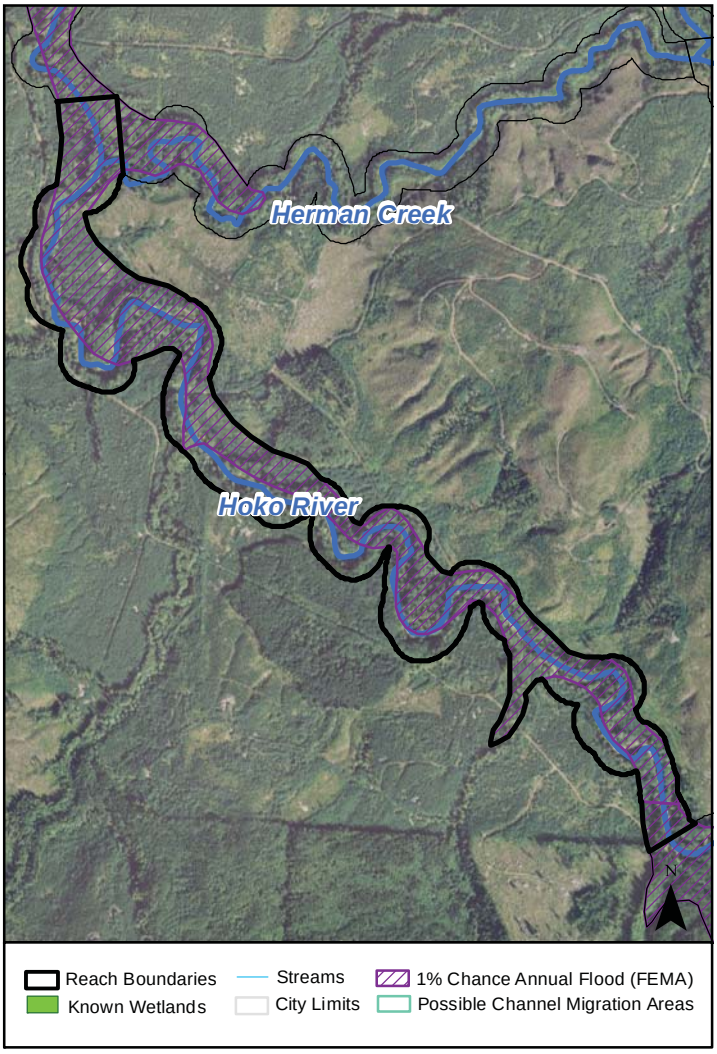
REACH AREA
195.34 Acres

REACH SUMMARY

Reach 6 of the Hoko River extends from the Herman Creek confluence upstream to the Ellis Creek confluence. The stream channel is mostly unconfined throughout the reach. Vegetative cover in the reach is primarily forest cover. The reach provides spawning and rearing habitat for Chinook, coho, and chum salmon, in addition to steelhead and cutthroat trout.

The reach contains commercial forest lands. The majority of the reach is located in the FEMA 100-year floodplain and/or channel migration area. Geologic hazard areas for slides are also located in portions of the reach.

Under current zoning regulations, approximately one-third of the reach area has the potential for new development. However, much of this land is currently zoned for commercial forestry, which limits new residential development to 1 home per 80 acres. Actual development potential in the reach is low.



PHYSICAL

Channel Configuration

The stream channel is mostly unconfined and flows through moderately steep foothills. Portions of the reach have been deeply incised, resulting in several cascades.

Hazard Areas

Several river banks and surrounding areas are unstable (8%) with potential for slides mapped at the confluence between Hoko River and Herman Creek. Areas for potential erosion are primarily mapped in the northwest portion of the reach (4%). Most of the reach lies within the FEMA 100-year floodplain (67%) and a channel migration zone (90%).

ECOLOGY

Riparian Vegetation

67% of the reach zone consists of forest habitat while 13% of the reach contains herb and shrub habitat.

Habitats and Species

There is no priority wildlife habitat mapped within the reach.

This reach provides spawning habitat for steelhead trout (100%) and Chinook (100%), and coho salmon (100%). The presence of resident cutthroat and chum salmon are also mapped within the reach.

Water Quality

The portion of the Hoko River within the reach has a State impaired water quality listing for temperature. Additionally, an unnamed creek (tributary to the Hoko River) is listed for temperature. Hoko River water quality within the reach is listed by Stre

Hoko River: Reach 6

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership is 99.9% private and 0.1 public.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

No public access is available in this reach. Lands adjacent to the reach are privately owned.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

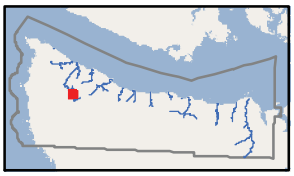
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Hoko River: Reach 7

SHORELINE LENGTH
2.5 Miles

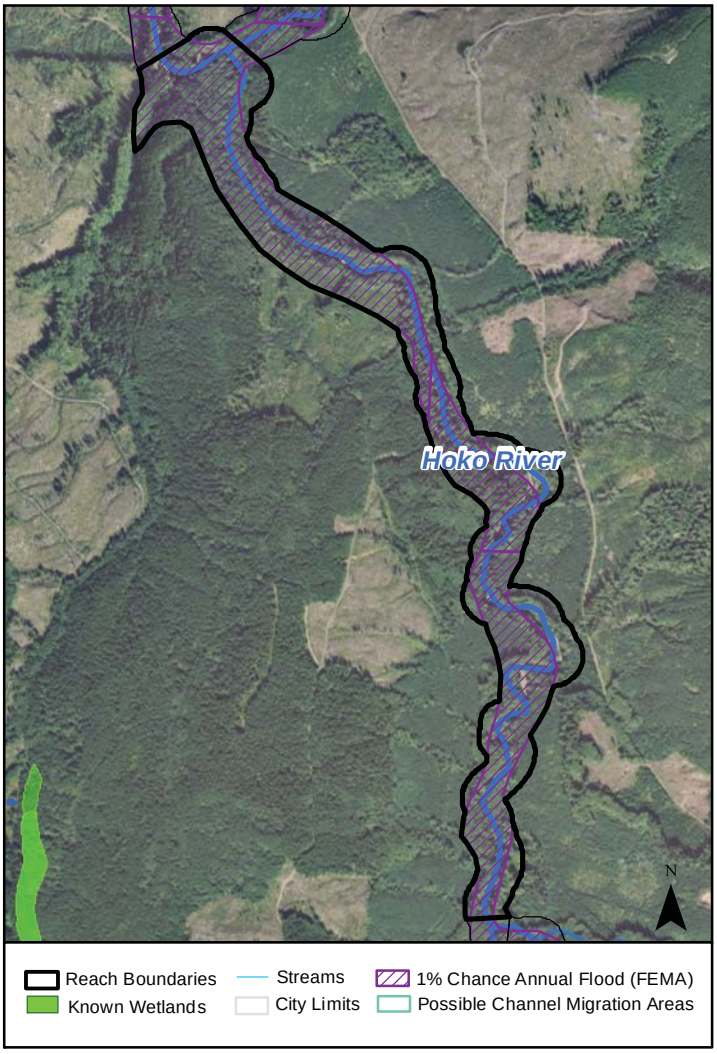
REACH AREA
145.86 Acres

REACH SUMMARY

Reach 7 of the Hoko River extends from the confluence of Ellis Creek, upstream to the confluence of Cub Creek. Dense forest cover is present within the reach. The reach provides spawning and rearing habitat for Chinook, coho, and chum salmon, in addition to steelhead and cutthroat trout is located in the reach.

The majority of the reach consists of private timber land, although some public timber parcels are present. The majority of the reach is located within the FEMA 100-year floodplain and/or channel migration area. Geologic hazards for land slides are present within the reach.

Under current zoning regulations, over three-quarters of the reach has potential for new development. However, this land is currently zoned for commercial forestry, which limits new residential development to 1 home per 80 acres. Actual development potential in the reach is low.



PHYSICAL

Channel Configuration

The stream channel within the reach is confined by moderately steep foothills. Portions of the reach have been deeply incised resulting in several cascades.

Hazard Areas

Several river banks and surrounding areas are unstable (12%) with potential for slides mapped in the northwestern portion of the reach. Areas for potential erosion are mapped in the southern northern segments of the reach (2%). Most of the reach lies within the FEMA 100-year floodplain (76%) and a channel migration zone (79%).

ECOLOGY

Riparian Vegetation

79% of the reach zone consists of continuous forest habitat, while 16% of the reach contains herb and shrub habitat.

Habitats and Species

There is no priority wildlife habitat mapped within the reach.

This reach provides spawning habitat for steelhead trout (100%) and Chinook (100%), and coho salmon (100%). The presence of resident cutthroat and chum salmon are also mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. River water quality within the reach is listed by Streamkeepers as "compromised" for B-IBI.

Hoko River: Reach 7

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership is 79% private and 21% public.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

Public lands are located within the reach, but no public access areas are available.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

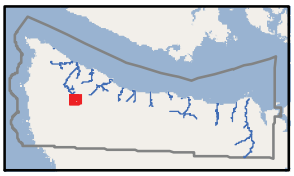
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Hoko River: Reach 8

SHORELINE LENGTH
2.6 Miles

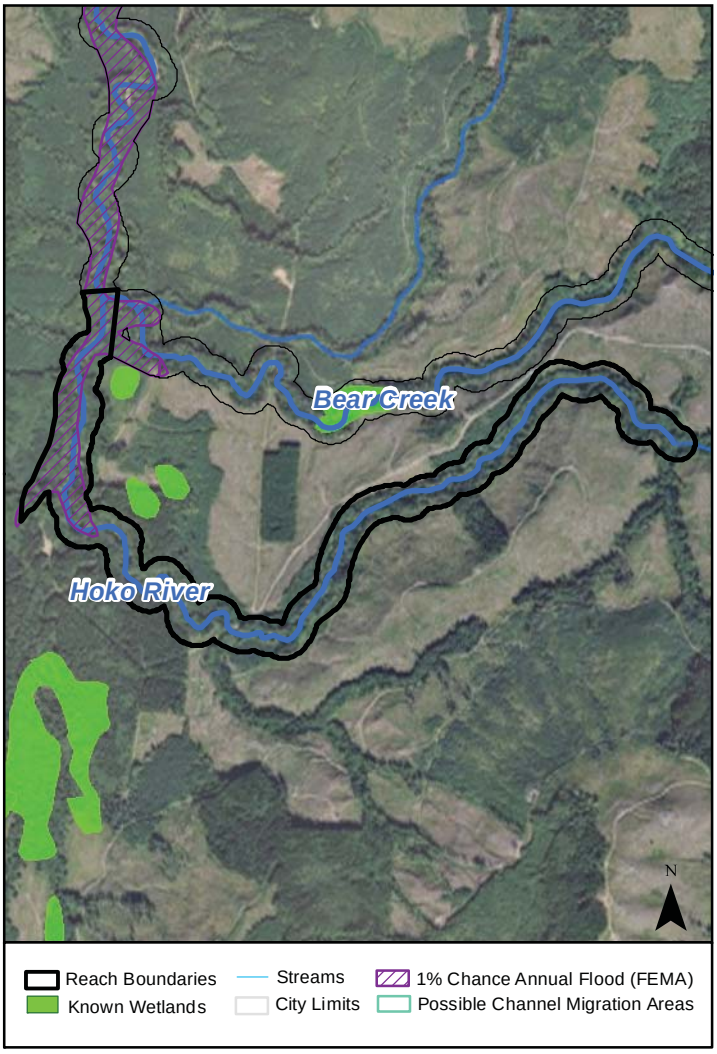
REACH AREA
135.83 Acres

REACH SUMMARY

Reach 8 of the Hoko River extends from the confluence of Cub Creek to approximately 2.6 miles upstream. Dense contiguous forest cover extends throughout the reach. The reach supports spawning and rearing habitat for Chinook, coho, and chum salmon, in addition to steelhead and cutthroat trout.

The majority of the reach consists of private timber land, although some public timber parcels are present. The lower portion of the reach is located within FEMA 100-year floodplain and/or channel migration areas. Geologic hazards for land slides are present within the upper reach.

Under current zoning regulations, approximately three-quarters of the reach has potential for new development. However, this land is currently zoned for commercial forestry, which limits new residential development to 1 home per 80 acres. Actual development potential in the reach is low.



PHYSICAL

Channel Configuration

The stream channel within the reach is confined by moderately steep foothills. Portions of the reach have been deeply incised resulting in several cascades.

Hazard Areas

Several river banks and surrounding areas are unstable (27%) with potential for slides mapped in the central and northeast portions of the reach. Potential erosion areas are mapped in the northeast portion of the reach (11%). Most of the northwestern reach area leading up to the confluence between Bear Creek and Hoko River is in the FEMA 100-year floodplain (18%).

ECOLOGY

Riparian Vegetation

82% of the reach zone contains continuous forest habitat, while 11% of the reach contains herb and shrub habitat.

Habitats and Species

There is no priority wildlife habitat mapped within the reach.

This reach provides spawning habitat for steelhead trout (97%) and Chinook (100%), and coho salmon (100%). The presence of resident cutthroat and chum salmon are also mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. There are no Streamkeepers water quality data available for this reach.

Hoko River: Reach 8

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership is 78% private and 22% public.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

Public lands are located within the reach, but no public access areas are available.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

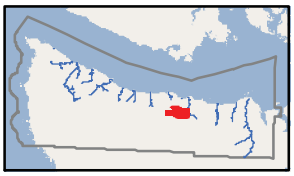
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Indian Creek

SHORELINE LENGTH
5.5 Miles

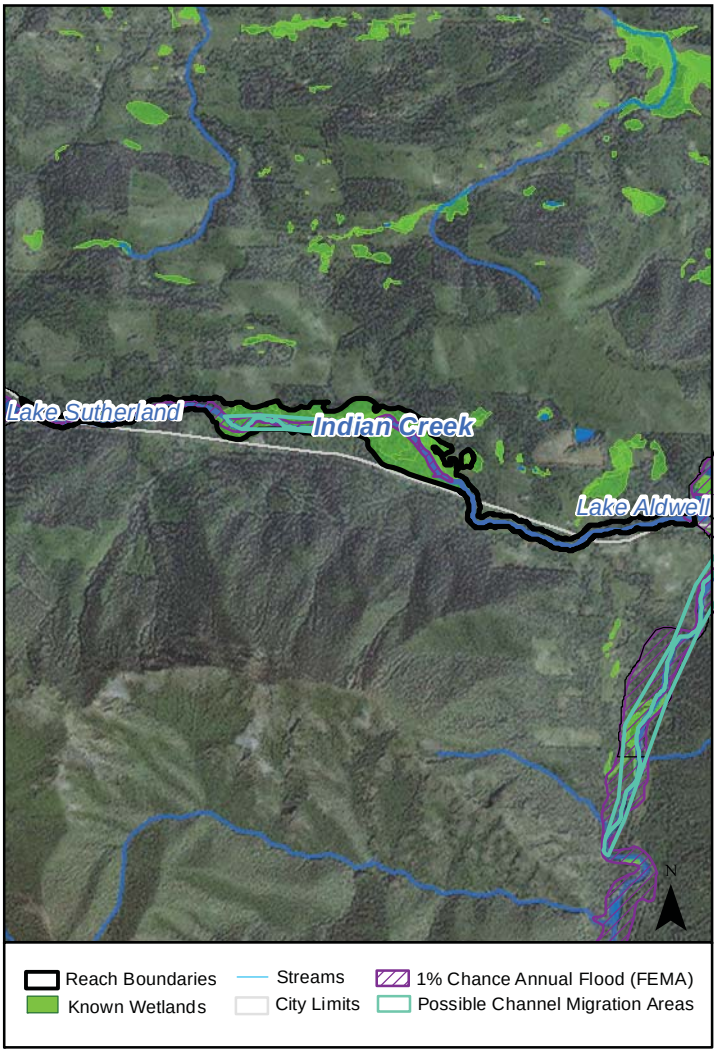
REACH AREA
459.72 Acres

REACH SUMMARY

The reach extends from the outlet of Lake Sutherland to the creek's confluence with the Elwha River. The valley floor within the reach is generally broad and flat from the Lake Sutherland outlet until the stream is within a mile of a half of the Elwha, where the stream falls into a narrow, ravine-like valley. The majority of the reach area contains dense forest cover. The creek provides habitat for resident cutthroat and rainbow trout. With the upcoming Elwha dam removals, anadromous fish stocks will likely return and/or be reintroduced to the creek.

The predominant land use in the reach is timber, much of which is public land managed by DNR. However, some low-density residential development is located within the reach. Flood hazard areas are located within the eastern portion of the reach. The existing residences along the creek are generally set back from the flood hazard areas. Highway 101 borders the stream throughout much of the reach, and crosses the stream in 3 locations.

Under current zoning regulations, approximately 15% of the reach has potential for new, low-density residential development. Some of the undeveloped parcels lie within identified flood hazard areas.



PHYSICAL

Channel Configuration

The valley floor of the creek is generally broad and flat from the Lake Sutherland outlet and flows through a large, associated wetland complex. The stream falls into a narrow, ravine-like valley upstream of its confluence with the Elwha River.

Hazard Areas

Several stream banks and surrounding areas are unstable (9%) with potential for slides in the southeastern portion of the reach. Potential erosion areas are mapped in the northwestern portions of the reach (15%). Most of the central portion of the reach lies within a channel migration zone (10%) and the FEMA 100-year floodplain (21%).

ECOLOGY

Riparian Vegetation

53% of the reach zone contains forest habitat, while 10% of the reach contains herb and shrub habitat. An additional 8% of the reach is lawn/landscaping.

Habitats and Species

62% of the reach is identified as wetland habitat, primarily concentrated in the central portion of the reach. There are no priority wildlife habitats mapped within the reach.

The presence of resident cutthroat and rainbow trout is mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. Indian Creek water quality is listed by Streamkeepers as "healthy" for both WQI and B-IBI.

Indian Creek

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (65%), residential (19%), vacant (9%), roads (5%), agriculture (1%), open space (1%), and lodging (trace). Timber land is located through the reach, while residential land is located in the east. Land ownership in the reach is approximately 50% private and 50% public.

Zoning and Parcel Data

The reach is zoned for rural residential (42%) and commercial forestry (58%).

Under current zoning regulations there is moderate potential for significant new residential development within the reach.

Public Access

Public lands are located throughout the reach. Public access to shorelines is available through undeveloped, informal access points along Highway 101.

Impervious Surfaces

Approximately 6% of the reach is covered by impervious surfaces.

Shoreline Modifications

Highway 101 crosses the creek in 3 locations within the reach.

Contaminated Sites

No identified contaminated sites are located within the reach.

Cultural Resources

There is 1 historic site that is registered, but not listed.

Lake Sutherland

SHORELINE LENGTH
0.04 Miles

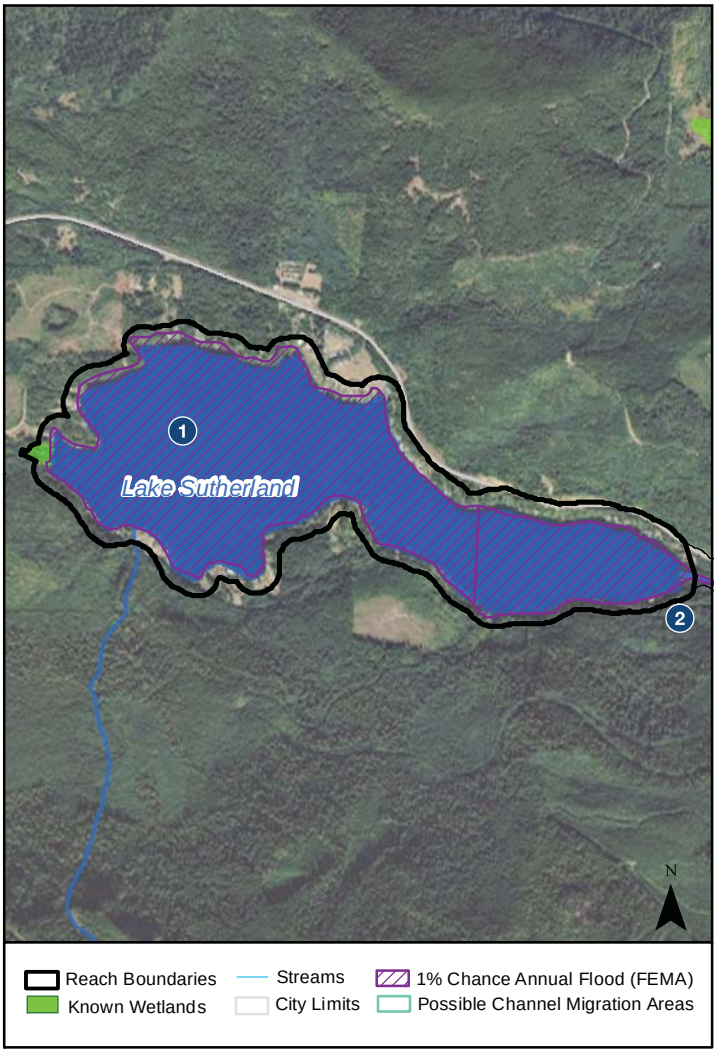
REACH AREA
485.54 Acres

REACH SUMMARY

Lake Sutherland is approximately 500 acres in area, and drains to Indian Creek. While natural vegetation within the reach has been completely cleared in some areas, over half of the shoreland area contains dense forest cover. The lake provides habitat for shore-spawning kokanee salmon, and resident cutthroat and rainbow trout. With the upcoming Elwha dam removals, anadromous fish stocks will likely return and/or be reintroduced to the lake.

Most of the shoreline along Lake Sutherland contains moderate- to high-density residential development, and many docks are present along the shoreline. Portions of the developed lakeshore lie within mapped flood hazard areas. A small outlet structure at the lake outlet serves to retain fish stock and control water levels in the lake. Flooding events along the lake shore have occurred recently, which Lake Sutherland residents attribute to accumulating sediments and large woody debris at the outlet.

Under current zoning regulations, approximately 15% of the reach has potential for new (infill) development. Most of the undeveloped land consists of 1-acre lots, which cannot be further subdivided. Some of the undeveloped parcels are located within mapped flood hazard areas.



PHYSICAL

Channel Configuration

Not applicable

Hazard Areas

Several areas within the reach are unstable (13%) with potential for erosion mapped from the southwest to southeast and along the northeast portions of the reach. Potential slide areas are mapped in the eastern and southwestern portions (3%). Portions of the shoreline lie within the FEMA 100-year floodplain (16%).

Shoreline Oblique Photos (2006)

ECOLOGY

Riparian Vegetation

53% of the reach contains forest habitat while 34% of the reach contains lawn/landscaping and developed areas.

Habitats and Species

2% of the reach is identified as wetland habitat, located at the west shore of the lake. There are no priority wildlife habitats mapped within the reach.

The presence of kokanee salmon, resident cutthroat, and rainbow trout is mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. Water quality at the lake outlet is listed by Streamkeepers as "impaired" for B-IBI and "compromised" for WQI.

Lake Sutherland

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is residential (61%), roads (15%), vacant (15%), open space (3%), and commercial (trace). Residential and vacant lands border the entire water body. Land ownership in the reach is approximately 95% private and 5% public.

Zoning and Parcel Data

The reach is zoned for rural residential (94%), commercial forestry (3%), and parks/public land (3%).

Under current zoning regulations there is moderate potential for significant new residential development within the reach.

Public Access

Public access to the lake is available through developed boat launch facilities located along the South Shore Rd.

Impervious Surfaces

Approximately 18% of the reach is covered by impervious surfaces.

Shoreline Modifications

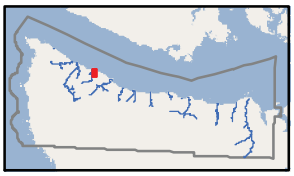
Most of the Lake Sutherland shoreline has been modified with bulkheads and docks.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Last Creek

SHORELINE LENGTH
0.02 Miles

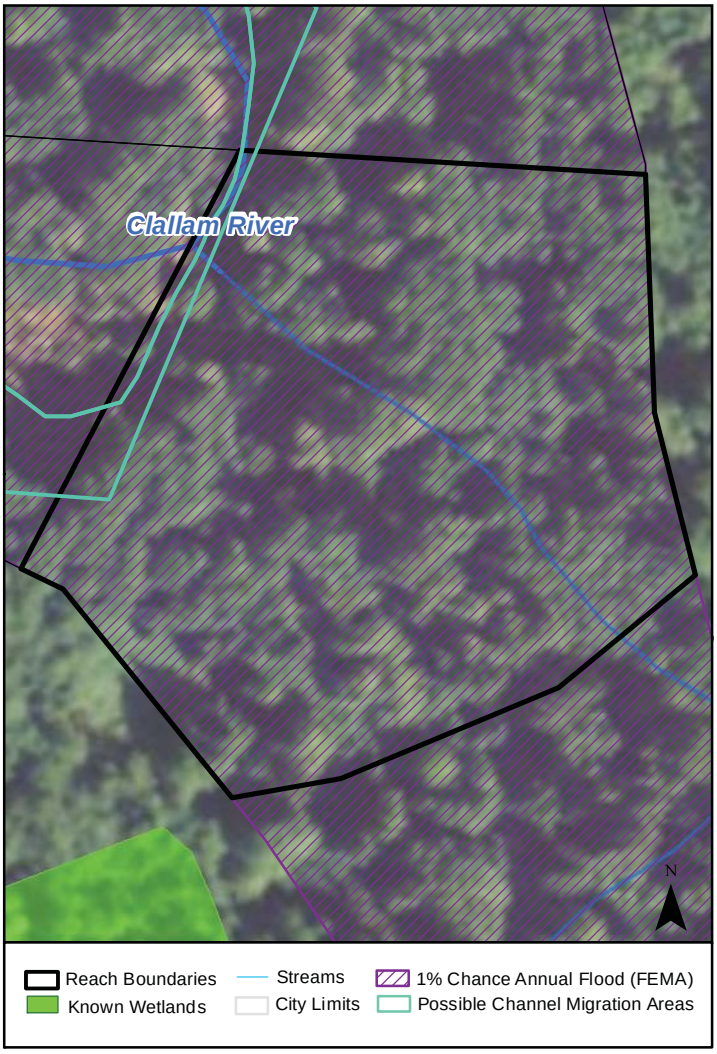
REACH AREA
5.09 Acres

REACH SUMMARY

The reach extends from the Clallam River confluence to approximately 0.1 miles upstream. The reach contains dense forest cover. The reach supports spawning and rearing habitat for coho salmon, in addition to steelhead and resident cutthroat trout.

The reach contains commercial forest lands. The reach is situated entirely within the FEMA 100-year floodplain. A geologic hazard area for erosion is located in the north eastern portion of the reach.

Under current zoning regulations, the reach is currently zoned for commercial forestry and cannot be subdivided for new development.



PHYSICAL

Channel Configuration

The stream trends generally straight as it flows westward toward its confluence with the Clallam River.

Hazard Areas

Potential erosion areas are mapped in the northeast portion of the reach (1%). Most of the northwestern portion of the reach, near the confluence with the Clallam River, lies within a channel migration zone (4%). All of the reach is located within the FEMA 100-year floodplain (100%) and a channel migration zone (100%).

ECOLOGY

Riparian Vegetation

90% of the reach area contains forest habitat, while 6% of the reach contains herb and shrub habitat.

Habitats and Species

There is no priority wildlife habitat mapped within the reach.

This reach provides spawning habitat for steelhead trout (16%) and coho salmon (85%), and juvenile rearing habitat for coho salmon (15%). The presence of resident cutthroat and chum salmon are also mapped within the reach.

Water Quality

The downstream portion of Last Creek within the reach has a State impaired water quality listing for temperature. There are no Streamkeepers water quality data available for Last Creek.

Last Creek

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership is 100% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

No public access is available in this reach. Lands adjacent to the reach are privately owned.

Impervious Surfaces

No impervious surfacse are mapped within the reach.

Shoreline Modifications

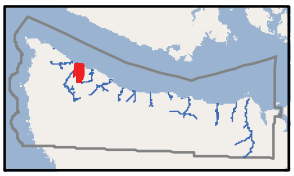
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Little Hoko River

SHORELINE LENGTH
4.6 Miles

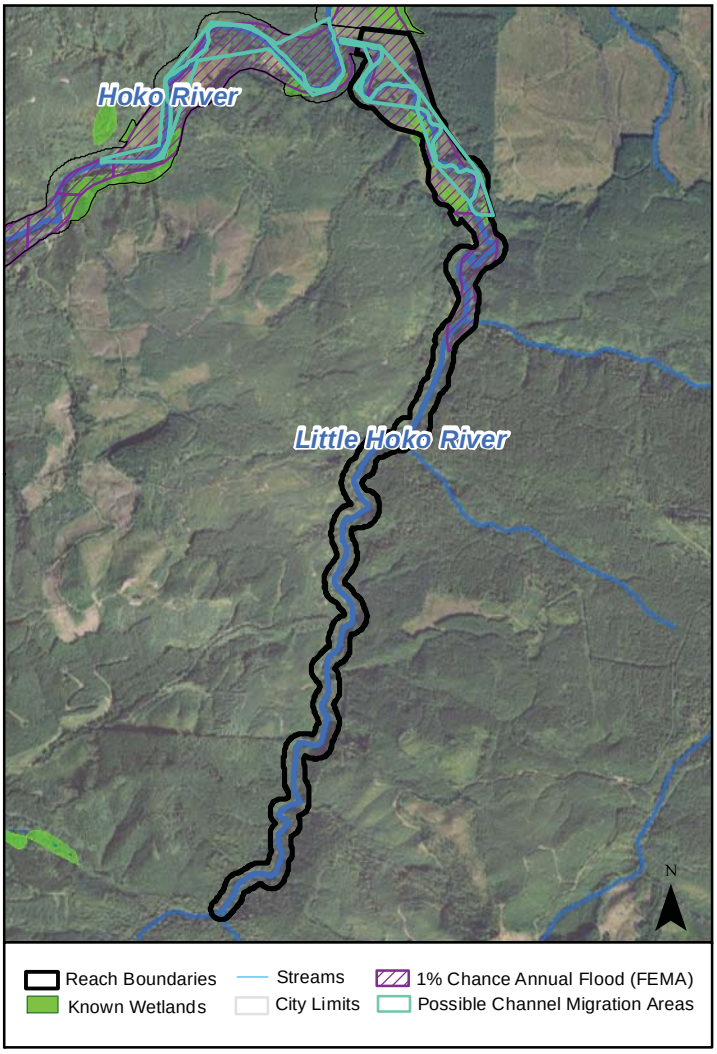
REACH AREA
268.03 Acres

REACH SUMMARY

The reach extends from the Hoko River confluence to the Lamb Creek confluence. Continuous forest cover is present throughout most of the reach. The reach supports spawning and rearing habitat for Chinook, chum, and coho salmon, in addition to steelhead and cutthroat trout.

The reach contains public and private timber land, and over half the reach area consists of park land (the undeveloped Hoko River State Park). The lower portion of the reach is located in the FEMA 100-year floodplain and/or channel migration hazard area. Geologic hazard areas for erosion and land slide are located in the upper reach.

Under current zoning regulations, there is minimal opportunity for new development within the reach.



PHYSICAL

Channel Configuration

The Little Hoko River reach meanders northwestward through moderately steep terrain before converging with the Hoko River in a low-gradient valley. The stream is generally confined to a narrow floodplain.

Hazard Areas

Several river banks and surrounding areas are unstable (36%) with potential for slides mapped in the southern and northeastern portions of the reach. Areas for potential erosion are mapped in the central portion of the reach (11%). Most of the confluence between Hoko River and Little Hoko River is part of a channel migration area (42%) and the FEMA 100-year floodplain (38%).

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 74% of the reach zone contains forest habitat while 15% contains herb and shrub habitat. Outlying the stream corridor vegetation is comprised primarily of herb and shrub habitat and agriculture land.

Habitats and Species

5% of the reach is identified as wetland habitat, near the mainstem confluence. There is no priority wildlife habitat mapped within the reach.

This reach provides spawning habitat for steelhead trout (99%) and Chinook (100%), chum (100%), and coho salmon (99%). The presence of resident cutthroat are also mapped within the reach.

Water Quality

The downstream portion of the Little Hoko River within the reach has a State impaired water quality listing for temperature. River water quality is listed by Streamkeepers as "compromised" for WQI.

Little Hoko River

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is open space (58%) and timber (42%). Open space is located in the north half of the reach, while timber land is located in the south. Land ownership in the reach is 78% public and 22% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (66%) and parks/public land (34%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

The reach can be accessed near the confluence with the mainstem Hoko, at the undeveloped Hoko River State Park.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

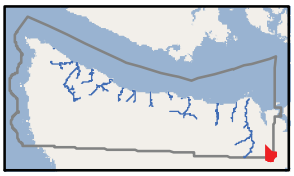
The downstream end of the Little Hoko River is channelized, through the Hoko-Ozette road bridge.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Little Quilcene River

SHORELINE LENGTH
1.3 Miles

REACH AREA
64.46 Acres

REACH SUMMARY

The reach extends approximately 1 mile upstream from the Jefferson County limits. The reach contains dense forest cover. The Little Quilcene River within the reach provides habitat for resident cutthroat trout; anadromous fish passage to the reach is blocked by a natural falls at RM 7.0, in Jefferson County.

The majority of the reach area lies within Olympic National Forest, with a small portion on private timber land. Under current zoning regulations, there is no potential for subdivision or residential development within the reach.

PHYSICAL

Channel Configuration
No data

Hazard Areas
No potential erosion or slide areas are mapped within this reach.

ECOLOGY

Riparian Vegetation
99% of the reach consists of forest land

Habitats and Species
There is no priority wildlife habitat mapped within the reach.

This reach provides habitat for resident cutthroat.

Water Quality
The reach has no State impaired water quality listings. There are no Streamkeepers water quality data available for the Little Quilcene River.

Little Quilcene River

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership in the reach is 94% public and 6% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

Most of the reach is publically owned, but there is no known public access.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

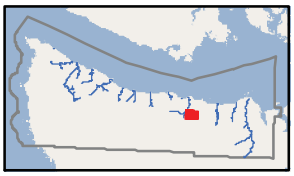
There are no shoreline modifications mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Little River

SHORELINE LENGTH
2.8 Miles

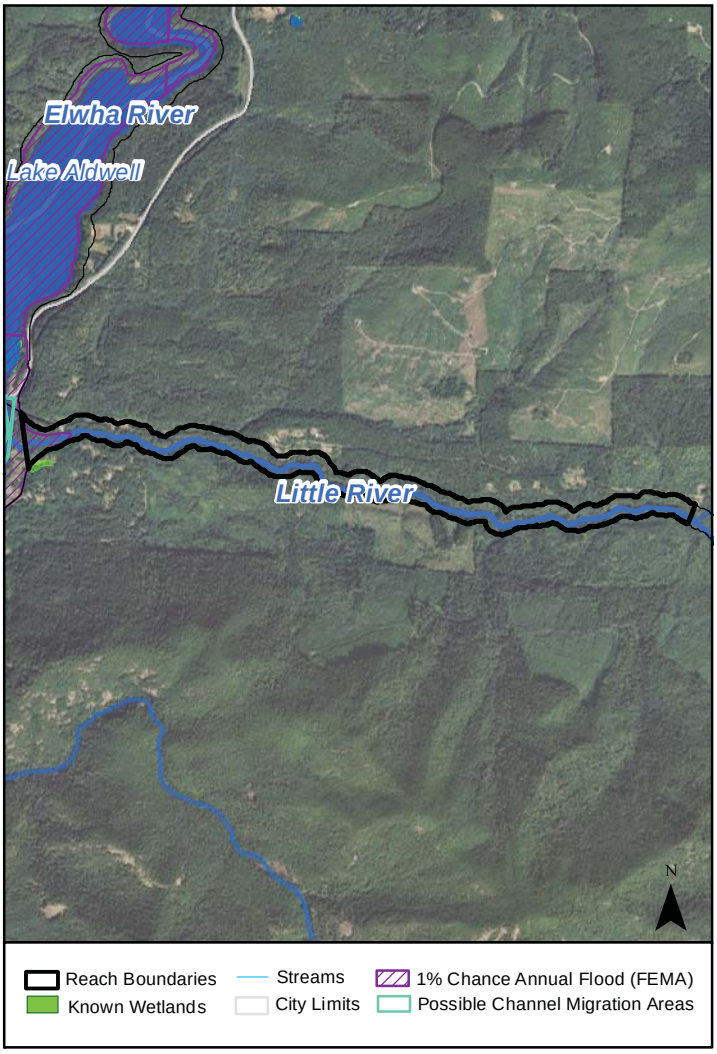
REACH AREA
143.98 Acres

REACH SUMMARY

The reach extends from the Elwha River confluence to the South Branch Little River confluence. Most of the reach area is forested, but forest cover has been altered in some areas by low-density residential development and Little River Road. Erosion and slide hazard areas are mapped in portions of the reach. The Little River provides habitat for bull trout, resident cutthroat, and rainbow trout. The Elwha River Dam blocks anadromous fish access to the reach; anadromous fish are likely to return to the river after the dam is removed.

Land use within the reach is primarily commercial timber, with some rural residential development located at the east end of the reach.

Under current zoning regulations, development potential within the reach is limited. Most of the land within the reach cannot be further subdivided.



PHYSICAL

Channel Configuration

The reach has a moderate-to-steep gradient, and is tightly confined within the river valley.

Hazard Areas

Many river banks and surrounding areas are unstable (69%) with potential for slides mapped in the central and eastern reach areas. Potential erosion areas are mapped in the northwest portion of the reach (14%). Most of the area surrounding the Elwha River confluence is located within the FEMA 100-year floodplain (5%).

ECOLOGY

Riparian Vegetation

92% of the reach area consists of forest habitat while 7% of the reach consists of lawn/landscaping.

Habitats and Species

There is no priority wildlife habitat mapped within the reach.

This reach provides habitat for bull trout and resident cutthroat.

Water Quality

The reach has no State impaired water quality listings. There are no Streamkeepers water quality data available for the Little River.

Little River

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (75%), residential (16%), vacant (8%), roads (1%), and open space (trace). Timber land is located throughout the majority of the reach. Residential and vacant lands are located in the east. Land ownership in the reach is approximately 90% private and 10% public.

Zoning and Parcel Data

The reach is zoned for rural residential (19%), commercial forest / residential mixed use (25%), and commercial forestry (56%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

Public lands are located throughout the reach. Developed public access is available throughout the reach along the Little River Trail. Recreational sites are also located at the confluence of the Elwha and Little Rivers.

Impervious Surfaces

Approximately 1% of the reach is covered by impervious surface.

Shoreline Modifications

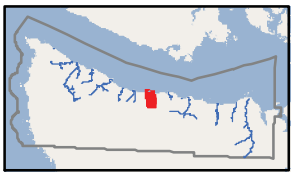
Olympic Hot Springs Road crosses the Little River near its confluence with the Elwha.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There is 1 inventoried pre-contact site within the reach.



Lyre River: Reach 1

SHORELINE LENGTH
4.0 Miles

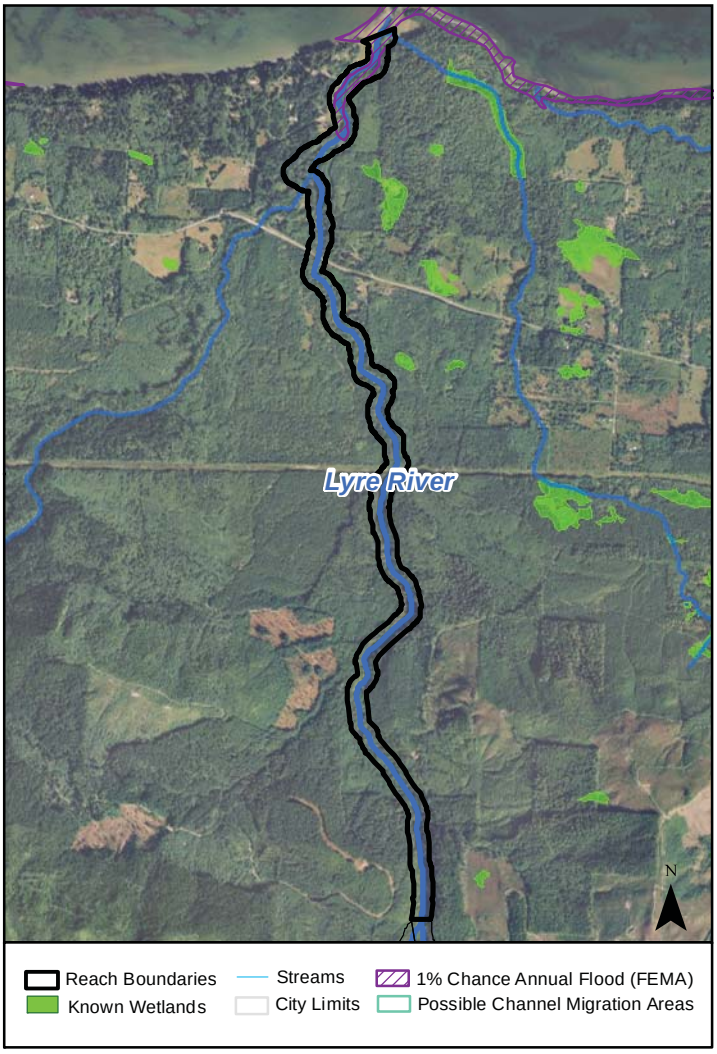
REACH AREA
205.55 Acres

REACH SUMMARY

Reach 1 of the Lyre River extends from near the mouth to the confluence with Boundary Creek. The reach has a fairly steep gradient and flows within a relatively confined channel. Vegetative cover throughout the reach is primarily forest habitat. The reach provides spawning and rearing habitat for chum salmon and steelhead trout. Chinook and coho salmon have also been observed within the reach along with resident cutthroat trout. Breeding populations of bald eagle and band-tailed pigeon also utilize portions of the reach. Bank armoring and channelization have adversely affected habitat in the lower 1 mile of the reach.

The upper two thirds of the reach are public forest lands (managed by DNR). Low density residential development is located in the lower portion of the reach, near Highway 112. The lower 0.4 miles of the reach located within a tsunami hazard zone. Geologic hazard areas including slides and erosion areas are located throughout the reach. Portions of the stream are also within the FEMA 100-year floodplain. Developed public access is available at the Lyre River campground, while informal/undeveloped public access to the shoreline is available along Lyre River Rd.

Under current zoning regulations, approximately one-third of the reach has potential for new residential development. Parcel boundaries vary in size and shape, but many have the potential to be subdivided into smaller lots (approximately 2 to 5 houses per acre). Most of the developable lands are located within geologic, tsunami, and/or flood hazard areas.



PHYSICAL

Channel Configuration

The reach has a fairly steep gradient and flows within a relatively confined channel.

Hazard Areas

Potential erosion areas are mapped within the northwestern and eastern portions of the reach (40%). Many stream banks and surrounding areas extending north to south through the reach are subject to slides (50%). The northern portion of the reach lies within a tsunami hazard zone (6%), the FEMA 100-year floodplain (7%), and a channel migration zone (29%).

ECOLOGY

Riparian Vegetation

88% of the reach area contains dense forest habitat, while 8% of the reach contains herb and shrub habitat. An additional 5% of the reach is lawn/landscaping and developed areas.

Habitats and Species

Designated priority specie habitats mapped within the reach include bald eagle (2%) and band-tailed pigeon (52%).

This reach provides spawning habitat for steelhead trout (48%) and chum salmon (89%), and juvenile rearing habitat for steelhead (1%). The presence of resident cutthroat and coho salmon are also mapped within the reach.

Water Quality

The portion of the Lyre River within the reach has a State impaired water quality listing for temperature. River water quality within the reach is listed by Streamkeepers as "impaired" for B-IBI but "healthy" for WQI.

Lyre River: Reach 1

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (58%), residential (18%), open space (9%), vacant (7%), unknown (5%), lodging (2%), and roads (1%). Timer land is located in the middle and southern sections of the reach. Residential, open space, and vacant lands are located in the north. Land ownership in the reach is 57% public and 43% private.

Zoning and Parcel Data

The reach is zoned for rural residential (31%), commercial forest / residential mixed use (8%), and commercial forestry (61%).

Under current zoning regulations there is moderate potential for significant new residential development within the reach, particularly at the downstream end of the reach.

Public Access

Public access to this reach is available at the Lyre River Campground, and along Lyre River Road.

Impervious Surfaces

Approximately 1% of the reach is covered by impervious surfaces.

Shoreline Modifications

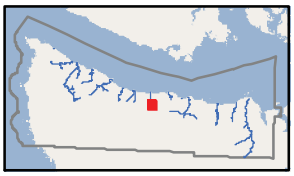
Highway 112 crosses the river within the reach. The lower portion of the reach is channelized through a private campground.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Lyre River: Reach 2

SHORELINE LENGTH
1.3 Miles

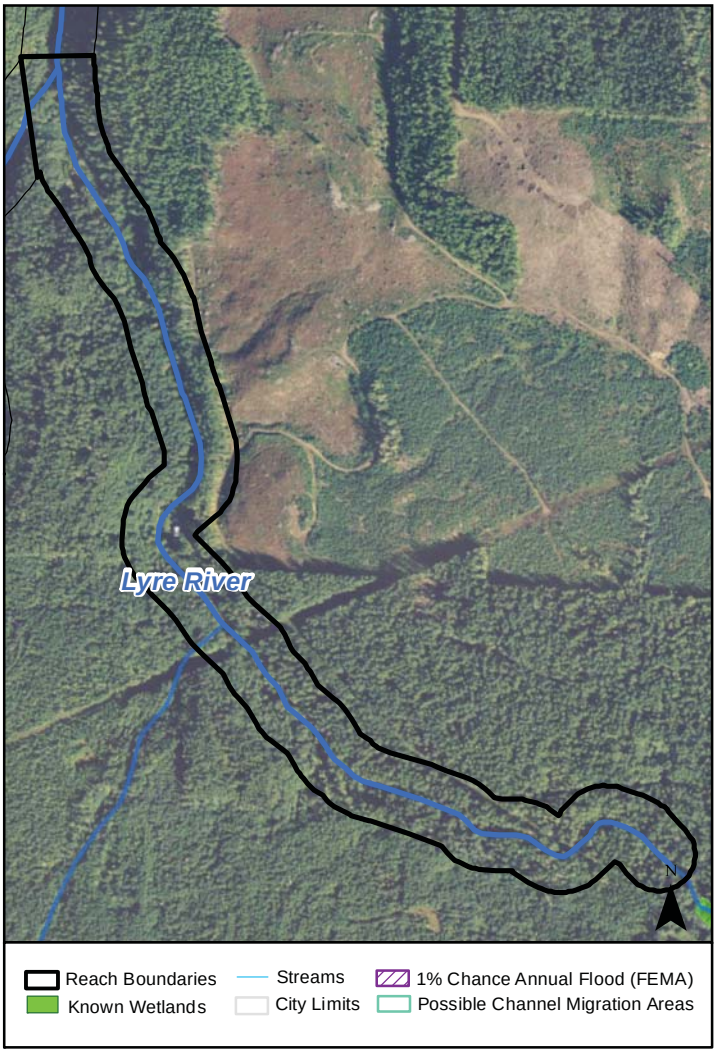
REACH AREA
61.74 Acres

REACH SUMMARY

Reach 2 of the Lyre River extends from the Boundary Creek confluence to just below Lake Crescent. The reach area is almost entirely covered by continuous forest habitat. The reach provides habitat for cutthroat and rainbow trout. A series of cascades and falls located at RM 2.7 prevent upstream migration and spawning of salmon and steelhead in this reach.

The majority of the reach is located on public forest land (DNR and Olympic National Forest). Some private timber parcels are located near the confluence of June Creek and in the southeastern portion of the reach. The lower half of the reach lies in a geologically unstable zone, and is susceptible to erosion.

Under current zoning regulations, the majority of the reach is publically owned and cannot be subdivided. Privately owned timber lands in the reach are not eligible for subdivision.



PHYSICAL

Channel Configuration

The upper Lyre River originates from Lake Crescent before flowing north and west along a mostly straight and narrow stream corridor, surrounded by steep mountain slopes.

Hazard Areas

Potential erosion areas are mapped in the north half of the reach (53%).

ECOLOGY

Riparian Vegetation

91% of the reach zone contains dense forest habitat while 7% of the reach contains herb and shrub habitat.

Habitats and Species

There is no priority wildlife habitat mapped within the reach

This reach provides habitat for resident cutthroat and rainbow trout, and spawning habitat for Beardslee trout.

Water Quality

The downstream portion of the Lyre River within the reach has a State impaired water quality listing for temperature. River water quality within the reach is listed by Streamkeepers as "compromised" for B-IBI and WQI.

Lyre River: Reach 2

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (98%) and open space (2%). Land ownership in the reach is 80% public and 20% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (98%) and parks/public land (2%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

Public lands are located throughout the reach, but there are no formal public access areas available.

Impervious Surfaces

Approximately 1% of the reach is covered by impervious surfaces.

Shoreline Modifications

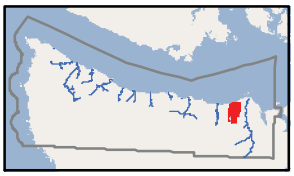
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

One structure, a historic railroad corridor for logging, is inventoried for historic significance but determined to be not eligible for listing.



McDonald Creek

SHORELINE LENGTH
7.6 Miles

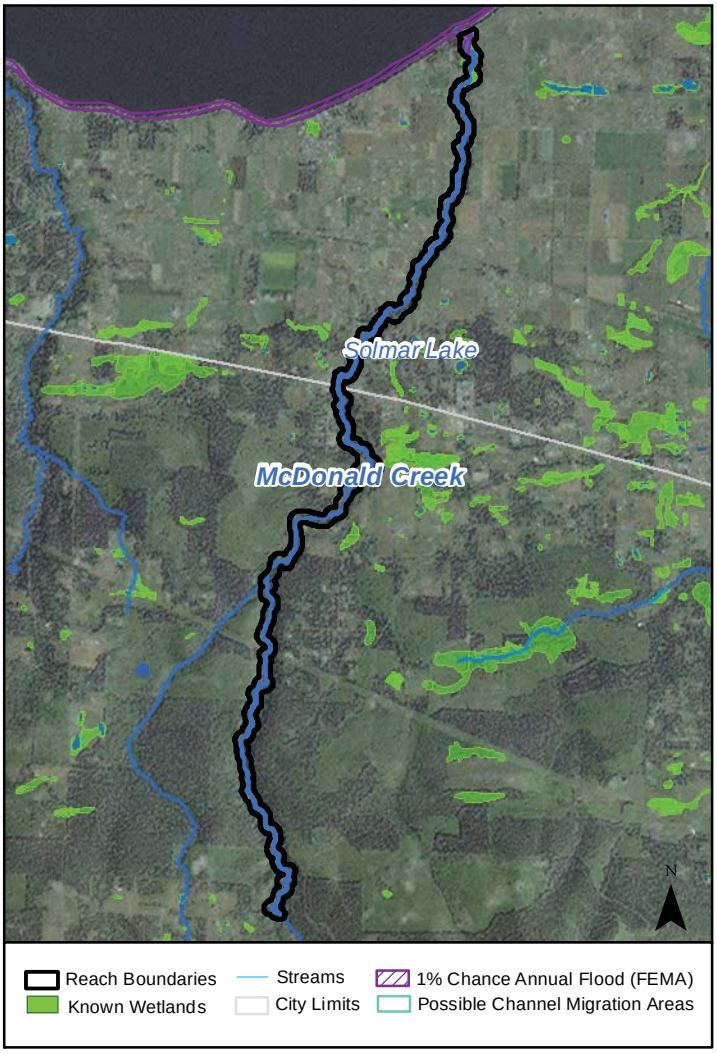
REACH AREA
415.31 Acres

REACH SUMMARY

The reach extends from near the mouth upstream to Gellor Road. McDonald Creek flows fairly straight, and is located within a deep ravine. The lands within the reach are predominantly forested. McDonald Creek is utilized as a conveyance for a portion of the Dungeness irrigation system; Dungeness River water is put into the creek at RM 5, and withdrawn downstream at RM 2. The Creek provides spawning habitat for steelhead and coho salmon, and the reach provides habitat for bald eagle, peregrine falcon, and wood duck.

The upper portion of the reach consists primarily of publically owned timber land managed by DNR. Low- to moderate-density development surrounds the lower portion of the reach, but forest cover within the riparian corridor is largely intact. Erosion and landslide areas are mapped along the stream channel for most of its extent. However, these hazard areas are generally confined to the creek's forested riparian corridor on undeveloped land.

Under current zoning regulations, approximately 20% of the reach has potential for new residential development (1 to 5 acre lots). However, the presence of the steep canyon likely precludes development within the reach area.



PHYSICAL

Channel Configuration

McDonald Creek flows fairly straight, and is located within a deep ravine.

Hazard Areas

Several stream banks and surrounding areas are unstable with potential for erosion (16%) and slides (75%). Areas for potential erosion are mapped in isolated areas in the east and west. Slide hazard areas are mapped throughout the reach length. Most of the northern portion of the reach is located in the tsunami hazard zone (1%) and the FEMA 100-year floodplain (1%).

ECOLOGY

Riparian Vegetation

87% of the reach zone contains forest habitat while 4% of the reach supports herb and shrub habitat. An additional 8% of the reach is lawn/landscaping.

Habitats and Species

4% of the reach is identified as wetland habitat, primarily located in the northern portion of the reach. Designated priority habitats mapped within the reach include bald eagle (8%), peregrine falcon (21%), and wood duck (10%).

This reach provides spawning habitat for steelhead trout (52%) and coho salmon (70%).

Water Quality

The reach has no State impaired water quality listings. Water quality of the creek is listed by Streamkeepers as "compromised" for B-IBI but "healthy" for WQI.

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is residential (44%), timber (35%), vacant (10%), open space (8%), roads (2%), unknown (1), and agriculture (trace). Residential land is located in the north half of the reach, while timber is located in the south. Land ownership in the reach is 74% private and 26% public.

Zoning and Parcel Data

The reach is zoned for rural residential (79%) and commercial forestry (21%).

Under current zoning regulations there is moderate potential for significant new residential development within the reach.

Public Access

Undeveloped, informal public access to the creek is available along Sherburne Rd. The Olympic Discovery Trail crosses the creek between Highway 101 and Old Olympic Highway.

Impervious Surfaces

Approximately 3% of the reach is covered by impervious surfaces.

Shoreline Modifications

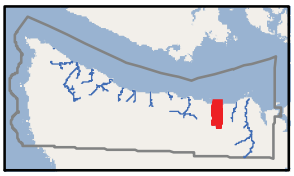
There are two road crossings over the stream (Old Olympic Highway and Highway 101).

Contaminated Sites

No identified contaminated sites are located within the reach. Underground storage tanks are being monitored at the McDonald Creek Store located in the central portion of the reach along U.S. Highway 101.

Cultural Resources

The Gene Pogue Farm (barn structure built in 1939) is listed on the State Registry of Heritage Barns.



Morse Creek

SHORELINE LENGTH
9.2 Miles

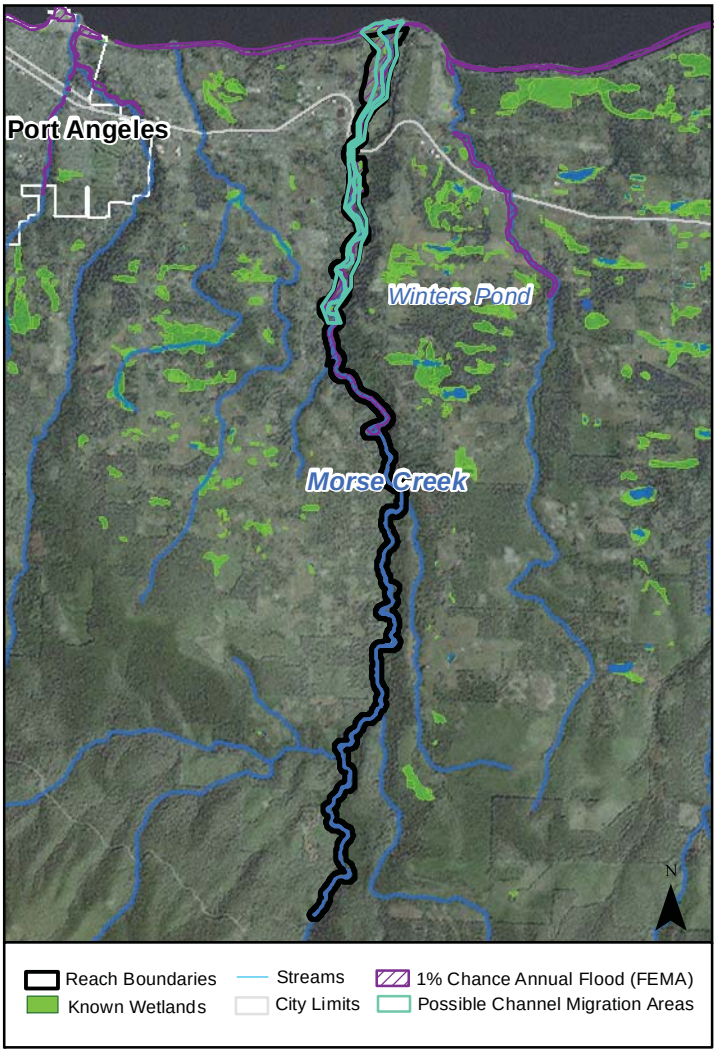
REACH AREA
551.53 Acres

REACH SUMMARY

The reach extends from near the creek mouth to the boundary of Olympic National Park. Below the park, the creek is generally confined in a ravine-like canyon, but below approximately RM 1.7 the valley broadens into a relatively wide, low-gradient floodplain. The upper portion of the reach is largely forested, but forest cover decreases downstream in the developed areas. Morse Creek provides spawning habitat for steelhead, and Chinook, chum, coho, and pink salmon. In addition, the presence of bull trout, residential cutthroat, and rainbow trout are identified in the creek. The reach also provides habitat for wood duck and harlequin duck.

Land use in the upper portion of the reach is primarily low- to moderate- density residential, with some commercial timber parcels. Higher density residential development in present in the reach downstream from approximately RM 3.0. Much of the upper portion of the reach lies within erosion and landslide hazard areas. Channel migration zones and mapped flood hazard areas are present in the lower portion of the reach. Many homes are present within these hazard areas.

Under current zoning regulations, almost half of the reach area has potential for new residential development. The undeveloped land is distributed throughout the reach. The undeveloped parcels vary in size, but most could be subdivided into 2 or 5 acre residential lots. Many of the undeveloped lots lie within identified geologic, flooding, and/or channel migration hazard areas.



PHYSICAL

Channel Configuration

Within the reach, the creek is generally confined in a ravine-like canyon, but below approximately RM 1.7 the valley broadens into a relatively wide, low-gradient floodplain, but the channel was historically channelized.

Hazard Areas

Potential erosion areas are mapped along the central portion of the reach (26%) with slide areas mapped throughout the southern extent of the reach (41%). The northern portion of the reach lies within a tsunami hazard zone (8%) and within the channel migration zone (41%). Portions of the reach lie within the FEMA 100-year floodplain (33%).

ECOLOGY

Riparian Vegetation

72% of the reach areas is contains forest habitat while 12% of the reach contains herb and shrub habitat. An additional 9% of the reach is lawn/landscaping.

Habitats and Species

4% of the reach is identified as wetland habitat, primarily located in the northern portion of the reach. Designated priority habitats within the reach include harlequin duck (21%) and wood duck (1%).

This reach provides spawning habitat for steelhead trout (47%) and Chinook (41%), chum (59%), coho (98%), and pink salmon (96%). The presence of bull trout, resident cutthroat and rainbow trout are also mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. Water quality of the creek is listed by Streamkeepers as "compromised" for B-IBI but "healthy" for WQI.

Morse Creek

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is residential (28%), open space (25%), timber (19%), utilities (18%), vacant (6%), and roads (5%). Open space is located in the northern portion of the reach while residential is located through the middle portion of the reach. Utilities are located in the south. Land ownership in the reach is 80% private and 17% public.

Zoning and Parcel Data

The reach is zoned for rural residential (79%) and commercial forestry (21%).

Under current zoning regulations there is high potential for significant new residential development within the reach, particularly in the lower third of the reach.

Public Access

Just upstream from Highway 101 is a publically owned and accessible WDFW-managed parcel of land. The mouth of the creek can be accessed via the Olympic Discovery Trail.

Impervious Surfaces

Approximately 10% of the reach is covered by impervious surfaces.

Shoreline Modifications

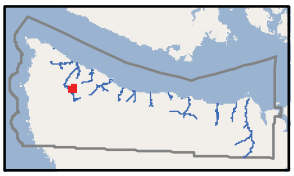
Several levee sections border the stream channel near the mouth, and the lower 1.2 miles of the creek was historically channelized. Highway 101 crosses the stream near the mouth.

Contaminated Sites

No identified contaminated sites are located within the reach.

Cultural Resources

One structure, the abutments for the Old Morse Creek Bridge (built 1931), is inventoried for historic significance but not listed.



North Branch Herman Creek

SHORELINE LENGTH
1.1 Miles

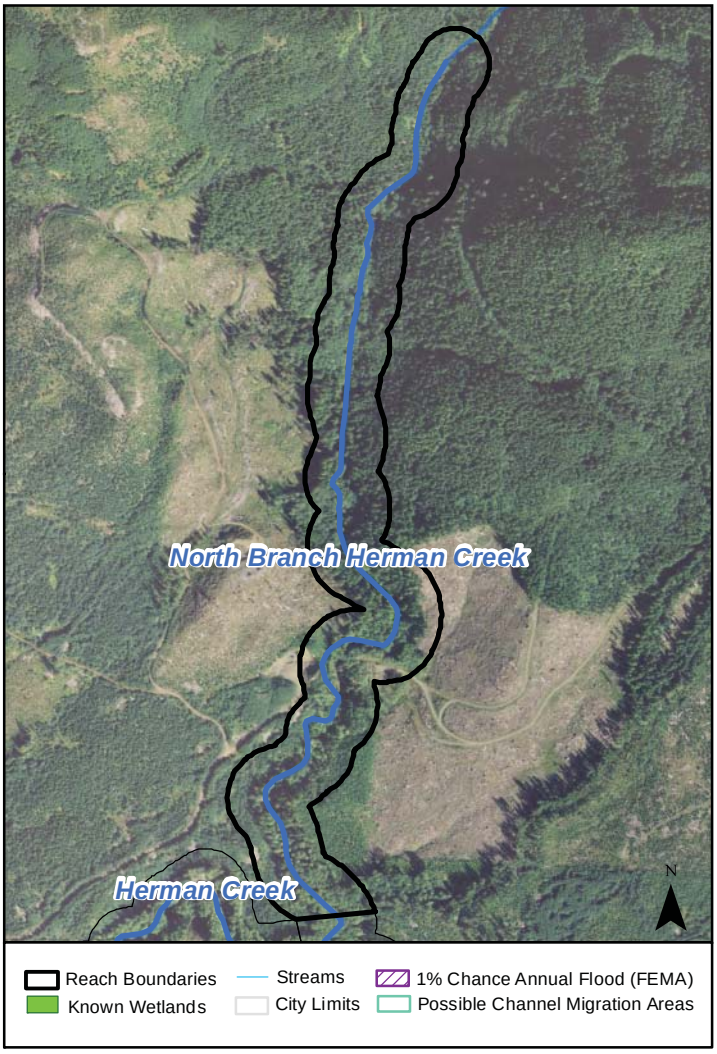
REACH AREA
56.94 Acres

REACH SUMMARY

The reach extends from the Herman Creek confluence to approximately 1.8 miles upstream. The stream profile in the upper portion of the reach is relatively straight and trends generally south. The channel becomes more sinuous by middle reach and by the lower reach the stream contains several meanders. Vegetative cover in the reach consists primarily of dense forest cover, with some herb and shrub habitat is located in the lower portion of the reach. The reach provides habitat for coho salmon and steelhead trout.

The reach contains timber lands, both publically and privately owned. Many of the stream banks and surrounding areas are unstable. Geologic hazard areas for erosion and slides extend through the upper and lower portions of the reach, respectively.

All of the land within the reach is zoned for commercial timber. Under current zoning regulations, approximately one-quarter of the reach has potential for residential development, but at a density no greater than 1 dwelling per 80 acres. Actual development potential is low.



PHYSICAL

Channel Configuration

The stream profile in the upper portion of the reach is relatively straight and trends generally south. The channel becomes more sinuous by middle reach and by the lower reach the stream contains several meanders.

Hazard Areas

Many stream banks and surrounding areas are unstable (76%) with potential for slides mapped in the central and northern reach areas. Potential erosion areas are mapped at the Herman Creek confluence (14%).

ECOLOGY

Riparian Vegetation

91% of the reach area contains forest habitat, while 9% of the reach contains herb and shrub habitat.

Habitats and Species

There is no priority wildlife habitat mapped within the reach.

The presence of steelhead trout and coho salmon is mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. There are no Streamkeepers water quality data available for North Branch Herman Creek.

North Branch Herman Creek

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership in the reach is 52% and 48% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

Public lands are located in the northern portion of the reach, but no public access is available.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

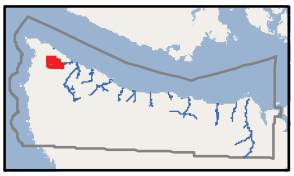
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



North Fork Sekiu River

SHORELINE LENGTH
5.2 Miles

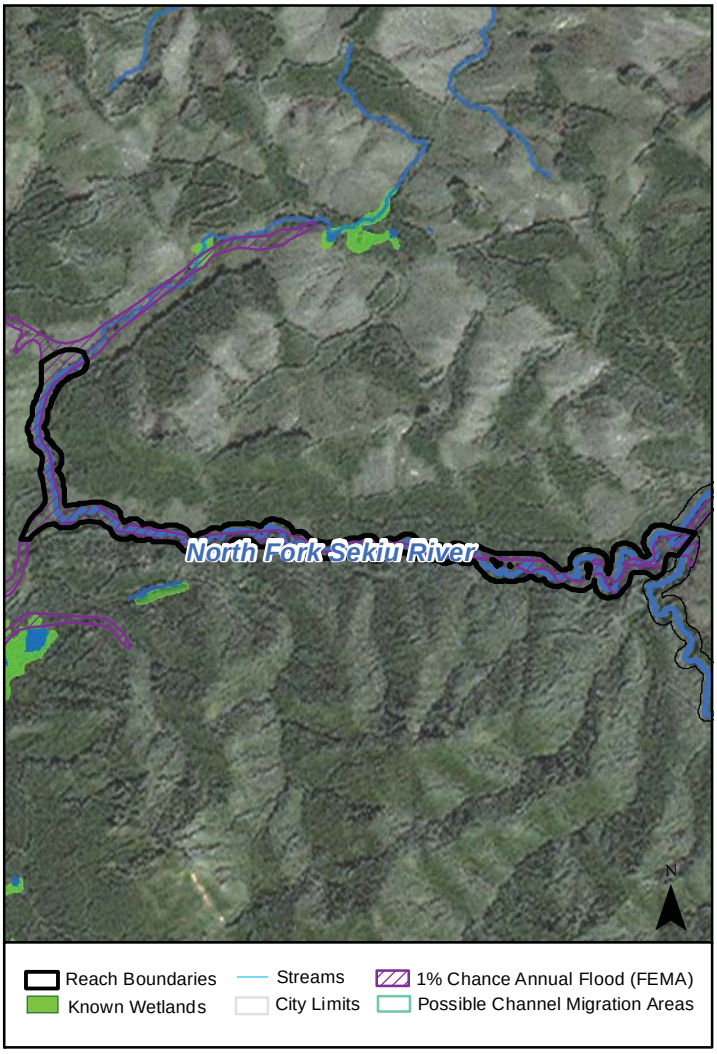
REACH AREA
282.02 Acres

REACH SUMMARY

The reach extends from the confluence with the Sekiu River to approximately 4.6 miles upstream. In the upper portion of the reach, the river is characterized by a relatively straight channel. The channel becomes increasingly sinuous and meandering downstream before its confluence with the mainstem Sekiu. The majority of the reach contains dense forest habitat. The reach supports spawning and rearing habitat for Chinook, coho, and chum salmon, as well as steelhead trout.

The upper and lower portions of the reach are primarily privately owned commercial timber lands. The middle reach contains public forest lands managed DNR. Much of the reach is located within the FEMA 100-year floodplain. Geologic hazard areas for erosion and land slides are located throughout the reach, but are concentrated in the upper and lower portions of the reach.

Under current zoning regulations, approximately two-thirds of the reach area has the potential for new residential development, but at a density no more than 1 dwelling per 80 acres. Developable lands are located in flood and/or geologic hazard areas. Actual development potential within the reach is low.



PHYSICAL

Channel Configuration

In the upper portion of the reach, the river is characterized by a relatively straight channel. The channel becomes increasingly sinuous and meandering downstream before its confluence with the mainstem Sekiu.

Hazard Areas

Potential erosion areas are mapped in isolated pockets extending east to west within the reach (10%). Slide areas are mapped through the east and extending southeast to southwest through the reach (44%). Most of the reach is located within the FEMA 100-year floodplain (56%) and a channel migration zone (49%)

ECOLOGY

Riparian Vegetation

77% of the reach zone contains forest habitat, while 16% of the reach contains herb and shrub habitat.

Habitats and Species

There is no priority wildlife habitat mapped within the reach.

This reach provides spawning habitat for steelhead trout (93%) and Chinook (100%), chum (1%), and coho salmon (100%). The presence of resident cutthroat is also mapped within the reach.

Water Quality

The portion of the North Fork Sekiu River within the reach has a State impaired water quality listing for temperature. River water quality is listed by Streamkeepers as "compromised" for B-IBI.

North Fork Sekiu River

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership in the reach is 80% private and 20% public.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

Public lands are located in the central portion of this reach.
Undeveloped informal public access is available from Sekiu River Road.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

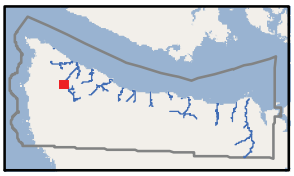
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Old Royal Creek

SHORELINE LENGTH
0.4 Miles

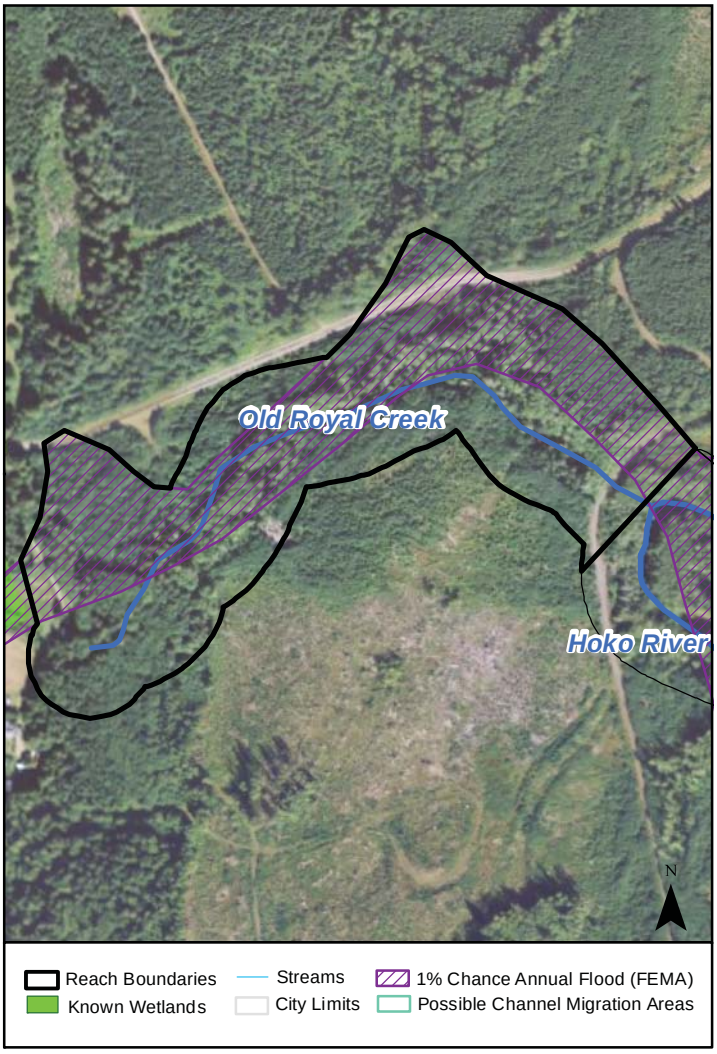
REACH AREA
30.32 Acres

REACH SUMMARY

The reach extends from the Hoko River confluence to approximately 0.4 miles upstream. The majority of the reach area is located within the FEMA 100-year floodplain. The reach is covered by contiguous forest cover. Old Royal Creek provides habitat for coho salmon and steelhead trout.

Low-density residential development is located in the upper portion of the reach, but most structures are located outside the reach boundary. The middle and lower portions of the reach contain commercial timber lands.

Under current zoning regulations, approximately one-third of the reach has the potential for moderate- to low-density residential development. Two-thirds of the reach are zoned for commercial timber land and are currently not eligible for subdivision. Developable lands are located within the mapped flood hazard area.



PHYSICAL

Channel Configuration
No data

Hazard Areas
Several stream banks and surrounding areas are unstable (13%) with potential for slides mapped at the confluence between Old Royal Creek and Hoko River. Most of the Old Royal Creek and Hoko River confluence is part of the FEMA 100-year floodplain (55%).

ECOLOGY

Riparian Vegetation
80% of the reach area contains continuous forest habitat, while 5% of the reach contains herb and shrub habitat. An additional 7% of the reach consists of lawn/landscaping.

Habitats and Species
There is no priority wildlife habitat mapped within the reach.

The presence of steelhead trout and coho salmon is mapped within the reach.

Water Quality
The portion of Old Royal Creek within the reach has a State impaired water quality listing for temperature. There are no Streamkeepers water quality data available for the creek.

Old Royal Creek

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (83%) and residential (16%). Timber land is located in the eastern portion of the reach while residential lands are located in the south west.

Zoning and Parcel Data

The reach is zoned for rural residential (35%) and commercial forestry (65%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

No public access is available in this reach. Lands adjacent to the reach are private.

Impervious Surfaces

No impervious surface is mapped within the reach.

Shoreline Modifications

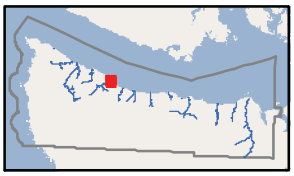
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Pysht River: Reach 1

SHORELINE LENGTH
1.9 Miles

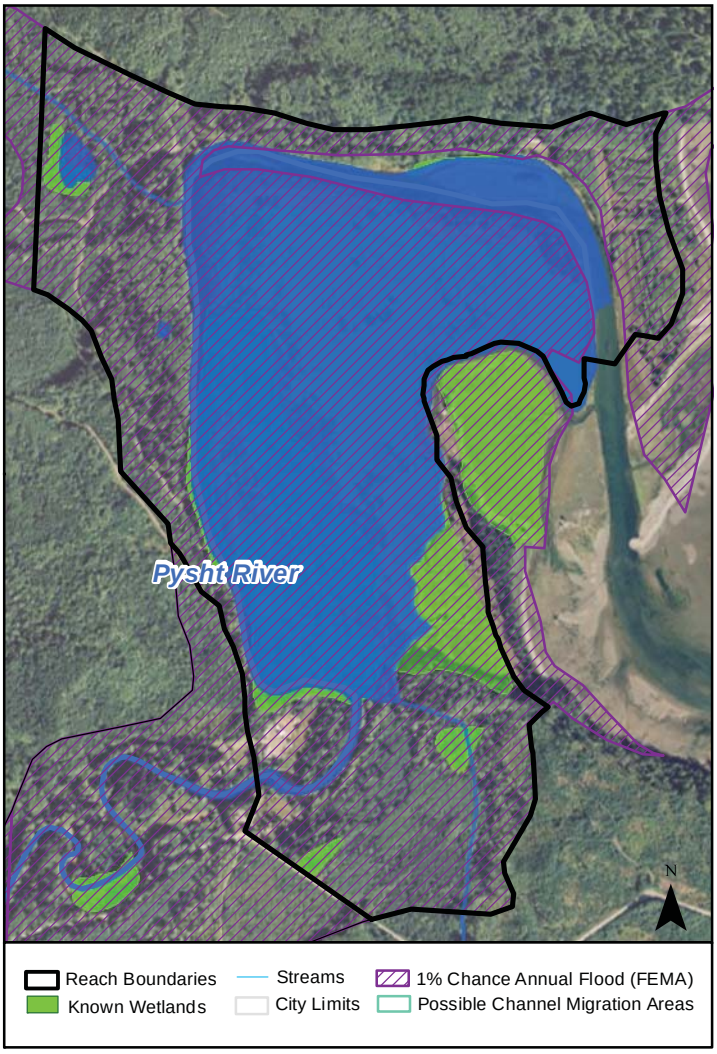
REACH AREA
426.86 Acres

REACH SUMMARY

Reach 1 of the Pysht River extends from near the river mouth upstream approximately 2 miles, and encompasses the large, flat alluvial floodplain complex. The channel profile through the reach is sinuous, and contains a series of wide meanders and several side channels that braid and join the mainstem near its mouth. Most of the river channel within the reach is constrained by levees. The stream corridor is bordered by a thin, but dense stand of forest cover, and patches of herb and shrub habitat. The reach provides habitat for Chinook, chum, and coho salmon, in addition to steelhead and resident cutthroat trout. In addition, the reach supports breeding populations of bald eagle and waterfowl concentrations. Tidal and estuarine influence extends upstream through the reach.

The majority of the reach contains commercial forest lands. The northern portion of the reach contains limited rural residential development. The reach is situated within a tsunami hazard zone and the FEMA 100-year floodplain. Geologic hazard areas for erosion and slides are located in the eastern portion of the reach.

The majority of the Pysht River estuary is protected in a conservation easement. A lesser portion of the reach area has the potential to be subdivided for new residential development. However, much of this land is zoned for commercial forestry, which only allows 1 residence per 80 acres. Most of the developable land is located in tsunami and/or flood hazard areas. The significant presence of wetland habitat within the reach may preclude development in many areas.



PHYSICAL

Channel Configuration

The lower Pysht River is characterized by long sweeping meanders that flow across a broad alluvial floodplain.

Hazard Areas

Potential erosion areas are mapped in the west (7%) along with slide areas (3%). Most of the reach lies within a tsunami hazard zone (64%), the FEMA 100-year floodplain (100%), and a channel migration zone (84%).

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 25% of the reach contains forest habitat while 13% contains herb and shrub habitat. Outlying the stream corridor vegetation is comprised mostly of forest habitat intermixed with patches of herb and shrub habitat.

Habitats and Species

42% of the reach is identified as wetland habitat, concentrated throughout the central portion of the reach and along the Pysht River. Designated priority habitats mapped within the reach include bald eagle (68%), waterfowl concentration (52%), and estua

This reach provides spawning habitat for steelhead trout (50%) and coho salmon (8%), and juvenile rearing habitat for Chinook (5%) and coho salmon (92%). The presence of resident cutthroat and chum salmon are also mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. Pysht River water quality within the reach is listed by Streamkeepers as "compromised" for both B-IBI and WQI.

Pysht River: Reach 1

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (73%), residential (14%), vacant (13%), and roads (trace). Timber lands are located in the western half of the reach while residential and vacant lands are located in the northeast and southeast portion of the reach, respectively. Land ownership in the reach is 100% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

No public access is available in this reach. Lands adjacent to the reach are privately owned

Impervious Surfaces

Approximately 1% of the reach is covered by impervious surfaces.

Shoreline Modifications

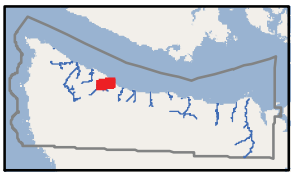
The river channel is constrained by levees throughout most of the reach, and was historicaly hydromodified to accommodate log transport.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are 7 inventoried pre-contact sites, as well as 1 inventoried historic site – the Pysht River log camp of Merrill and Ring (historic logging use from 1916 to 1944). There are no registered sites.



Pysht River: Reach 2

SHORELINE LENGTH
5.5 Miles

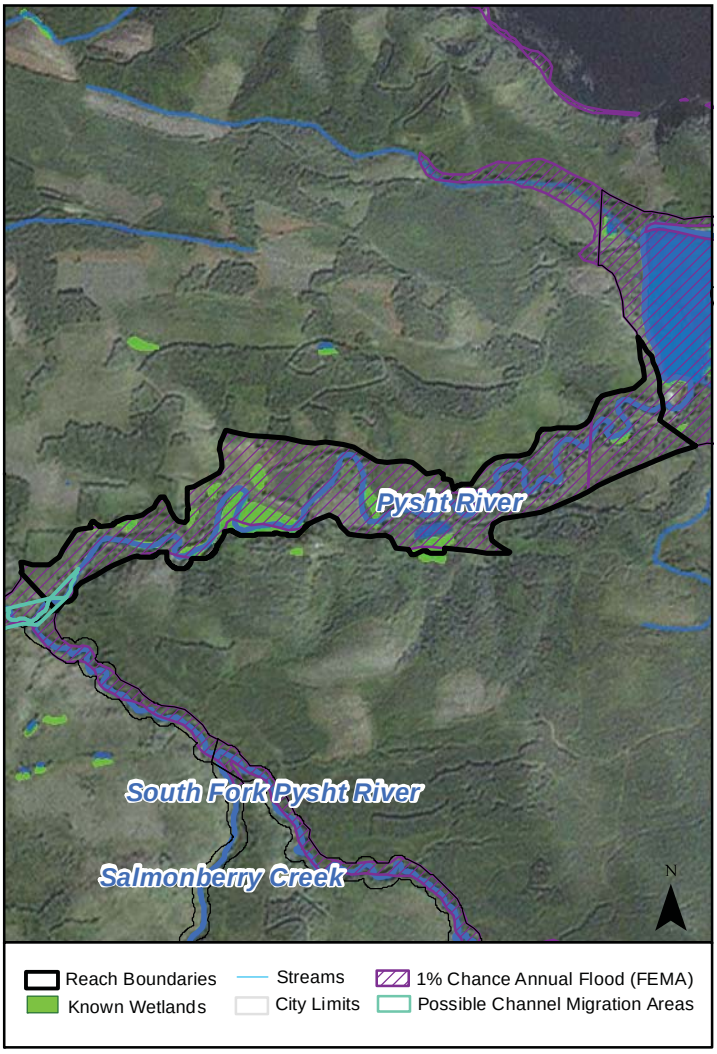
REACH AREA
775.65 Acres

REACH SUMMARY

Reach 2 of the Pysht River extends from the Pysht River Road Bridge to the South Fork Pysht River confluence. The river channel within the reach is highly sinuous and meandering. The river is bounded by State Highway 112 that runs parallel to the stream through much of the reach, and functions as a lateral barrier between the river and its natural floodplain. Vegetation through the reach is a mixture of dense forest cover and herb and shrub habitat. A number of anadromous fish including Chinook, chum, and coho salmon, as well as steelhead trout utilize the reach for spawning and rearing. The reach supports breeding populations of bald eagles.

Low-density residential development and commercial forest lands are located in the majority of the reach. Portions of the lower reach are located in the tsunami hazard area. The majority of the reach is located in the FEMA 100-year floodplain, while geologic hazard areas for erosion and slides are located in the upper portion of the reach. Several residential developments are currently located in flood, geologic, and/or tsunami hazard areas.

Under current zoning regulations, approximately a third of the reach area has the potential to be subdivided for moderate- to low-density residential development. Most of the developable land is located in flood, geologic, and/or the tsunami hazard areas.



PHYSICAL

Channel Configuration

This reach of the Pysht River is characterized by several large, well defined, sweeping meanders that flow across a broad, low gradient floodplain.

Hazard Areas

Potential erosion areas are mapped in the southern portion of the reach (5%), along with slide areas (4%). The western portion of the reach is located in a tsunami hazard zone (4%). Most of the reach is located within the FEMA 100-year floodplain (97%) and a channel migration zone (58%).

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 37% of the reach zone contains forest habitat while 12% contains herb and shrub habitat. Outlying the stream corridor vegetation is comprised mostly of a mix of forest and herb and shrub habitat.

Habitats and Species

10% of the reach is identified as wetland habitat, located in patches throughout the reach. The designated priority habitat mapped within the reach is bald eagle (11%).

This reach provides spawning habitat for steelhead trout (100%) and Chinook (93%, and chum salmon (82%), and juvenile rearing habitat for Chinook (7%) and coho salmon (100%). The presence of resident cutthroat are also mapped within the reach.

Water Quality

The upstream and middle portions of the Pysht River within the reach has State impaired water quality listings for temperature. River water quality within the reach is listed by Streamkeepers as "compromised" for both B-IBI and WQI.

Pysht River: Reach 2

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (59%), vacant (30%), residential (7%), roads (4%), and agriculture (trace). Timber land is located in the east while vacant and residential lands are located in the northwest portion of the reach. Land ownership in the reach is 98% private and 2% public.

Zoning and Parcel Data

The reach is zoned for rural residential (12%) and commercial forestry (88%).

Under current zoning regulations there is moderate potential for significant new residential development within the reach.

Public Access

No developed public access is available within this reach. A small portion of public shorelines can beinformally accessed from Highway 112.

Impervious Surfaces

Approximately 4% of the reach is covered by impervious surfaces.

Shoreline Modifications

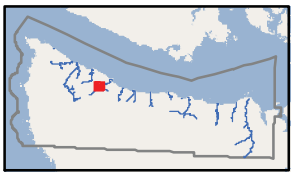
Highway 112 runs parallel to the Pysht River within the reach, which blocks access to its floodplain.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Pysht River: Reach 3

SHORELINE LENGTH
1.5 Miles

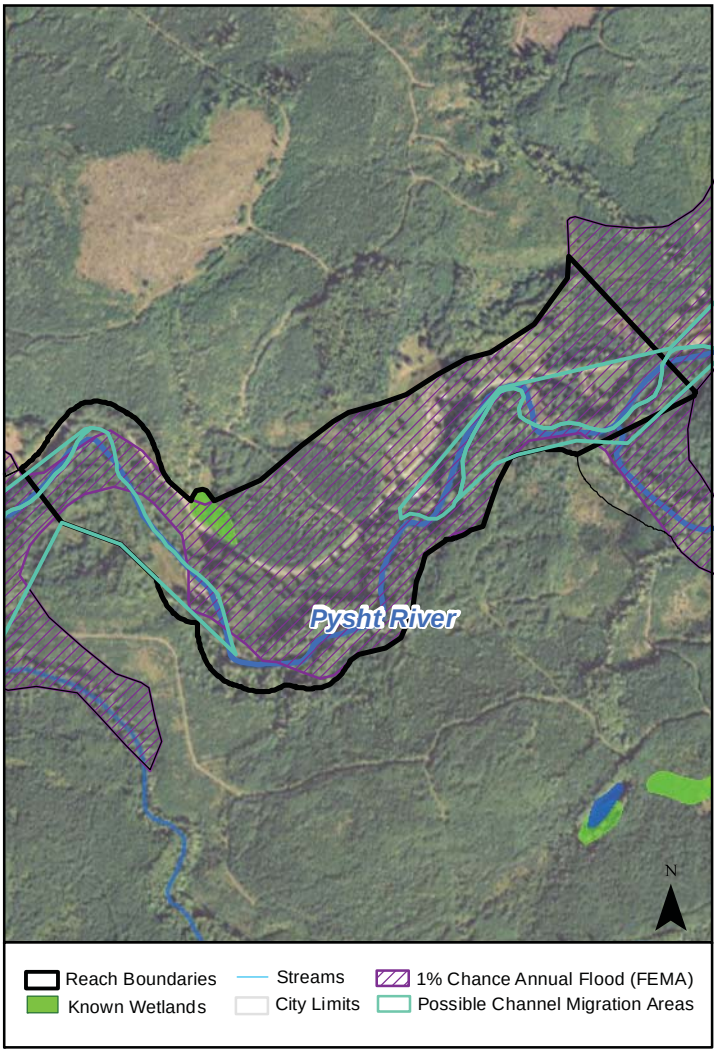
REACH AREA
134.15 Acres

REACH SUMMARY

Reach 3 of the Pysht River extends from the South Fork Pysht River confluence to approximately 1.5 miles upstream. The river is bordered by Highway 112 to the north, which acts as a barrier between the river and its natural floodplain. Vegetation in the riparian corridor is primarily dense forest cover, intermixed by patches herb and shrub habitat. The reach provides spawning and rearing habitat for Chinook, chum, and coho salmon, in addition to steelhead and cutthroat trout.

Low-density residential development is located in the lower half of the reach, and the upper half contains commercial forest lands. The majority of the reach is situated within the FEMA 100-year floodplain and/or the active channel migration area. Geologic hazard areas for erosion and landslides are located in the southeast and southwest, respectively. Existing residences within the reach are located in the flood and/or channel migration hazard areas.

Under current zoning regulations, approximately one-third of the reach has the potential for new rural residential development. Many of the developable parcels are located in the river's floodplain.



PHYSICAL

Channel Configuration

Channel configuration through this reach consists of large meander bends followed by several long, relatively straight channel segments.

Hazard Areas

Several stream banks and surrounding areas are unstable with potential for erosion in the southeast and southwest (5%) and for slides in the south central portion of the reach (7%). Most of the reach lies within a channel migration zone (60%) and in the FEMA 100-year floodplain (84%).

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 40% of the reach zone contains forest habitat, 16% contains herb and shrub habitat, and 10% is lawn/landscaping. Outlying the stream corridor, vegetation is comprised mostly of forest habitat intermixed with shrub and herb habitat and lawn/landscaping.

Habitats and Species

1% of the reach is identified as wetland habitat, located in the northeastern portion of the reach. There are no priority wildlife habitats mapped within the reach.

This reach provides spawning habitat for steelhead trout (100%) and Chinook (93%), chum (99%), and coho (85%), and juvenile rearing habitat for coho salmon (15%). The presence of resident cutthroat are also mapped within the reach.

Water Quality

The downstream portion of the Pysht River within the reach has a State impaired water quality listing for temperature. Additionally, the South Fork Pysht River (confluence) is listed for temperature. Pysht River water quality within the reach is listed a

Pysht River: Reach 3

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is vacant (47%), timber (34%), residential (14%), and roads (6%). Vacant and residential lands are located in the northern portion of the reach while timber lands are located in the southern and western portions of the reach. Land ownership in the reach is 100% private.

Zoning and Parcel Data

The reach is zoned for rural residential (57%) and commercial forestry (43%).

Under current zoning regulations there is moderate potential for significant new residential development within the reach.

Public Access

No public access is available in this reach. Lands adjacent to the reach are privately owned.

Impervious Surfaces

Approximately 6% of the reach is covered by impervious surfaces.

Shoreline Modifications

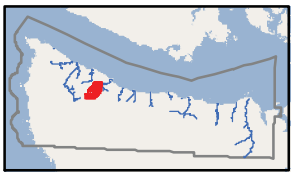
Highway 112 runs parallel to the Pysht River within the reach, which acts as a barrier between the river and its natural floodplain.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Pysht River: Reach 4

SHORELINE LENGTH
5.4 Miles

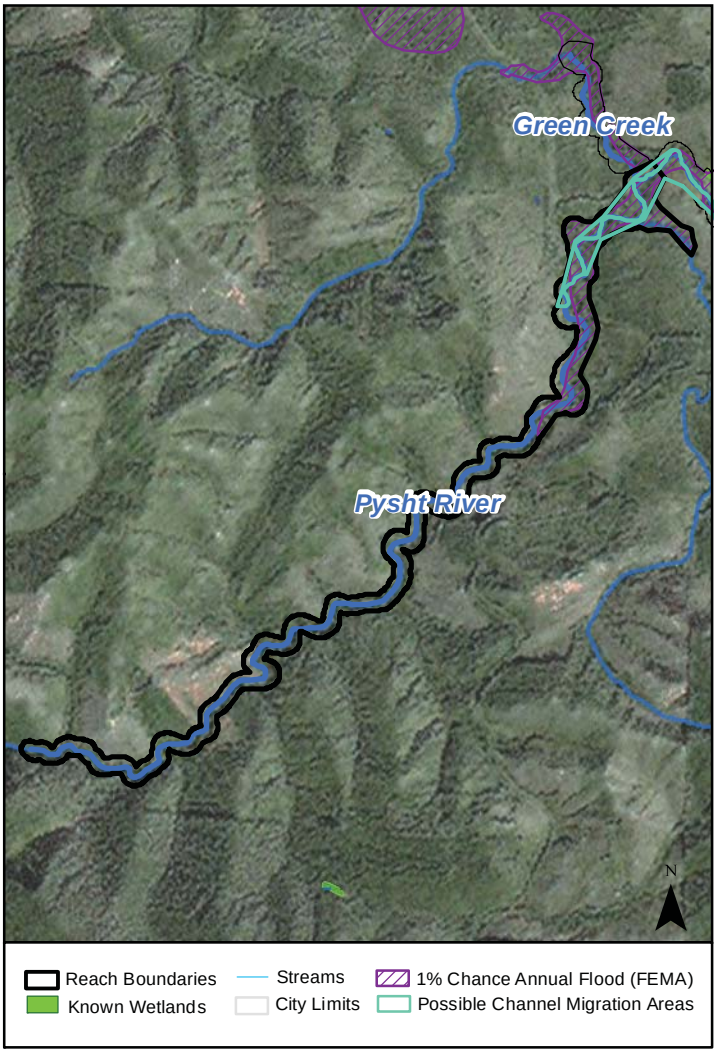
REACH AREA
327.20 Acres

REACH SUMMARY

Reach 4 of the Pysht River extends from near the Green Creek confluence to approximately 5.4 miles upstream. The river channel within the reach is confined to a narrow floodplain. Contiguous forest cover extends throughout much of the reach. The reach provides spawning and rearing habitat for Chinook, coho, and chum salmon, as well as steelhead and resident cutthroat trout. The reach supports breeding populations of bald eagle.

The majority of the reach consists of commercial forest lands. The lower third of the reach is situated in the FEMA 100-year floodplain and/or channel migration zone. Geologic hazard areas for erosion and landsides are located throughout the upper two-thirds of the reach.

Under current zoning regulations, approximately one-third of the reach has the potential to be subdivided for new residential development. However, much of this land is zoned for commercial forestry, and residential density is limited to 1 dwelling per 80 acres. Developable lands are located within flood, channel migration and/or geologic hazard areas.



PHYSICAL

Channel Configuration

The river channel within the reach is confined to a narrow floodplain.

Hazard Areas

Potential erosion areas are mapped in the east and northeast portions of the reach (39%) along with slide areas in the east and southeast (23%). Much of the eastern portion of the reach is located in a channel migration zone(49%) and in the FEMA 100-year floodplain (31%).

ECOLOGY

Riparian Vegetation

86% of the reach zone contains forest habitat, 8% contains herb and shrub habitat.

Habitats and Species

The designated priority habitat mapped within the reach is bald eagle (8%).

This reach provides spawning habitat for steelhead trout (93%) and Chinook (100%), chum (43%), and coho (100%) salmon, and juvenile rearing habitat for steelhead trout (1%). The presence of resident cutthroat are also mapped within the reach.

Water Quality

The upstream portion of the Pysht River within the reach has a State impaired water quality listing for temperature. Additionally, Needham Creek (tributary to the Pysht River) is listed for temperature. There are no Streamkeepers water quality data avail

Pysht River: Reach 4

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (90%), vacant (5%), residential (2%), and roads (2%). Timber lands are located in the western portion of the reach while vacant and residential lands are located in the northeast. Land ownership in the reach is 97% private and 3% public.

Zoning and Parcel Data

The reach is zoned for rural residential (19%) and commercial forestry (81%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

Public lands are located in the southern portion of the reach, but no public access areas are available.

Impervious Surfaces

Approximately 2% of the reach is covered by impervious surfaces.

Shoreline Modifications

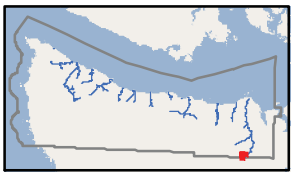
Highway 112 crosses the river in the lower portion of the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Royal Creek

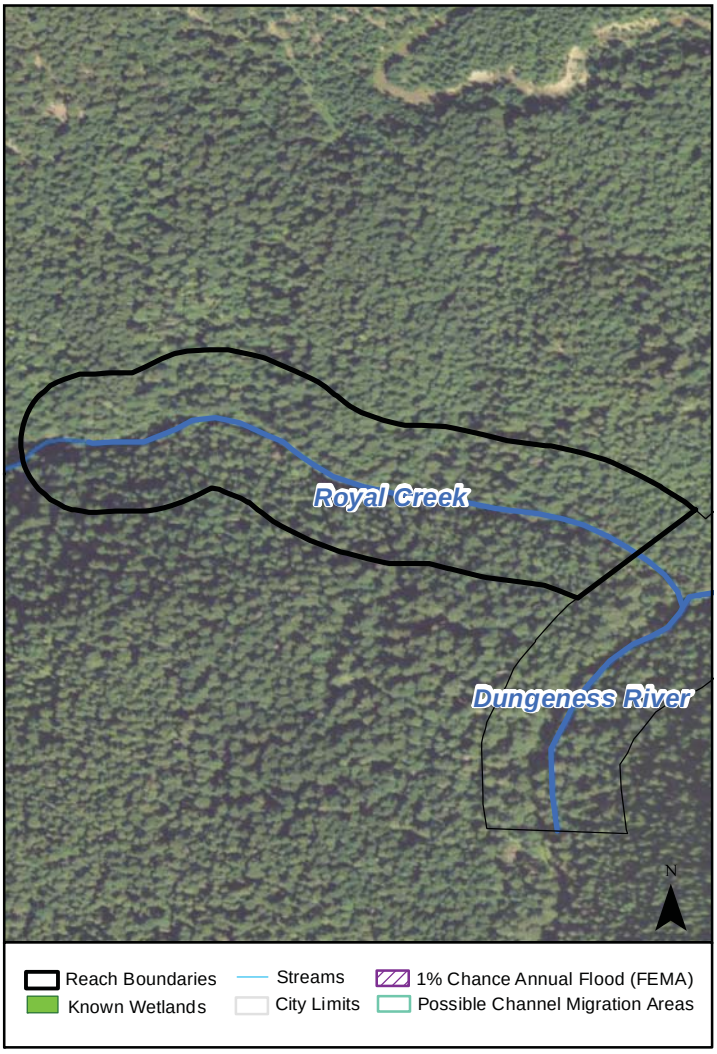
SHORELINE LENGTH
0.3 Miles

REACH AREA
16.85 Acres

REACH SUMMARY

The reach extends from the Dungeness River confluence to approximately 0.4 miles upstream. Within the reach, the stream channel is relatively confined straight. Vegetation throughout the reach consists of dense forest cover. The reach provides habitat for resident cutthroat and rainbow trout.

The reach is located in Olympia National Forest. It can be accessed via trail, from Forest Service Road 2870.



PHYSICAL

Channel Configuration

Within the reach, the stream channel is relatively confined and straight.

Hazard Areas

No potential erosion or slide areas were mapped within this reach.

ECOLOGY

Riparian Vegetation

100% of the reach contains continuous forest habitat.

Habitats and Species

There is no priority wildlife habitat mapped within the reach.

The presence of resident cutthroat and rainbow trout are mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. There are no Streamkeepers water quality data available for the creek.

Royal Creek

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership
Land ownership in the reach is 100% public (Olympic National Forest).

Zoning and Parcel Data
The reach is zoned for commercial forestry (91%) and parks / public land (9%).

Under current zoning regulations there is low potential for significant new development within the reach.

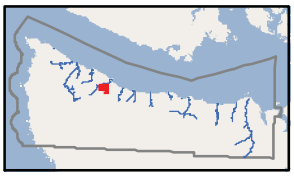
Public Access
The reach can be accessed via trail from Forest Service Road 2870

Impervious Surfaces
No impervious surfaces are mapped within the reach.

Shoreline Modifications
No shoreline modifications are mapped within the reach.

Contaminated Sites
No identified contaminated sites are located within this reach.

Cultural Resources
There are no inventoried sites within the reach.



Salmonberry Creek

SHORELINE LENGTH
1.1 Miles

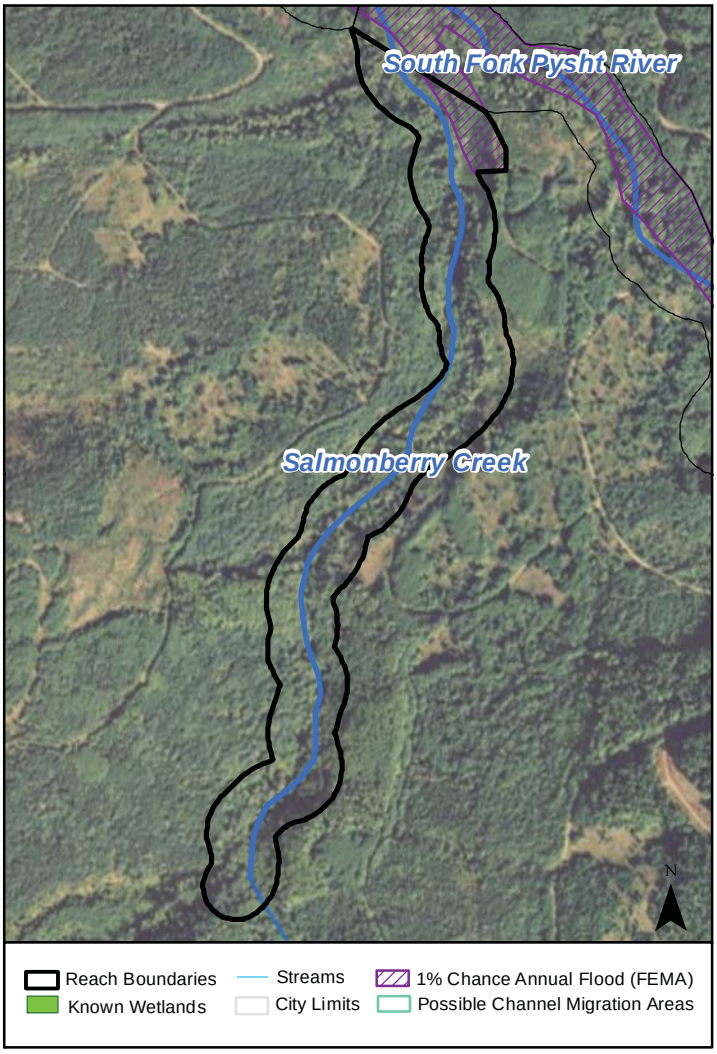
REACH AREA
56.42 Acres

REACH SUMMARY

The reach extends from the South Fork Pysht River confluence to approximately 1.1 miles upstream. Within the reach, the channel is relatively narrow and confined. Vegetation along the stream corridor is primarily forest cover, with patches of herb and shrub habitat. The reach provides spawning and rearing habitat for coho salmon, in addition to steelhead and resident cutthroat trout.

The reach consists entirely of commercial forest lands. The lower portion of the reach lies within the FEMA 100-year floodplain. Geologic hazard areas for erosion and slides are located through the lower and upper portions of the reach, respectively.

All of the land within the reach is zoned for commercial timber. Under current zoning regulations, most of the parcels are subdividable and could be developed with residences, but at a density no greater than 1 dwelling per 80 acres. Developable areas within the reach lie within flood and/or geologic hazard areas. Actual development potential in the reach is low.



PHYSICAL

Channel Configuration

Within the reach, the channel is relatively narrow and confined.

Hazard Areas

Several stream banks and surrounding areas are unstable within the reach. Potential erosion areas are mapped in the northern portion of the reach (61%) while slide areas were mapped in the southern portion (38%). Portions of the reach are located within the FEMA 100-year floodplain (5%).

ECOLOGY

Riparian Vegetation

82% of the reach zone contains dense forest habitat, while 18% of the contains herb and shrub vegetation communities.

Habitats and Species

There is no priority wildlife habitat mapped within the reach.

This reach provides spawning habitat for coho salmon (100%). The presence of resident cutthroat and steelhead trout are also mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. There are no Streamkeepers water quality data available for the creek.

Salmonberry Creek

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership in the reach is 100% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

No public access is available in this reach. Lands adjacent to the creek are privately owned.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

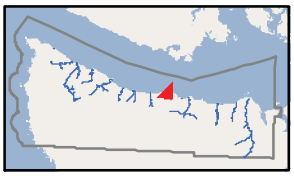
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Salt Creek: Reach 1

SHORELINE LENGTH
0.8 Miles

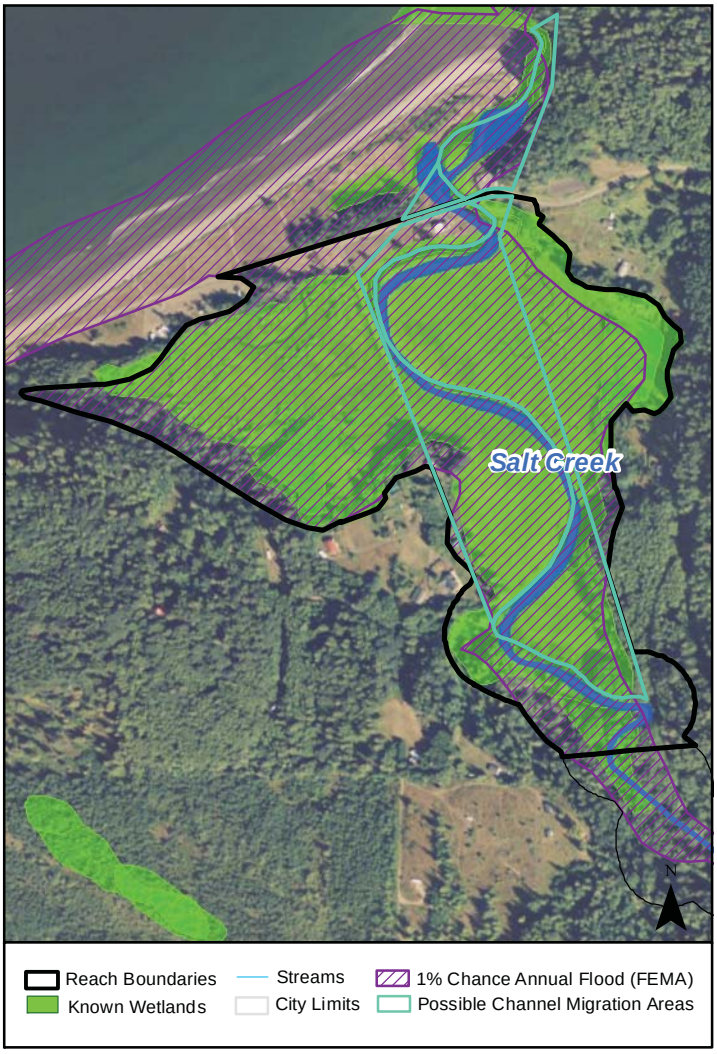
REACH AREA
87.14 Acres

REACH SUMMARY

Reach 1 of Salt Creek extends from near the mouth to approximately 0.65 miles upstream. The channel profile through the reach is highly sinuous, with several side channels joining the mainstem near the mouth. Vegetative cover throughout the reach is mostly herb and shrub habitat, bordered in places by riparian forest. Wetland (salt marsh) habitat extends across the floodplain. The reach provides habitat for coho, chum and Chinook salmon, as well as steelhead, cutthroat, and rainbow trout. The reach supports breeding populations of bald eagle. Several adjacent tributaries have culvert structures, which reduces access to side-channel habitat within the reach.

The majority of the reach area contains rural residential development. Approximately one-third of the land is zoned for commercial forestry and cannot be subdivided. The majority of the reach lies within a tsunami hazard zone, the FEMA 100-year floodplain, and/or identified channel migration areas.

Under current zoning regulations, approximately two-thirds of the reach has the potential for new residential development. Parcel boundaries vary in size and shape, but many have the potential to be subdivided into smaller 2 acre lots. However, the significant presence of wetland habitat within the reach may preclude development in many areas. Most of the subdividable land is located within tsunami, flood, and/or channel migration zone hazard areas.



PHYSICAL

Channel Configuration

Reach 1 of Salt Creek meanders northwestward along a narrow valley at the base of Striped Peak before emerging into a large emergent tidal wetland located on a broad alluvial fan at the mouth of Crescent Bay.

Hazard Areas

Potential erosion areas are mapped in the northwest and southwest portions of the reach (5%) along with slide areas (1%). Most of the reach lies within a tsunami hazard zone (93%) and the FEMA 100-year floodplain (88%). Active channel migration areas are mapped in the eastern portions of the reach (39%),

ECOLOGY

Riparian Vegetation

Within 300 feet of the stream, 13% of the reach zone is forest habitat, while 49% of herb and shrub habitat. Outlying the stream corridor, vegetation is comprised mostly of herb and shrub habitat intermixed with some forest habitat.

Habitats and Species

80% of the reach is identified as wetland habitat. The designated priority habitat mapped within the reach is bald eagle (82%).

This reach provides spawning habitat for steelhead trout (100%) and provides juvenile rearing habitat for coho salmon (100%). The presence of chum salmon and resident cutthroat are also mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. Creek water quality within the reach is listed by Streamkeepers as "compromised" for both B-IBI WQI.

Salt Creek: Reach 1

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is residential (59%), vacant (21%), open space (13%), lodging (5%), and roads (2%). Residential lands are located in the east while vacant lands are located in the west. Open space is located in the southeast. Land ownership in the reach is 100% private.

Zoning and Parcel Data

The reach is zoned for rural residential (80%), rural commercial (4%), commercial forestry / residential mixed use (2%), and parks/public land (14%).

Under current zoning regulations there is low potential for significant new development within the reach. Wetland habitat limits development potential within the reach.

Public Access

All of the land within the reach is privately owned. However, a portion of the reach can be accessed by patrons of an adjacent private campground.

Impervious Surfaces

Approximately 2% of the reach is covered by impervious surfaces.

Shoreline Modifications

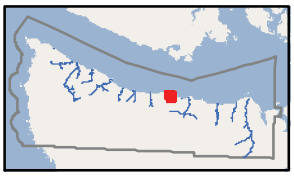
A private road bisects the salt marsh, which disconnects the creek from the western portion of its natural estuary. In addition, several culverts are located on tributaries to Salt Creek within the reach boundary.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Salt Creek: Reach 2

SHORELINE LENGTH
4.0 Miles

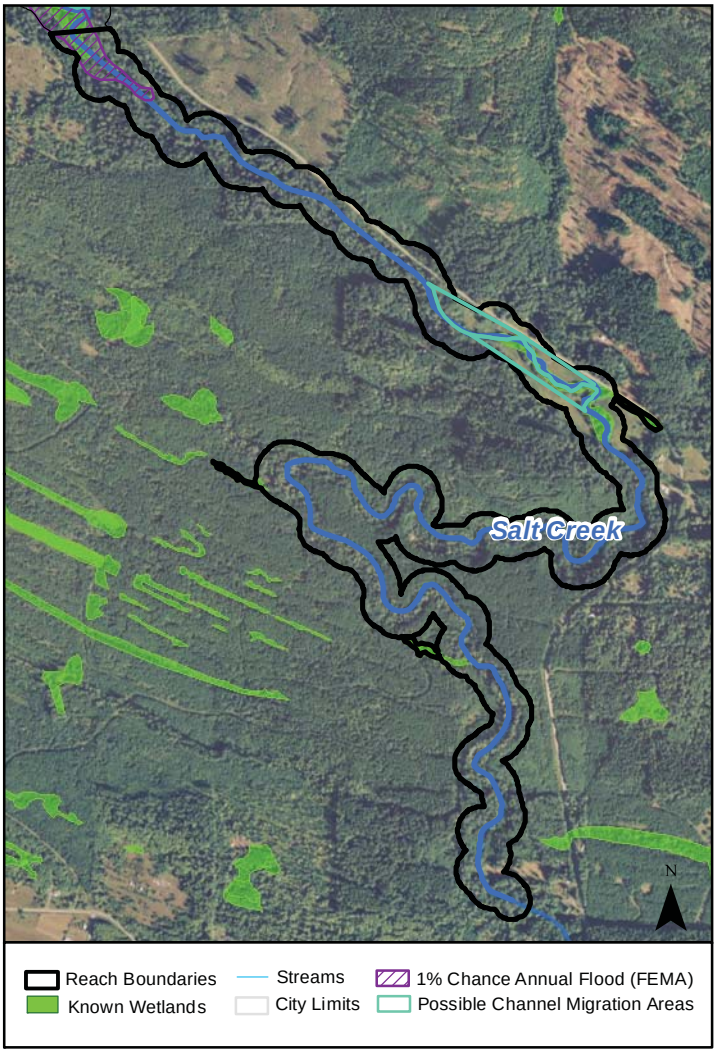
REACH AREA
217.89 Acres

REACH SUMMARY

Reach 2 of Salt Creek extends from the upper portion of its alluvial fan to approximately 0.5 mile downstream of Highway 112. The stream channel within the reach is highly sinuous, and has a low gradient. The reach contains dense forest habitat sparsely intermixed by herb and shrub habitat. Wetlands are located in the lower third of the reach. The reach provides spawning and rearing habitat for coho salmon and steelhead trout, as well as resident cutthroat trout. The reach also provides priority habitat for breeding populations of band-tailed pigeon. A semi-passable dam is located at RM 6.5 which limits upstream fish migration.

The lower third of the reach consists of public forest lands (managed by DNR). The upper two-thirds of the reach are zoned for commercial forestry. The northern portion of the reach is within a tsunami hazard zone, while geologic hazard and slide areas are located in the south. Portions of the reach are located within the FEMA 100-year floodplain and the active channel migration area.

Under current zoning regulations, the commercial forest land in the upper portion of the reach could be subdivided for new residential development, but at a density no greater than 1 dwelling per 80 acres. Actual development potential within the reach is low.



PHYSICAL

Channel Configuration

The upper reach of Salt Creek meanders northwestward throughout a narrow valley.

Hazard Areas

Potential erosion areas are mapped in the south (22%) along with slide areas (34%). The northern portion of the reach is located within a tsunami hazard area (11%) and the active channel migration area (6%). Portions of the reach are located in the FEMA 100-year floodplain (23%).

ECOLOGY

Riparian Vegetation

90% of the reach zone is contains forest habitat, while 5% of contains herb and shrub habitat.

Habitats and Species

4% of the reach is identified as wetland habitat, primarily located in the northern and central portions of the reach. The designated priority habitat mapped within the reach is band-tailed pigeon (61%).

This reach provides spawning habitat for steelhead trout (100%) and coho salmon (89%), and juvenile rearing habitat for coho salmon (10%). The presence of resident cutthroat is also mapped within the reach.

Water Quality

The upstream portion of Salt Creek within the reach has a State impaired water quality listing for temperature, and the downstream portion is listed for dissolved oxygen. Water quality is listed by Streamkeepers as "compromised" for B-IBI but "healthy" f

Salt Creek: Reach 2

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (52%), roads (23%), residential (11%), open space (8%), and vacant (6%). Timber lands are located in the southern portion of the reach while roads and residential lands are located in the north. Land ownership in the reach is 96% private and 4% public.

Zoning and Parcel Data

The reach is zoned for rural residential (12%), rural mixed use (15%), commercial forest / residential mixed use (32%), commercial forestry (29%), and parks/public land (12%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

No public access is available in this reach. Lands adjacent to the reach are privately owned.

Impervious Surfaces

Approximately 2% of the reach is covered by impervious surfaces.

Shoreline Modifications

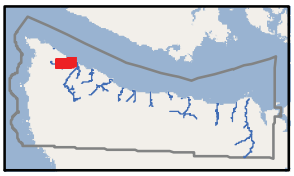
A semi- fish-passable dam is located at RM 6.5 which limits upstream fish migration.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



Sekiu River

SHORELINE LENGTH
5.7 Miles

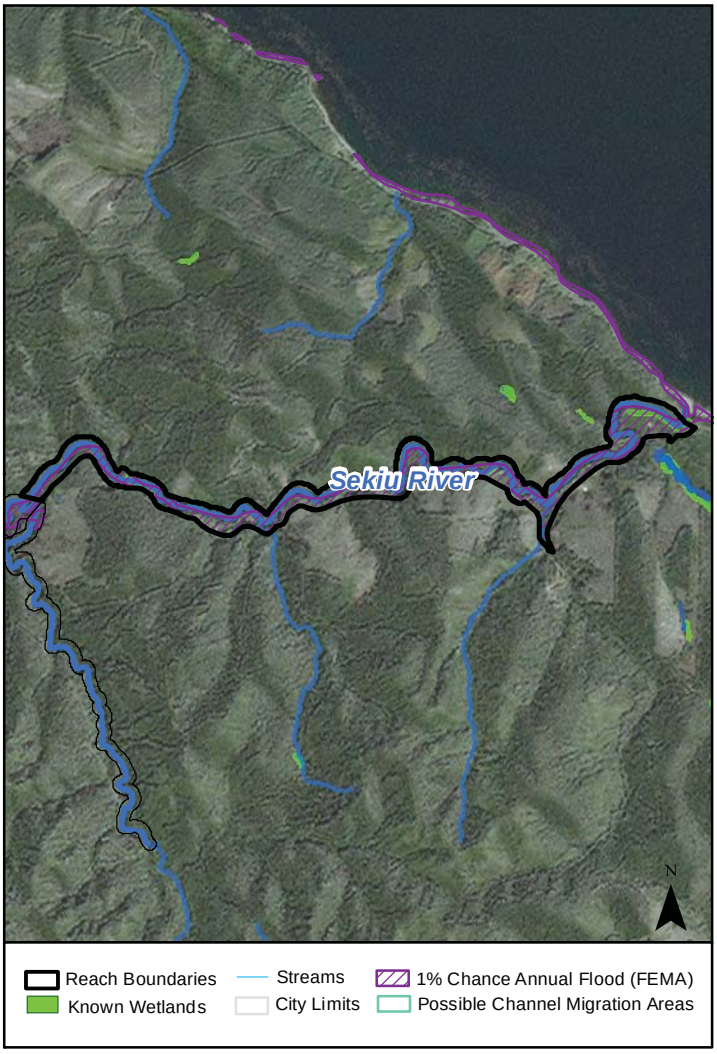
REACH AREA
402.9 Acres

REACH SUMMARY

The reach extends from the confluence of the North and South Forks of the Sekiu River downstream to the Highway 112 bridge crossing (near the river's mouth). The stream channel in the upper portion of the reach is characterized by relatively straight channel segments followed by long sweeping meanders. The river becomes increasingly sinuous in the middle of the reach, and the channel in the lower section contains several meanders across a flat and wide floodplain. The Sekiu River Road borders much of the river, which separates the river from much of its natural floodplain. The majority of the reach is covered by dense forest habitat. The reach provides habitat for Chinook, coho, and chum salmon, in addition to steelhead and resident cutthroat trout. The reach also provides habitat for breeding populations of bald eagle.

Moderate- to low-density rural development is located in the lower portion of the reach. The middle and upper portions of the reach contain commercial forest land. The lower portion of the reach is located within a tsunami hazard area and the FEMA 100-year floodplain. Geologic hazard areas for erosion and landslides are located in the middle and upper portions of the reach, respectively.

Under current zoning regulations the majority of the reach has the potential for new residential development. The lower third of the reach contains several undeveloped parcels of various sizes and shapes, and is zoned for moderate- to low-density residential development. The upper two-thirds of the reach contains commercial timber land that could be subdivided for new residential development, but at a density of no more than 1 dwelling per 80 acres. Most of the developable lands are located in tsunami, flood, and/or geologic hazard areas.



PHYSICAL

Channel Configuration

The stream channel in the upper portion of the reach is characterized by relatively straight channel segments followed by long sweeping meanders. The river becomes increasingly sinuous in the middle of the reach, and the channel in the lower section contains several meanders across a flat and wide floodplain.

Hazard Areas

Potential erosion areas are mapped in the western half of the reach (11%) along with slide areas (26%). The eastern portion of the reach is located in a tsunami hazard area (38%) and within the FEMA 100-year floodplain (62%).

ECOLOGY

Riparian Vegetation

65% of the reach zone contains forest habitat, while 14% contains natural herb and shrub habitat. An additional 7% of the reach consists of lawn/landscaping and developed areas.

Habitats and Species

3% of the reach is identified as wetland habitat, primarily located near the mouth. The designated priority habitat mapped within the reach is bald eagle (6%).

This reach provides spawning habitat for steelhead trout (64%) and Chinook (100%), chum (100%) and coho salmon (81%), and juvenile rearing habitat for Chinook (trace) and coho salmon (19%). The presence of resident cutthroat is also mapped within the reac

Water Quality

The downstream portion of the Sekiu River within the reach has a State impaired water quality listing for temperature. River water quality is listed by Streamkeepers as "compromised" for B-IBI but "healthy" for WQI.

Sekiu River

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (87%), residential (6%), commercial (4%), vacant (2%), lodging (trace), and roads (trace). Land ownership in the reach is 100% private.

Zoning and Parcel Data

The reach is zoned for rural residential (12%), rural mixed use (15%), commercial forest/residential mixed use (32%), commercial forestry (29%), and parks/public land (12%).

Under current zoning regulations there is moderate potential for significant new residential development within the reach, particularly in the downstream third of the reach.

Public Access

No public access is available in this reach. Lands adjacent to the reach are privately owned.

Impervious Surfaces

Approximately 8% of the reach is covered by impervious surfaces.

Shoreline Modifications

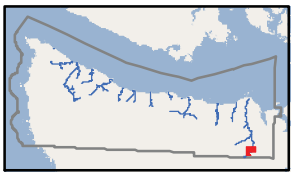
The Sekiu River Road borders much of the river, which separates the river from much of its natural floodplain.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There is 1 inventoried pre-contact site within the reach.



Silver Creek

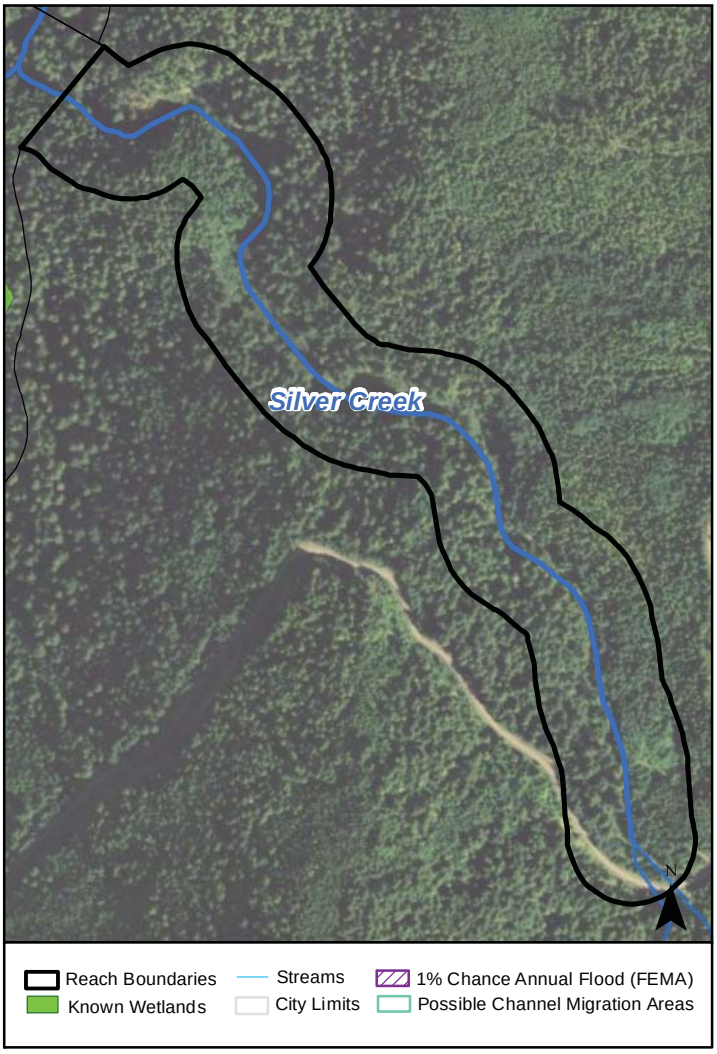
SHORELINE LENGTH
0.7 Miles

REACH AREA
33.73 Acres

REACH SUMMARY

The reach extends from the Dungeness confluence to approximately 1 mile upstream. The reach is covered by dense forest cover. Silver Creek provides habitat for resident cutthroat and rainbow trout.

The reach is located entirely within the Olympic National Forest, and can be accessed from Forest Service Road 2870.



PHYSICAL

Channel Configuration
No data

Hazard Areas
No potential erosion or slide areas were mapped within this reach.

ECOLOGY

Riparian Vegetation
85% of the reach zone contains forest habitat, while 13% of the reach contains herb and shrub habitat.

Habitats and Species
There is no priority wildlife habitat mapped within the reach.

The presence of resident cutthroat and rainbow trout is mapped within the reach.

Water Quality
The reach has no State impaired water quality listings. There are no Streamkeepers water quality available for the creek.

Silver Creek

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership in the reach is 100% public.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

The reach can be accessed via trail from Forest Service Road 2870

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

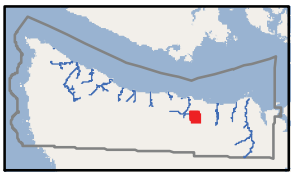
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



South Branch Little River

SHORELINE LENGTH
1.6 Miles

REACH AREA
82.69 Acres

REACH SUMMARY

The reach extends from the Little River confluence to approximately 1.6 miles upstream. Dense, contiguous forest cover extends throughout the reach. This reach provides habitat for bull trout, resident cutthroat, and rainbow trout. The Elwha River Dam blocks anadromous fish access to the reach.

Land use within the reach is primarily forestry. The upper two-thirds of the reach are located in the Olympic National Forest, while the lower portion of the reach is privately owned. Geologic hazard areas for landslides are located throughout the reach.

Under current zoning regulations, approximately one-third of the reach area has potential for new residential development. However, much of this land is zoned for commercial forestry, and residential density is limited to 1 dwelling per 80 acres. Much of the developable land is located within geologic hazard areas for landslides.

PHYSICAL

Channel Configuration
No data

Hazard Areas
Potential slide areas are located throughout the reach (98%).

ECOLOGY

Riparian Vegetation
100% of the reach area contains forest habitat.

Habitats and Species
There is no priority wildlife habitat mapped within the reach.

This reach provides habitat for bull trout, resident cutthroat, and rainbow trout.

Water Quality
The reach has no State impaired water quality listings. There are no Streamkeepers water quality data available for the river.

South Branch Little River

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (98%) and open space (2%).
Land ownership in the reach is approximately 20% and 80% public.

Zoning and Parcel Data

The reach is zoned for commercial forest/residential mixed use (1%), commercial forestry (97%), and parks/public land (2%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

Public access to the reach is available via the Little River Trail.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

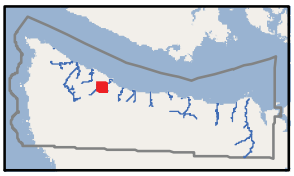
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



South Fork Pysht River: Reach 1

SHORELINE LENGTH
1.4 Miles

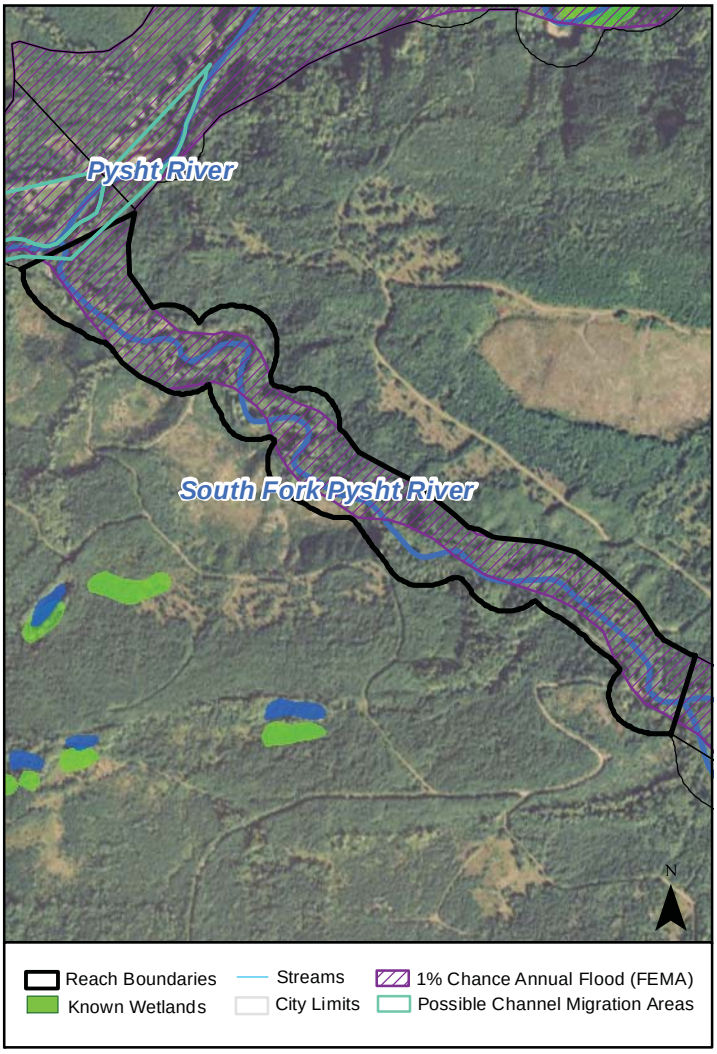
REACH AREA
83.91 Acres

REACH SUMMARY

Reach 1 of the South Fork Pysht River extends from the Pysht River confluence to the Salmon Creek confluence. The reach segment is relatively short and contains a fairly sinuous, meandering channel. Vegetative cover through the reach is mainly contiguous forest cover intermixed with sparse patches of herb and shrub habitat. The reach provides spawning and rearing habitat for Chinook and coho salmon, in addition to steelhead trout. The reach also provides habitat for resident cutthroat and chum salmon.

The majority of the reach is commercial forest land. The northern portion of the reach lies in the active channel migration area and the FEMA 100-year floodplain. Areas in the southwest and northeast portion of the reach are susceptible to geologic hazards (primarily erosion).

Under current zoning regulations, approximately two-thirds of the reach has potential for new residential development, but at a density no greater than 1 dwelling per 80 acres. Actual development potential is low. Developable parcels are located within the FEMA 100-year floodplain and geologic hazard areas.



PHYSICAL

Channel Configuration

The South Fork Pysht River is characterized by a narrow meandering stream channel, that flows through a series of steep mountainsides.

Hazard Areas

Potential erosion areas are mapped in the northeast and southwest portions of the reach (30%), along with geologic slide areas (15%). Most of the reach is within the FEMA 100-year floodplain (67%) and a channel migration zone (51%).

ECOLOGY

Riparian Vegetation

80% of the reach zone is consists of forest habitat, while 15% contains herb and shrub habitat.

Habitats and Species

There is no priority wildlife habitat mapped within the reach.

This reach provides spawning habitat for steelhead trout (100%) and Chinook (100%), and coho salmon (95%), and juvenile rearing habitat for coho salmon (4%). The presence of resident cutthroat and chum salmon are also mapped within the reach.

Water Quality

The downstream portion of the South Fork Pysht River within the reach has a State impaired water quality listing for temperature. Additionally, Pysht River (confluence) is listed for temperature. There are no Streamkeepers water quality data available fo

South Fork Pysht River: Reach 1

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (97%) and vacant (3%). Land ownership in the reach is 100% private.

Zoning and Parcel Data

The reach is zoned for rural residential (3%) and commercial forestry (97%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

No public access is available in this reach. Lands adjacent to the reach are privately owned.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

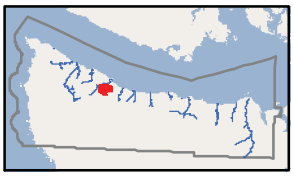
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



South Fork Pysht River: Reach 2

SHORELINE LENGTH
3.1 Miles

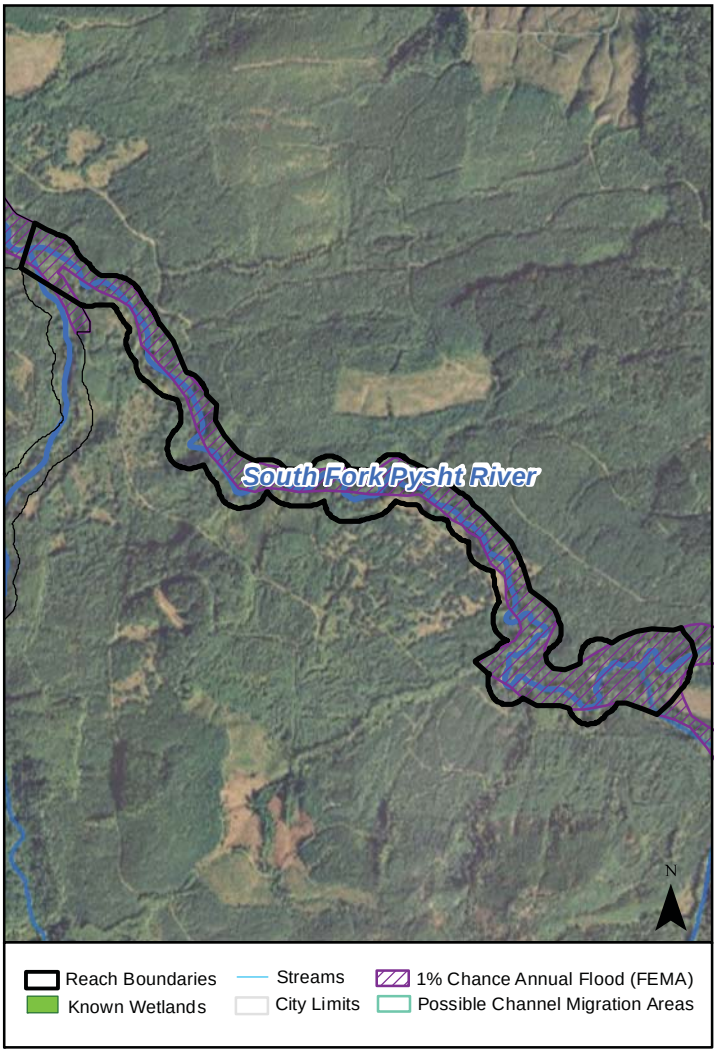
REACH AREA
178.48 Acres

REACH SUMMARY

Reach 2 of the South Fork Pysht River extends from the Salmon Creek confluence to just upstream of the Middle Creek confluence. The river channel is moderately sinuous in this reach. Vegetative cover is primarily a mixture of dense forest habitat intermixed by patches of herb and shrub habitat. The reach provides spawning habitat for steelhead, and Chinook and coho salmon. The presence of resident cutthroat and chum salmon are also mapped within the reach.

Land use within the reach is primarily commercial forestry. Most of the reach lies in the FEMA 100-year floodplain and in areas subject to geologic hazards. Three quarters of the reach is susceptible to erosion. Additionally, slide areas are located in the middle portion of the reach, along the north bank.

Under current regulations, the majority of the reach is zoned for commercial forestry. Most of the parcels are subdividable and could be developed with residences, but at a density no greater than 1 dwelling per 80 acres.



PHYSICAL

Channel Configuration

The South Fork Pysht River is characterized by a narrow meandering stream corridor, that flows through a series of steep mountainsides.

Hazard Areas

Potential erosion areas are located throughout the reach extending from the north to the south (65%) along with slide areas located in the east (10%). Portions of the reach lie within the FEMA 100-year floodplain (70%).

ECOLOGY

Riparian Vegetation

84% of the reach contains dense forest cover while 12% contains herb and shrub habitat.

Habitats and Species

There is no priority wildlife habitat mapped within the reach.

This reach provides spawning habitat for steelhead trout (97%) and Chinook (100%), and coho salmon (95%). The presence of resident cutthroat and chum salmon are also mapped within the reach.

Water Quality

The upstream and middle portions of the South Fork Pysht River within the reach has State impaired water quality listings for temperature. There are no Streamkeepers water quality data available for the South Fork Pysht River.

South Fork Pysht River: Reach 2

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership in the reach is 100% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

No public access is available in this reach. Lands adjacent to the reach are privately owned.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

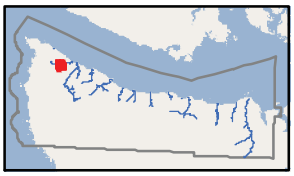
There are no shoreline modifications mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



South Fork Sekiu River

SHORELINE LENGTH
2.9 Miles

REACH AREA
145.87 Acres

REACH SUMMARY

The reach extends from the mainstem confluence to approximately 3 miles upstream. The reach is covered by dense forest cover. The South Fork Sekiu River contains spawning habitat for coho salmon and steelhead trout, and also provides habitat for resident cutthroat trout.

Land use within the reach is primarily commercial forestry. The lower portion of the reach is located within the FEMA 100-year floodplain. Geologic hazard areas for slides and erosion are located throughout the reach.

All of the land within the reach is zoned for commercial timber. Under current zoning regulations, most of the parcels are subdividable and could be developed with residences, but at a density no more than 1 dwelling per 80 acres. Actual development potential within the reach is low.

PHYSICAL

Channel Configuration
No data

Hazard Areas
Potential erosion areas are mapped in the east (2%) along with slide areas extending north to south through the reach (93%). Portions of the reach are located within an active channel migration area (1%) and in the FEMA 100-year floodplain (3%).

ECOLOGY

Riparian Vegetation
87% of the reach area contains forest habitat, while 12% contains herb and shrub habitat.

Habitats and Species
There is no priority wildlife habitat mapped within the reach.

This reach provides spawning habitat for steelhead trout (3%) and coho salmon (100%). The presence of resident cutthroat is also mapped within the reach.

Water Quality
The upstream and downstream portions of the South Fork Sekiu River within the reach has State impaired water quality listings for temperature. There are no Streamkeepers water quality data available for the River.

South Fork Sekiu River

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (100%). Land ownership in the reach is 100% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

No public access is available in this reach. Lands adjacent to the reach are privately owned.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

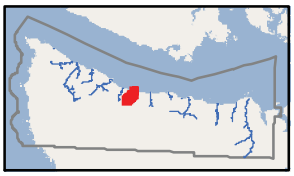
No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within this reach.

Cultural Resources

There are no inventoried sites within the reach.



West Twin River

SHORELINE LENGTH
5.3 Miles

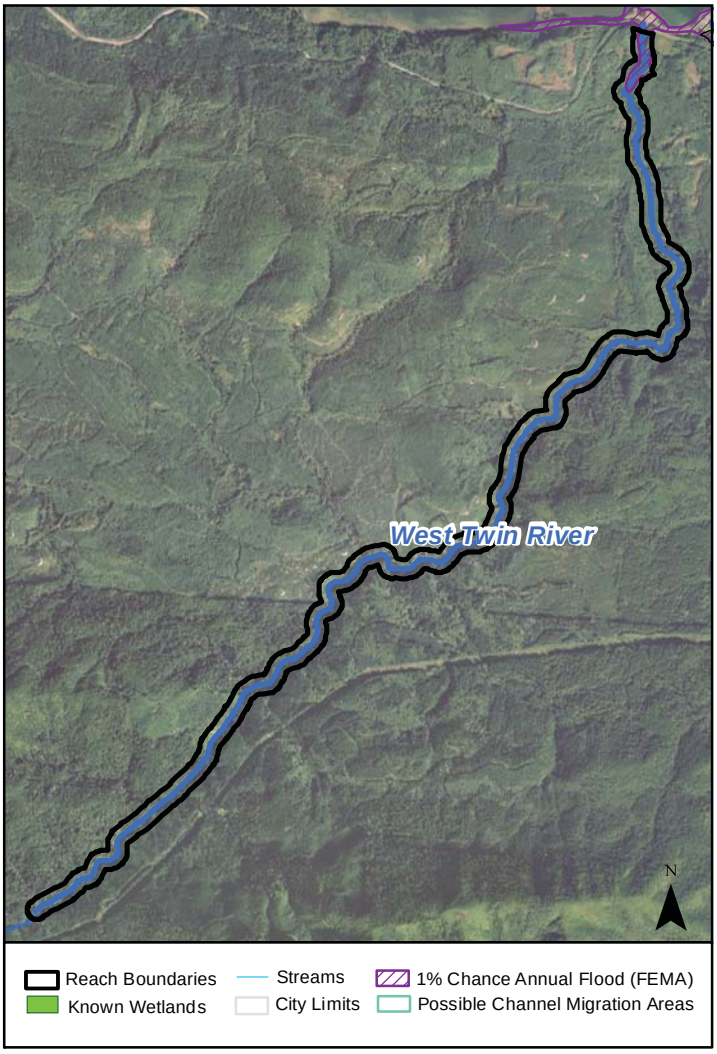
REACH AREA
256.52 Acres

REACH SUMMARY

The reach extends from State Highway 112 (near the mouth) upstream approximately 5 miles. The river flows northeast from steep mountain slopes onto lower gradient hills. The river then reenters a narrow valley between hillcrests to the east and west, emerging onto a low-gradient terrace and delta. Vegetative cover in the riparian corridor and surrounding watershed is comprised predominantly of dense forest habitat, intermixed with pockets of herb and shrub habitat. The reach provides spawning habitat for coho salmon and steelhead and rearing habitat for coho salmon. Resident cutthroat is also mapped within the reach. The reach supports breeding populations of bald eagle.

Approximately half of the reach contains private timber lands, while the other half of the reach is public timber/forest lands (managed by DNR). Private lands are located in the middle and lower half of the reach, along the west bank of the West Twin River. Public lands are located along the east bank of the West Twin River and in the upper portion of the reach. The lower portion of the reach is located within a tsunami hazard zone, FEMA 100-year floodplain, and geologic hazard areas.

Under current zoning regulations, the lower portion of the reach is primarily zoned for commercial timber production, and cannot be further subdivided. The upper reach is public forest lands.



PHYSICAL

Channel Configuration

The West Twin River flows northeast from steep mountain slopes onto lower gradient hills. The river then reenters a narrow valley between hillcrests to the east and west, emerging onto a low-gradient terrace.

Hazard Areas

Many stream banks and surrounding areas are unstable (4%) with potential for slides mapped in the central portion of the reach. Areas for potential erosion are mapped through the northwestern and central portions of the reach (10%). Most of the northern portion of the reach is in the tsunami hazard zone (8%), FEMA 100-year floodplain (3%), and a channel migration zone (15%).

ECOLOGY

Riparian Vegetation

93% of the reach contains forest habitat, while 7% contains herb and shrub habitat.

Habitats and Species

The designated priority habitat mapped within the reach is bald eagle (6%).

This reach provides spawning habitat for steelhead trout (38%) and coho salmon (79%), and juvenile rearing habitat for coho salmon (11%). The presence of resident cutthroat and chum salmon are also mapped within the reach.

Water Quality

The reach has no State impaired water quality listings. West Twin River water quality is listed by Streamkeepers as "healthy" for both B-IBI and WQI.

West Twin River

HUMAN ENVIRONMENT AND LAND USE

Existing Land Use and Ownership

Land usage within the reach is timber (80%), vacant (17%), and residential (3%). Timber is located through much of the reach while vacant and residential lands are located in the north. Land ownership in the reach is 60% public and 40% private.

Zoning and Parcel Data

The reach is zoned for commercial forestry (100%).

Under current zoning regulations there is low potential for significant new development within the reach.

Public Access

Public lands are located throughout the reach. Undeveloped, informal public access to shorelines within this reach can be accessed through the West Twin River Rd.

Impervious Surfaces

No impervious surfaces are mapped within the reach.

Shoreline Modifications

No shoreline modifications are mapped within the reach.

Contaminated Sites

No identified contaminated sites are located within the reach.

Cultural Resources

There are no inventoried sites within the reach.

7. REGULATORY PROGRAMS THAT COMPLEMENT THE SHORELINE MASTER PROGRAM

Clallam County's Shoreline Master Program is one of several regulatory programs that determines, influences, and shapes the type, intensity and impact of development along and adjacent to shoreline environments. Clallam County Code (CCC) has several additional provisions that work in concert with state and federal programs to protect shorelines and accommodate appropriate shoreline use and development. The following summary describes some of the key regulatory programs that support the overall goals and policies of the County's SMP.

7.1 *Local Regulations and Plans*

7.1.1 Comprehensive Plan and Zoning (CCC Title 31 and 33)

The County adopted its first comprehensive plan in 1967, and has made several updates to the plan to identify long-range planning goals and policies that address issues of a county-wide nature. Issues that have been identified through this process include the management of forest and mineral lands, urban growth and sprawl, transportation, economic development, affordable housing, natural, historical and cultural resources, utilities and capital facilities (CCC 31.01.300). The plan also fulfills the County's responsibilities to manage growth as mandated by the Growth Management Act (GMA).

The current Comprehensive Plan, adopted August 28, 2007, provides guidance for development within the unincorporated areas, as well as those lands held by the State. Although the County works cooperatively with the Tribes to achieve common goals, the Comprehensive Plan does not cover tribal trust lands.

CCC Title 33 establishes zoning districts in the County (Clallam County, 2010). These districts, which generally follow land use designations established in the Comprehensive Plan, include 6 resource and public zones, 13 rural zones, 7 urban zones, 13 commercial zones, and 2 industrial zones.

7.1.2 Critical Areas Regulations (CCC 27.12)

The GMA defines the following types of areas as "critical areas": critical aquifer recharge area, flood hazard areas, geologic hazard areas, habitat conservation areas (including most streams, lakes, and marine shorelines), and wetlands. Clallam County critical area regulations apply to all those unincorporated lands not within City, National Park / Forest lands, or tribal trust lands. Last amended in April 2007, the code provides protection standards for critical areas within the shoreline jurisdiction under Part Three of Title 27.12 through the use of buffers, land use restrictions, and building standards.

The regulations require buffers around wetlands and some fish and wildlife habitats. Buffer widths for regulated wetlands range from 25 feet to 200 feet depending on the wetland type and the nature of the proposed adjacent development. Buffer widths for aquatic habitat areas range from 25 feet to 150 feet based on the type of resource and nature of the proposed adjacent

development. Regulations also limit the types of alterations that are allowed within critical areas. Activities that are allowed often require the applicant to prepare a special report (i.e., geotechnical, wetlands, etc), including an analysis of the impact of the proposed development on the critical area and its buffer and a mitigation plan to compensate for identified impacts.

Ecology mandates that shoreline master programs provide protection for critical areas within shoreline jurisdiction. This was clarified in Engrossed House Bill 1653 (Washington State, 2010). Ecology has directed local jurisdictions to incorporate their critical area ordinance into their shoreline master programs according to one of two options:

1. Adopt by reference the critical area ordinance, citing the ordinance number and date of adoption; or

2. Incorporate the critical areas ordinance into the SMP as either an appendix or part of the body of the SMP.

Ecology's SMP Guidelines state that local governments that plan to integrate critical area regulations into SMPs must review the existing critical area regulations to ensure they meet SMA requirements for critical area protection. Jurisdictions must use *"the most current, accurate and complete scientific and technical information available"* (WAC 173-26-201(2)(a)).

7.1.3 Other Provisions of Clallam County Code

The County is also in the process of developing a comprehensive stormwater management plan and associated ordinances for stormwater management and clearing and grading. The County intends to move forward with revising and adopting a Small Project Drainage Manual, and will apply this manual for certain residential projects, as funding is available. An approved drainage plan will be required as a part of building permit submittals for new structures and expansion of existing structures. The drainage plan must control any increase in the amount and rate of stormwater runoff as a result of the development of that property. Standards vary depending whether the development occurs in an area with a community drainage system or not.

The CCC also establishes a special shellfish district to protect shellfish resources. The legal boundaries of the district include the Dungeness Watershed and those waters influenced by it through the irrigation system, and other independent tributaries to the Strait of Juan de Fuca from Bagley Creek east to and including the Sequim Bay Watershed. This encompasses the Dungeness and Graywolf rivers, the creeks of Bagley, McDonald, Matriotti, Meadowbrook, Cooper, Cassalery, Gierin, Bell, Johnson, Dean, Jimmycomelately, Chicken Coop and their tributaries.

7.1.4 Water Resources Inventory Area (WRIA) Plans

Watershed planning occurs under enabling legislation passed in 1998 (Watershed Management Act, RCW 90.82). It is closely tied to planning for other water and watershed resources, including local land use planning and other federal, state, regional, and local laws, regulations, and planning initiatives. The watershed planning process provides a framework for locally based resource management. The primary goals of local watershed planning are to assess the status of water resources within each WRIA and determine how to address competing demands for water.

The statute states one of it's purposes is "*...to develop a more thorough and cooperative method of determining the current water situation in each water resource inventory area of the state and to provide local citizens with the maximum possible input concerning their goals and objectives for water resources management and development*" (RCW 90.82.005).

The WRIA 18 Elwha-Dungeness Watershed Plan was adopted by the Clallam County Board of Commissioners in 2005. The WRIA 18 Initiating Governments include Clallam County, the City of Port Angeles, the Elwha Klallam Tribe, the Jamestown S´Klallam Tribe, and the Agnew Irrigation District. The WRIA 17 Quilcene-Snow planning area within Clallam County includes Sequim Bay and Miller Peninsula. These areas have been incorporated into the planning area WRIA 18. A Draft WRIA 19 Lyre-Hoko Watershed Plan was issued in 2008. The WRIA 19 Initiating Governments include Clallam County, the Lower Elwha Klallam Tribe, the Makah Tribe, and the Clallam Public Utility District. Portions of WRIA 20 Soleduc-Hoh planning area fall within Clallam County, but are not included in the current SMP update planning area.

7.1.5 Other Shoreline Master Programs

Two cities within Clallam County, Sequim and Port Angeles, are currently in the process of updating their own SMPs. These incorporated areas are not subject to the provisions of Clallam County's SMP.

7.2 *State and Federal Regulations and Plans*

Numerous state and federal agencies have regulatory jurisdiction over resources in the County's shoreline planning area. State and federal regulations apply throughout the County and sometimes overlap with existing County regulations and with each other. Among the most important of these regulations are: the federal Endangered Species Act, the federal Clean Water Act, the federal National Flood Insurance Program, the federal Rivers and Harbors Act, the State Forest Practices Act and State Hydraulic Code. Other relevant federal laws include the National Environmental Policy Act, Anadromous Fish Conservation Act, Clean Air Act, and the Migratory Bird Treaty Act. Other state laws that address shoreline issues include the State Environmental Policy Act, Salmon Recovery Act, and the Water Quality Protection Act.

A variety of agencies (e.g., U.S. Army Corps of Engineers, National Marine Fisheries Service, U.S. Fish and Wildlife Service, Washington Department of Ecology, Washington departments of Natural Resources and Fish and Wildlife) are involved in implementing these regulations, but these agencies typically only review shoreline permits that involve 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 and federal regulations can have a major effect on the design and implementation of a shoreline project, and on the timing and complexity of the permit review process.

7.2.1 Clean Water Act (CWA):

The federal CWA requires states to set standards for the protection of water quality. It also regulates excavation and dredging in waters of the U.S., including lakes, streams, and wetlands. Certain activities affecting shorelines, including all in-water work requires a permit from the

U.S. Army Corps of Engineers (Corps) and/or Washington State Department of Ecology under Section 404 and Section 401 of the CWA, respectively. Aquaculture operations, construction of bulkheads, docks, launching ramps, beaches, and shoreline restoration projects all have the potential to require permits under Section 404 and Section 401. The Corps and Ecology review all projects and require mitigation for adverse impacts.

7.2.2 Rivers and Harbors Act Section 10:

The federal Rivers and Harbors Act requires any project that creates an obstruction or alteration in, over, or under navigable U.S. waters to obtain a permit. Permits are issued by the Corps for construction and maintenance of docks, piers, pilings, bulkheads, and certain other in-water and over-water structures. Corps standards for Section 10 approval will dictate construction techniques, materials, and size and bulk allowed for construction of docks, piers, shoreline armoring, and other in-water / over-water structures. The Corps also requires mitigation for adverse effects caused by these construction activities.

7.2.3 Endangered Species Act

The federal ESA addresses the protection and recovery of federally listed species. Depending on the listed species, the ESA is administered by either the National Oceanic and Atmospheric Administration National Marine Fisheries Service or the United States Fish and Wildlife Service (collectively called 'the Services') Many of the County's shoreline waterbodies provide critical migration, spawning, and rearing habitat for threatened salmon species. Any project that has a 'federal nexus' (meaning it requires a federal permit, occurs on federal land or uses federal funding) must be reviewed to ensure that effects of the project will not result in a 'take' of listed species. The Services require project to implement specific conservation measures to ensure that listed species are not jeopardized.

7.2.4 State Hydraulic Code

The Washington Department of Fish and Wildlife regulates activities that use, divert, obstruct, or change the natural flow of the beds or banks of waters of the state and may affect fish habitat. Projects in the shoreline jurisdiction requiring construction below the ordinary high water mark could require an HPA. These projects would include construction of docks, bulkheads, culverts, and other in-water structures. Projects creating new impervious surface that could substantially increase stormwater runoff to waters of the state may also require approval.

7.2.5 Forest Practices Act

The Washington Forest Practices Act of 1974 (RCW 76.09) regulates activities that relate to growing, harvesting, or processing timber. The Forest Practices Board is an independent state agency that defines rules and regulations for forest practices. The rules are designed to protect public and natural resources such as water quality and fish habitat. By requiring harvesters to implement a reforestation plan, natural resources are protected while maintaining a viable timber industry. The Washington Department of Natural Resources (WDNR) administers the publication of the Forest Practices Board rules, along with guidance and other technical information. Specific rules involving water quality protection must be approved by Ecology prior to Forest Practices Board adoption.

Operators of lands covered under the Forest Practices Act must file a notice of intent to convert to a non-forestry use with DNR. The notice is then forwarded to the local jurisdiction, which has the authority to approve or deny associated development permits based on compliance with the provisions of the original application for forest practices.

The Forest Practices Act directs counties planning under the Growth Management Act to adopt and enforce ordinances and regulations for forest practices within their jurisdiction. The Clallam County Comprehensive Plan (section 31.02.140 of the CCC) and the use provisions within the SMP provide regulations for all areas containing forest lands for the protection of both environmental and commercial resources. Regulations for forest practices within the shoreline jurisdiction (approximately 25 percent of Clallam County shorelines) may not be more restrictive than those provided by the Forest Practices Act, except for the proposed conversion to non-forest land uses (RCW 90.58.030(2)(d)(ii)).

7.2.6 Aquatic Land Leasing

Much of the aquatic lands (tidelands) within Clallam County are publically owned and managed by DNR. A DNR authorization to use state-owned aquatic lands is required if a project will occur on or over state-owned aquatic lands.

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9. ABBREVIATIONS AND GLOSSARY

9.1 *Abbreviations*

°F	degrees Fahrenheit
ANS	aquatic nuisance species
B-IBI	benthic index of biotic integrity
BMPs	best management practices
CAO	Critical Areas Ordinance
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
CCC	Clallam County Code
CGS	Coastal Geologic Services
CLC	Cascade Land Conservancy
CLI	Climate Leadership Initiative
CMZ	channel migration zone
CSO	combined sewer overflow
CWA	Clean Water Act
cy	cubic yards
DARRP	Damage Assessment Remediation and Restoration Program
DO	dissolved oxygen
DOH	Washington Department of Health
DPS	distinct population segment
Ecology	Washington State Department of Ecology
EDC	endocrine disrupting chemical
EPA	U.S. Environmental Protection Agency
ESU	Evolutionarily Significant Unit
FEMA	Federal Emergency Management Agency
GIS	geographic information systems
GMA	Growth Management Act
HPA	Hydraulic Project Approval
km	kilometer
LID	low impact development
LWD	large woody debris
mg/L	milligrams per liter
MHHW	mean higher high water
MHW	mean high water
MLLW	mean lower low water
MRC	Marine Resources Committee
MTCA	Model Toxics Control Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NRDA	Natural Resources Damage Assessment
NST	Nearshore Science Team

NOPLE	North Olympic Peninsula Lead Entity
NOSC	North Olympic Salmon Coalition
NWI	National Wetland Inventory
NWSC	Northwest Straits Commission
OFM	Office of Financial Management
OHWM	ordinary high water mark
ONRC	Olympic Natural Resources Center
PAHs	polychlorinated aromatic hydrocarbons
PBDEs	polybrominated diphenyl ethers
PBTs	persistent bioaccumulative toxins
PCBs	polychlorinated biphenyls
PHS	Priority Habitats and Species
PNTPC	Point No Point Treaty Council
ppb	parts per billion
ppm	parts per million
PSAMP	Puget Sound Aquatic Monitoring Program
PSAT	Puget Sound Action Team
PSNERP	Puget Sound Nearshore Ecosystem Project
PSP	Puget Sound Partnership
PSRF	Puget Sound Restoration Fund
PVC	polyvinyl chloride
RCO	Washington Recreation and Conservation Office
RCW	Revised Code of Washington
RM	river mile
Sea Grant	University of Washington Sea Grant Program
SEPA	State Environmental Policy Act
SLR	sea level rise
SMA	Shoreline Management Act
SMP	Shoreline Master Program
SRT	self-regulating tide gate
SSRFB	State Salmon Recovery Funding Board
TDR	transfer of development rights
TESC	temporary erosion and sediment control
TMDL	total maximum daily load
TNC	The Nature Conservancy
USACE	U.S. Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UW	University of Washington
VEC	valued ecosystem component
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WFWC	Washington Fish and Wildlife Commission
WRIA	water resource inventory areas
WSDOT	Washington Department of Transportation
WSU Extension	Washington State University Cooperative Extension
WQI	Water quality index
WWU	Western Washington University

9.2 *Glossary*

- A -

Accretion means the gradual or imperceptible increase or extension of land by natural forces acting over a long period of time.

Adfluvial Fish means fish species that spend most of their life cycle in a lacustrine or lake environment, but return to rivers and streams to reproduce.

Adverse Impact means an impact that can be measured or is tangible and has a reasonable likelihood of causing moderate or greater harm to ecological functions or processes or other elements of the shoreline environment.

Aggradation means the accumulation of sediment in rivers and nearby landforms. Aggradation occurs when sediment supply exceeds the ability of a river to transport the sediment.

Algal Bloom means a proliferation of algae in a lake, stream, or pond. Algal blooms often cause water quality problems because as the algal bloom dies, the decomposition process uses dissolved oxygen from the water. .

Alluvial Fan means a fan-shaped deposit of sediment and organic debris formed where a stream flows or has flowed out of a mountainous upland onto a level plain or valley floor. Sediment is deposited because of a sudden change in sediment transport capacity (e.g., significant change in slope or confinement).

Alluvium is a general term for clay, silt, sand, gravel, or similar other unconsolidated materials, deposited during comparatively recent geologic time by a stream or other body of running water, as a sorted or semi-sorted sediment in the bed of the stream or on its floodplain or delta.

Alteration means any human-induced change in an existing condition. Alterations include, but are not limited to, grading, filling, channelizing, dredging, clearing (vegetation), draining, construction, compaction, excavation, or any other activity that changes the character of the area.

Anadromous Fish means fish species that spend most of their life cycle in salt water, but return to fresh water to reproduce.

Anthropogenic Sources means that the result or occurrence originated from the activity of humans. Anthropogenic sources include industry, agriculture, mining, transportation, construction, and residences.

Appurtenance means development that is connected to the use and enjoyment of a single-family residence and is located landward of the OHWM and/or the perimeter of a wetland. Appurtenances include a garage, deck, driveway, utilities, fences and grading which does not exceed 250 cubic yards (except to construct a conventional drainfield).

Aquifer means an underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt, or clay) from which groundwater can be usefully extracted from a well.

Archaeological Object means an object that provides physical evidence of an indigenous and subsequent culture including material remains of past human life such as monuments, symbols, tools, facilities, graves, skeletal remains and technological byproducts.

Archaeology means the systematic, scientific study of the human past through time.

Armoring means the addition of structures or material along the shoreline to decrease the impact of waves and currents or to prevent the erosion of banks or bluffs.

Artifact means a human-made object, such as a tool, weapon or ornament, especially those of archaeological or historical interest.

Assimilative Capacity means the capacity of a natural body of water to receive wastewater or toxic materials without deleterious effects and without damage to aquatic life or humans who consume the water.

Associated Wetlands means wetlands that are in proximity to and either influence or are influenced by a shoreline stream, lake or tidal water. This influence includes, but is not limited to, one or more of the following: periodic inundation, location within a floodplain, or hydraulic continuity (WAC 173-22-040).

Avulsion means an abrupt channel change to a river or stream, usually caused by a flood event.

- B -

Basin means the area drained by a river and its tributaries or a depressed area with no surface outlet.

Bedlands means those submerged lands below the line of navigability of navigable lakes and rivers.

Bedload means the particles that are transported in the water above the streambed by rolling, sliding, and/or saltating.

Bedrock is a general term for rock, typically hard, consolidated geologic material, that underlies soil or other unconsolidated, superficial material or can be exposed at the surface.

Berm means one or several accreted linear mounds of sand and gravel generally paralleling the shore at or landward of OHWM; berms are normally stable because of material size or vegetation, and are naturally formed by littoral drift.

Best Management Practices or BMPs means conservation practices or systems of practices and management measures that control soil loss, reduce water quality degradation, minimize impacts to surface waters, and control site runoff.

Bioengineered Shoreline Stabilization means biostructural and biotechnical alternatives to hardened structures (bulkheads, walls) for protecting slopes or other erosive features. Bioengineered stabilization uses vegetation, geotextiles, geosynthetics and similar materials. An example is Vegetated Reinforced Soil Slopes (VRSS), which use vegetation arranged and embedded in the ground to prevent shallow mass movement and surficial erosion.

Biological Oxygen Demand means the amount of oxygen required for the oxidation of the organic matter in a water sample or a waterbody.

Biotic means relating to life and living organisms, or caused by living organisms.

Biotoxin means a toxic substance of biological origin.

Boat Ramp means an inclined slab, set of pads, rails, planks, or graded slope used for launching boats with trailers or occasionally by hand.

Boathouse means any roofed and enclosed structure built onshore or offshore for storage of watercraft or floatplanes.

Bog means a type of wetland dominated by mosses that form peat. Bogs are very acidic, nutrient-poor systems, fed by precipitation rather than surface inflow, with specially adapted plant communities.

Braided Channel means to branch and rejoin repeatedly to form an intricate pattern or network of small interlacing stream channels.

Branch means a small stream that flows into another, usually larger, stream.

Buffer (Buffer Zone) means the area adjacent to a shoreline and/or critical area that separates and protects the area from adverse impacts associated with adjacent land uses.

Bulkhead means a wall-like structure such as a revetment that is placed parallel to the shoreline (at or near the OHWM) primarily for retaining uplands and fills prone to sliding or sheet erosion and to protect uplands and fills from erosion by waves or currents.

- C -

Candidate means a species considered for listing as threatened or endangered under the Endangered Species Act, indicating that there is a possibility that the species has potential to be at risk of becoming threatened or endangered in the foreseeable future.

Cascade means a waterfall, especially a small fall or one of a series of small falls, descending over steeply slanting rocks.

Catchment Area means an area surrounded by a continuous ridge within which all runoff is expected to join into a single stream; it extends from the point of junction of the stream to the highest point of the catchment ridge.

Channel Migration Zone means the area along a river or stream within which the channel can reasonably be expected to migrate over time as a result of normally occurring processes. It encompasses the area of current and historic lateral stream 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.

Channelization means the straightening, relocation, deepening or lining of stream channels, including construction of continuous revetments or levees, for the purpose of preventing gradual, natural stream meander and progression.

Colluvium is a general term applied to any loose, heterogeneous (mixed), and incoherent mass of soil material and/or rock fragments deposited by rainwash, sheetwash or slow continuous downslope creep; it usually collects at the base of gentle slopes or hillsides.

Comprehensive Plan means the guiding policy document for all land use and development regulations in a defined area and for regional services throughout the area including transit, sewers, parks, trails and open space.

Confluence means a place of meeting of two or more streams; the point where a tributary joins the main stream.

Conservation means the prudent management of rivers, streams, wetlands, wildlife and other environmental resources in order to preserve and protect them. This includes the careful use of natural resources to prevent depletion or harm to the environment.

Conservation Easement means a legal agreement that the property owner enters into to restrict uses of the land and conserve natural resources. The easement is recorded on a property deed, is attached to the land, and is legally binding on all present and future owners of the property.

Contaminant means any chemical, physical, biological, or radiological substance that does not occur naturally in groundwater, air, or soil or that occurs at concentrations greater than natural levels.

County means Clallam County, Washington.

Critical Aquifer Recharge Area or CARA means an area designated by WAC 365-190-080(2) that is determined to have a critical recharging effect on aquifers (i.e., maintain the quality and quantity of water) used for potable water as defined by WAC 365-190-030(2).

Critical Areas means the following areas designated in RCW 36.70.030: critical aquifer recharge areas, wetlands, geologically hazardous areas, frequently flooded areas, and fish and wildlife habitat conservation areas.

Critical Habitat means habitat areas with which endangered, threatened, sensitive or monitored plant, fish, or wildlife species have a primary association (e.g., feeding, breeding, rearing of young, migrating). Such areas are identified herein with reference to lists, categories, and definitions promulgated by the Washington Department of Fish and Wildlife as identified in WAC 232-12-011 or 232-12-014; in the Priority Habitats and Species (PHS) program of the Department of Fish and Wildlife; or by rules and regulations adopted by the U.S. Fish and Wildlife Service, National Marine Fisheries Service, or other agency with jurisdiction for such designations.

- D -

Dam means a barrier across a stream or river to confine or regulate flow or raise water levels for purposes such as flood or irrigation water storage, erosion control, power generation, or collection of sediment or debris.

Debris Flow means a moving mass of rock fragments, soil, and mud but more than half of the particles are larger than sand size. It is a general term that describes a mass movement of sediment mixed with water and air that flows readily down slopes.

Deciduous means falling off or shed seasonally or at a certain stage of development in the life cycle, as in plant leaves.

Deepwater Habitats means permanently flooded lands. Deepwater habitats include environments where surface water is permanent and often deep, so that water, rather than air, is the principal medium in which the dominant organisms live. The boundary between wetland and deepwater habitat in the riverine and lacustrine systems lies at a depth of two meters (6.6 feet) below low water; however, if emergent vegetation, shrubs, or trees grow beyond this depth at any time, their deepwater edge is the boundary.

Degradation as it pertains to riverine morphology means the lowering of a streambed due to such factors as increased scouring.

Denitrification means the conversion of nitrate (NO3-) to gaseous nitrogen (N2) by bacteria. In wetlands and riparian zones, denitrification can remove excess nitrogen resulting from agricultural runoff and residential fertilizers.

Deposition means the laying, placing, or accumulation of any material.

Detrital as it pertains to geology is the adjective form of “detritus,” which is loose rock or mineral material that is worn off or removed by mechanical means; especially fragmented material such as sand, silt, and clay that is derived from older rocks and moved from its place of origin.

Development means a use consisting of the construction or exterior alteration of structures, dredging, drilling, dumping, filling; removal of any sand, gravel or minerals; bulkheading; driving of pilings; placing of obstructions; or any project of a permanent or temporary nature that interferes with the normal public use of the surface of the waters overlying lands subject to the Shoreline Management Act at any state of water level.

Dike or Diking means an artificial wall, embankment, ridge, or mound, usually of earth or rock fill, built around a relatively flat, low lying area to protect it from flooding.

Dissolved Oxygen means the amount of oxygen, in parts per million by weight, dissolved in water, generally expressed in milligrams per liter (mg/L).

Distinct Population Segment or DPS means a subgroup of a vertebrate species that is treated as a species for purposes of listing under the Endangered Species Act. It is required that the subgroup be separable from the remainder of and significant to the species to which it belongs.

Dock means all platform structures or anchored devices in or floating upon waterbodies to provide moorage for pleasure crafts or landing for water-dependent recreation, including but not limited to floats, swim floats, floatplane moorages, and water ski jumps. Launch ramps are excluded.

Downcutting means stream erosion in which the cutting is directed in a downward direction.

Dredging is the removal or excavation of bottom sediments and is carried out at least partly underwater.

- E -

Ecological Functions or Shoreline Functions means the work performed or role played by the physical, chemical, and biological processes that contribute to the maintenance of the aquatic and terrestrial environments that constitute the shoreline's natural ecosystem. See WAC 173-26-200 (2)(c). Functions include, but are not limited to, habitat diversity and food chain support for fish and wildlife, groundwater recharge and discharge, high primary productivity, low flow stream water contribution, sediment stabilization and erosion control, storm and floodwater attenuation and flood peak desynchronization, and water quality enhancement through biofiltration and retention of sediments, nutrients, and toxicants. These beneficial roles are not listed in order of priority.

Ecoregion means a relatively large area of land or water containing geographically distinct assemblages of natural communities and species.

Ecosystem Processes or Ecosystem-wide Processes means the suite of naturally occurring physical and geologic processes of erosion, transport, and deposition; they can include specific chemical processes that shape landforms within a specific shoreline ecosystem and determine both the types of habitat and the associated ecological functions.

Ecosystem Diagnosis and Treatment or EDT Modeling means the application of an analytical computer model that is able to link species' population abundances to varying habitat conditions in order to predict the response of a species to various conditions; it is able to predict the amount of increase or decrease of a population in response to habitat conditions.

Embankment means a linear structure, usually of earth or gravel, constructed to extend above the natural ground surface and designed to prevent water from overflowing a level tract of land.

Embayment means a bay, either the deep indentation or recess of a shoreline, or the large body of water thus formed.

Emergent means non-woody, erect wetland plant species that typically grow emerging from flooded areas and shallow marshes.

Emergent Wetland means a wetland with at least 30 percent of the surface area covered by erect, rooted, herbaceous vegetation as the uppermost vegetative strata.

Endangered as it relates to species or habitats means listed and protected under the Endangered Species Act, indicating that the described species is in danger of extinction throughout all or a significant portion of its range.

Enhancement means actions performed within an existing degraded shoreline, critical area and/or buffer to intentionally increase or augment one or more functions or values of the existing area. Enhancement actions include, but are not limited to, increasing plant diversity and cover, increasing wildlife habitat and structural complexity (snags, woody debris), installing environmentally compatible erosion controls, or removing non-indigenous plant or animal species.

Environment Designation means a categorical classification of a land parcel that reflects the type of development that has or should take place in a given area.

Erosion means a process whereby wind, rain, water and other natural agents mobilize, transport, and deposit soil particles.

Erosion Hazard Areas means lands or areas underlain by soils identified by the U.S. Department of Agriculture Natural Resource Conservation Service (NRCS) as having a high potential to destabilize in the future. Severe or Very Severe as it pertains to erosion means hazards and areas subject to impacts from lateral erosion related to moving water, such as river channel migration and shoreline retreat.

Estuary means a partially enclosed, coastal body of water that has an unhindered connection to the ocean and is fed by one or more freshwater streams or rivers.

Eutrophic means having waters rich in mineral and organic nutrients that promote a proliferation of plant life, especially algae. After the algae population explodes, bacterial degredation reduces the dissolved oxygen content of the water and often causes harm to other aerobic organisms.

Eutrophication is the process by which waters become more “eutrophic”.

Evolutionarily Significant Unit or ESU means a population of organisms that is considered distinct for purposes of conservation. Delineating ESUs is important when considering conservation actions. This term can apply to any species, subspecies, geographic race, or population.

Excavation means the disturbance, displacement and/or disposal of unconsolidated earth material such as silt, sand, gravel, soil, rock or other material from all areas landward of OHWM.

- F -

Fecal Coliform means a group of bacteria that are commonly associated with feces produced by humans, mammals and birds and that can be found in untreated sewage water.

Feeder Bluff means a primary sediment input area that can feed miles of beaches.

Fill Material means any solid or semi-solid material, including rock, sand, soil, clay, plastics, construction debris, wood chips, overburden from mining or other excavation activities, and materials used to create any structure or infrastructure, that when placed, changes the grade or elevation of the receiving site.

Filling means the act of transporting or placing by any manual or mechanical means fill material from, to, or on any soil surface, including temporary stockpiling of fill material.

Fish and Wildlife Habitat Conservation Areas (FWHCA) are areas important for maintaining species in suitable habitats within their natural geographic distribution so that fragmented populations are not created.

Fish Habitat means a complex of physical, chemical, and biological conditions that provide the life supporting and reproductive needs for a species or life stage of fish. Although the habitat requirements of a species depends on its age and activity, the basic components of fish habitat in rivers, streams, ponds, and nearshore areas include, but are not limited to, clean water; appropriate temperatures; adequate water depth and velocity; appropriate substrates for spawning; adequate supply of aquatic and terrestrial insects; and unimpeded passage.

Fisheries means all species of fish and shellfish (commonly or regularly originating or harvested commercially for human sustenance and sport), combined with the aquatic plants, animals and habitat needed for continued propagation and growth of such species.

Fisheries Enhancement means actions taken to rehabilitate, maintain or create fisheries habitat, including but not limited to hatcheries, spawning channels, lake rehabilitation, and planting of fisheries stocks. Fisheries enhancement differs from aquaculture in that the increase in fisheries stocks eventually becomes available for public rather than private harvest.

Float means a floating platform similar to a dock that is anchored or attached to pilings.

Flood or Flooding means a general and temporary condition of partial or complete inundation of normally dry land areas due to the overflow of inland waters and/or the unusual and rapid accumulation of runoff of surface waters from any source.

Flood Insurance Rate Map or FIRM means the map that displays the federally designated floodplains in a specific location. Such maps are used in city and county planning, in the insurance industry, and by individuals who want to avoid moving into a home at risk of flooding or who want to know how to protect their property.

Flooding Regime means the temporal pattern during which flooding occurs.

Floodplain or FEMA Floodplain means all federally-designated lands along a river or stream that may be inundated by the base flood of a river or stream.

Floodplain Management means a long-term program to reduce flood damages to life and property and to minimize public expenses due to floods through a comprehensive system of planning, development regulations, building standards, structural works, monitoring and warning systems.

Floodway means the area, as identified in a master program, that either:

1. has been established in federal emergency management agency flood insurance rate maps or floodway maps, or

2. those portions of a river valley lying streamward from the outer limits of a watercourse upon which flood waters are carried during periods of flooding that occur with reasonable regularity, although not necessarily annually

Flume means an artificial inclined channel used for conveying water for industrial purposes, such as power production.

Fluvial means of or pertaining to a river; a system that is influenced by a river or rivers.

Forage Fish means small fish which breed prolifically and serve as food for predatory fish.

Forest Land means all land that is capable of supporting a merchantable stand of timber and is not being actively used, developed, or converted in a manner that is incompatible with timber production.

Forest Practices means any activity conducted on or directly pertaining to forest land and relating to growing, harvesting, or processing of timber; including, but not limited to: (1) road and trail construction; (2) fertilization; (3) prevention and suppression of diseases and insects; or other activities that qualify as a use or development subject to the Shoreline Management Act. Excluded from this definition is preparatory work such as tree marking, surveying and removal of incidental vegetation such as berries, greenery, or other natural products whose removal cannot normally be expected to result in damage to shoreline natural features. Also excluded from this definition is preparatory work associated with the conversion of land for non-forestry uses and developments. Log storage away from forest land is considered under industry.

Forested Wetland means a wetland that supports a forested canopy over more than 30 percent of the habitat area as defined by the U.S. Fish and Wildlife Service Classification System for wetlands.

Fork as it pertains to a riverine system means a place where two or more streams join to form a larger waterway.

Freeboard means the additional height above the recorded or design high-water mark of an engineering structure, such as a dam, seawall, flume, or culvert, that represents an allowance against overtopping by transient disturbances, including waves induced by surge or landslides.

Frequently Flooded Areas means lands in the floodplain subject to a one percent or greater chance of flooding in any given year and those lands that provide important flood storage, conveyance and attenuation functions, as determined by a local government in accordance with WAC 365-190-080(3). Classifications of frequently flooded areas include, at a minimum, the 100-year floodplain designations of the Federal Emergency Management Agency and the National Flood Insurance Program.

Fry as it pertains to fisheries means juvenile fish.

Function Assessment or Functions and Values Assessment mean a set of procedures, applied by a qualified consultant, to identify the ecological functions being performed in a shoreline or critical area, usually by determining the presence of certain characteristics, and determining how well the area is performing those functions. Function assessments can be qualitative or quantitative and may consider social values potentially provided by area. Function assessment methods must be consistent with Best Available Science.

- G -

Gabions are composed of masses of rock, rubble, or masonry tightly enclosed, usually by wire mesh, to form massive blocks. They are used to form walls on beaches to retard wave erosion or as foundations for breakwaters or jetties.

Game Fish means those species of fish that are classified by the Washington Department of Fish and Wildlife as game fish (WAC 232-12-019).

Gastropod means a mollusk (such as snails and slugs) usually with a univalve shell or no shell, and a distinct head bearing sensory organs.

Geologically Hazardous Areas means areas that, because of their susceptibility to erosion, sliding, earthquake, or other geological events, pose unacceptable risks to public health and safety and may not be suited for commercial, residential, or industrial development.

Geologically Unstable means the relative instability of a shoreform or landform for development purposes over the long term or the intended life of any proposed structure. Soil, slope, ground or surface water, other geologic conditions, vegetation and effects of development are common factors that contribute to instability. Areas characterized by banks or bluffs composed of unconsolidated alluvial or glacial deposits (till and drift material), severely fractured bedrock, active and substantial erosion, substantially deformed trees and shrubs, or active or inactive earth slides are likely to be considered geologically unstable.

Geomorphic means pertaining to or like the form or figure of the earth.

Geomorphology is the shape or form of a natural surface or object (as well as the study of the forms of the land surface and the processes producing them).

Geomorphic Shoretype – A classification system for Puget Sound shorelines focused on underlying geology, tidal influence, and weather exposure. Shoretypes common to Clallam County marine shorelines include the following:

- Accretion shoreforms (areas where gradual addition of sediment to the beach leads to increases in shoreline elevation and/or seaward expansion of the shoreline)
- Feeder bluffs and feeder bluff exceptional (areas of substantial sediment input into the net shore drift system; *feeder bluffs* have periodic sediment input with a longer recurrence interval as compared to *feeder bluff exceptional* areas)
- Transport zones (areas that do not contribute appreciable amounts of sediment to the net shore drift system, and that do not experience long-term accretion)
- Modified (areas that have been altered to a state where it was unknown during mapping efforts whether or not sediment was it contributed)

- No appreciable drift (areas where there is no appreciable amount of sediment transport)

Glacial Outwash means the stratified detritus (chiefly sand and gravel) removed from a glacier by meltwater streams and deposited in front of or beyond the terminal moraine or along the margin of an active glacier.

Glacial Drift means drift transported by glacier or icebergs, and deposited directly on land or in the sea.

Glaciation means having been covered with a glacier or subject to glacial epochs in the past.

Glide means a gently flowing, calm reach of shallow water in a stream.

Gorge means a narrow, deep valley with nearly vertical rocky walls, enclosed by mountains, smaller than a canyon, and more steep-sided than a ravine.

Gradient means the degree of inclination, or rate of ascent or descent, of an inclined part of the earth's surface with respect to the horizontal; it is the steepness of a slope. It is expressed as a ratio (vertical to horizontal), a fraction (such as meters/ kilometers or feet/miles), a percentage (of horizontal distance), or an angle (in degrees).

Grading means the movement or redistribution of the soil, sand, rock, gravel, sediment, or other material on a site in a manner that alters the natural contour of the land.

Groundwater means all the water that exists beneath the land surface or beneath the bed of any stream, lake or reservoir, or other body of surface water.

Growth Management Act or GMA means RCW 36.70A and 36.70B, as amended.

- H -

Habitat means the natural environment in which an organism normally lives or occurs.

Hazardous Area means any shoreline area which is hazardous for intensive human use or structural development due to inherent and/or predictable physical conditions such as, but not limited to, geologically hazardous areas, frequently flooded areas, and coastal high hazard areas.

Hazardous Substance means any liquid, solid, gas, or sludge, including any material, substance, product, commodity, or waste, regardless of quantity, that exhibits any of the physical, chemical or biological properties described in WAC 173-303-090 or 173-303-100.

Headland means the source of a stream.

Headwater means the source and upper part of a stream, especially of a large stream or river, including the upper drainage basin.

Historic Site means those sites that are eligible or listed on the Washington Heritage Register, National Register of Historic Places or any developed historic registry formally adopted by a local government.

Hydric Soil means a soil that is saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions in the upper part. The presence of hydric soil shall be determined following the methods described in the Washington State Wetland Identification and Delineation Manual (RCW 36.70A.175).

Hydrologic Soil Groups means soils grouped according to their runoff-producing characteristics under similar storm and cover conditions. Properties that influence runoff potential are depth to seasonally high water table, intake rate and permeability after prolonged wetting, and depth to a low permeable layer. Hydrologic soil groups are normally used in equations that estimate runoff from rainfall, but can be used to estimate a rate of water transmission in soil. There are four hydrologic soil groups:

- Low runoff potential and a high rate of infiltration potential;
- Moderate infiltration potential and a moderate rate of runoff potential;
- Slow infiltration potential and a moderate to high rate of runoff potential; and
- High runoff potential and very slow infiltration and water transmission rates.

Hydrology means of or pertaining to the movement, distribution or quality of water on the earth.

Hydromodifications means the direct change of streambanks or channels that has the capacity to alter streamflow or habitat availability.

Hydrophytic Vegetation means macrophytic plant life growing in water or on a substrate that is at least periodically deficient in oxygen.

Hyporheic Zone means the saturated zone located beneath and adjacent to streams that contain some proportion of surface water from the surface channel mixed with shallow groundwater. The hyporheic zone serves as a filter for nutrients, as a site for macroinvertebrate production, is important in fish nutrition, and provides other functions related to maintaining water quality.

- I -

Igneous means rock or minerals that solidified from molten or partly molten material; magma.

Impairment means damage that compromises or reduces the strength or quality of the item. It is commonly used as a classification of water under the Clean Water Act meaning poor water quality.

Impervious Surface means a hard surface area that either prevents or retards the entry of water into the soil mantle. Common impervious surfaces may include, but are not limited to, rooftops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled macadam or other surfaces which similarly impede the natural infiltration of stormwater. Impervious surfaces do not include surface screated through proven low impact development techniques.

Infiltration means the downward entry of water into the immediate surface of soil.

Incised Stream means a stream that has cut its channel through the bed of the valley floor, as opposed to one flowing on a floodplain.

Intermittently means coming and going at intervals; not continuous.

Intertidal is the substratum from the extreme low water of spring tides to the upper limit of spray or influence of ocean-driven salts. It includes all land that is sometimes submerged, but sometimes exposed to air.

Inundation means spreading of water over land that is not normally submerged.

Invasive Species means a species that is (1) non-native (or alien) to a specific geographic area; and (2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health. Invasive species can be plants, animals, and other organisms (e.g., microbes). Human actions are the primary means of invasive species introductions.

- J -

Juvenile Salmon are immature salmon; fry.

- K -

- L -

Lacustrine means pertaining to lakes.

Lagoon means a narrow water body between the mainland and a barrier that parallels the shore.

Lake means a body of standing water in a depression of land or expanded part of a stream, of 20 acres or greater in total area. A lake is bounded by the OHWM, or where a stream enters the lake, the extension of the lake's OHWM within the stream.

Landslide is a general term covering a wide variety of mass movement landforms and processes involving the downslope transport, under gravitational influence, of soil and rock material en masse; it includes debris flows, debris avalanches, earthflows, mudflows, slumps, mudslides, rockslides, and rock falls.

Landslide Hazard Areas means areas that, due to a combination of site conditions like slope inclination and relative soil permeability, are susceptible to mass wasting.

Large Woody Debris or LWD means the large trees, sticks and branches that fall into streams and rivers. They can divert water and provide microhabitats for organisms.

Levee means a natural or artificial embankment on the bank of a stream designed to keep floodwaters from inundating adjacent land. Some levees have revetments on their sides.

Liquefaction means a phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking or other rapid loading.

Littoral means living on, or occurring on, the shore.

Littoral Drift means material, such as gravel and sand, which is moved along the shore by a littoral current.

- M -

Macrophytic Algae means algae that are distinguished by the differentiation of cells into complex tissues and organs similar to higher plants. These algae are usually attached to a substrate via a specialized holdfast.

Mainstem means the principal course of a stream.

Marsh means a low, flat wetland area on which the vegetation consists mainly of herbaceous plants such as cattails, bulrushes, tules, sedges, skunk cabbage or other hydrophytic plants. Shallow water usually stands on a marsh, at least during part of the year.

Mass Wasting means downslope movement of soil and rock material by gravity. This includes soil creep, erosion, and various types of landslides, not including bedload associated with natural stream sediment transport dynamics.

Mean Annual Flow means the average flow of a river or stream (measured in cubic feet per second) from measurements taken throughout the year. If available, flow data for the previous 10 years should be used in determining mean annual flow.

Meander means one of a series of regular curves, bends, loops, or windings in the course of a stream.

MHHW means Mean Higher High Water, a tidal datum. It is the average of the higher high water heights of each tidal day observed over the roughly 18 year cycle known as the “National Tidal Datum Epoch”. For stations with

time series shorter than 18 years, station data are compared with a nearby control tide station in order to derive a complete time series.

MLLW means Mean Lower Low Water; a tidal datum. It is the average of the lower low water heights of each tidal day observed over the roughly 18 year cycle known as the "National Tidal Datum Epoch". For stations with time series shorter than 18 years, station data are compared with a nearby control tide station in order to derive a complete time series.

Migration (salmonid) means the systematic movement of a salmon population from their natal freshwater streams, out to the open ocean, and back to the same stream where they hatched.

Mitigation means individual actions that may include a combination of the following measures, listed in order of preference:

- Avoiding an impact altogether by not taking a certain action or parts of actions;
- Minimizing impacts by limiting the degree or magnitude of an action and its implementation;
- Rectifying impacts by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating an impact over time by preservation and maintenance operations during the life of the action;
- Compensating for an impact by replacing or providing substitute resources or environments; and
- Monitoring the mitigation and taking remedial action when necessary.

Mooring means the location where a vessel can fasten to a fixed object such as a pier or quay, or to a floating object such as an anchor buoy.

- N -

Natal means pertaining to birth.

Nearshore Habitats lie along the shoreline and include the strip of shallow water and the land immediately adjacent to the shoreline.

Net Shore Drift is the long-term, overall effect of shore drift occurring over a period of time along a particular segment of marine shoreline. Net shore drift is typically described at a *drift cell* scale, with each drift cell including a sediment source (erosional bluff, river mouth), an area of sediment transport, and an area of sediment accumulation (accretion). Net shore drift is influenced by patterns of water movement along a coastline and patterns of wave-induced movement into a coastline.

Native Vegetation means plant species that are indigenous and historically found in the local area.

No Net Loss means the maintenance of the aggregate total of a local government's shoreline ecological functions. The no net loss standard requires that the impacts of shoreline development and/or use, whether permitted or exempt, must be identified and mitigated such that there are no resulting adverse impacts on ecological functions or processes.

Non-point Source means a diffuse source of contaminants, without a single point of origin, introduced into a receiving stream.

- O -

Off-channel Habitat means areas distinctly separate from the main channel that lie outside the main channel cross-sectional profile such as sloughs, meander cutoffs, and secondary or abandoned channels.

Open Space means any parcel or area of land or water not covered by structures, hard surfacing, parking areas and other impervious surfaces except for pedestrian or bicycle pathways, or sites dedicated for active or passive recreation, visual enjoyment or critical area development buffers.

Ordinary High Water Mark or OHWM means that mark that will be found by examining the bed and banks of a lake or stream and ascertaining where the presence and action of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland, in respect to vegetation as that condition exists on June 1, 1971, as it may naturally change thereafter, or as it may change thereafter in accordance with approved development. In any area where the OHWM cannot be found, the OHWM adjoining fresh water shall be the line of mean high water. For braided streams, the OHWM is found on the banks forming the outer limits of the depression within which the braiding occurs.

Overwater Structure means any manmade structure that hangs over a surface water body such as a dock, deck, bridge, or building.

Oxbow means a closely looping stream meander resembling the U-shaped frame embracing an ox's neck, having an extreme curvature such that only a neck of land is left between two parts of the stream.

- P -

Palustrine means wetlands that include inland marshes and swamps as well as bogs, fens, tundra and floodplains. Palustrine systems include any inland wetland which lacks flowing water, contains ocean-derived salts in concentrations of less than 0.05%, and is non-tidal.

Peat means an accumulation of partially decayed vegetation matter.

Pelagic Habitats are habitats that are found in zones of open sea or ocean; they are not near the coast.

Perched Aquifer means groundwater separated from an underlying body of groundwater by an unsaturated zone.

Perennial means present at all seasons of the year.

Permeability means the property or capacity of a porous rock, sediment, or soil for transmitting a fluid; it is a measure of the relative ease of fluid flow through a substrate.

Pilings means either wood, reinforced concrete or steel cylinders that are driven deep and embedded into the ground to serve as an intrinsic part of a deep foundation for a structure.

Plug means a mass of sediment filling the part of a stream channel abandoned by the formation of a cutoff.

Point Source means a stationary location or fixed facility from which contaminants are discharged; it is a single identifiable source of contamination.

Pool / riffle means an area of stream or river habitat, which is seemingly stagnant at the surface but in reality, water is flowing downstream. A riffle is an area where the water flows through the channel at a higher velocity due to a moderate gradient.

Pre-contact Materials means archeological items that originated prior to European contact.

Preservation means actions taken to ensure the permanent protection of existing, ecologically, culturally, or historically important areas, structures, or species that a local government has deemed worthy of long-term protection.

Priority Habitat means a habitat type with a unique or significant value to one or more species. An area classified and mapped as priority habitat must have one or more of the following attributes: comparatively high fish or wildlife densities; comparatively high fish or wildlife species diversity; fish spawning habitat; important wildlife habitat; important fish or wildlife seasonal range; important fish or wildlife movement corridors; rearing and foraging habitat; refuge; limited availability; high vulnerability to habitat alteration; unique or dependent species; or shellfish beds. A priority habitat may be described by its unique vegetation type or by a dominant plant species that is of primary importance to fish and wildlife (such as oak woodlands or eelgrass meadows). A priority habitat may also be described by a successional stage (such as old growth and mature forests). Alternatively, a priority habitat may consist of a specific habitat element (such as talus slopes, caves, snags) of key value to fish and wildlife. A priority habitat may contain priority and/or non-priority fish and wildlife (WAC 173-26-020(24).

Priority Species means wildlife species of concern due to their population status and their sensitivity to habitat alteration, as defined by the Washington Department of Fish and Wildlife.

Protection means the practice of conserving and guarding valued resources in order to preserve and ensure their existence in the future.

Properly Functioning Conditions or PFCs are the sustained presence of natural habitat-forming processes necessary for the long-term survival of the species through the full range of environmental variation (NMFS, 1996). Indicators of PFCs vary between different landscapes based on unique physiographic and geologic features. Since aquatic habitats are inherently dynamic, PFCs are defined by the persistence of natural processes that maintain habitat productivity at a level sufficient to ensure long-term survival (NMFS 1996). PFCs commonly include the following elements: water quality, habitat accessibility, the suitability of various habitat elements, channel condition and dynamics, and overall watershed conditions. A condition of “not properly functioning” would be one in which the natural habitat-forming processes have been impaired to the point where the long-term survival of the species is in question.

Public Access means the public's right to get to and use the State's public waters, the water/land interface and associated shoreline area. It includes physical access that is either lateral (areas paralleling the shore) or perpendicular (an easement or public corridor to the shore), and/or visual access facilitated by scenic roads and overlooks, viewing towers and other public sites or facilities.

- Q -

Quaternary means the geologic time period from the end of the Pliocene Epoch roughly 1.8 million years ago to the present.

- R -

Ravine means a small, narrow, deep depression, smaller than a gorge or a canyon but larger than a gully; it is usually carved by running water.

Reach means a segment of shoreline and associated planning area that is mapped and described as a unit (for purposes of inventorying conditions) due to homogenous (similar) characteristics that include land use and/or natural environment characteristics

Rearing Habitat means areas where juvenile fish grow and mature.

Recharge means the process involved in the absorption and addition of water from the unsaturated zone to groundwater.

Recreation means an experience or activity in which an individual engages for personal enjoyment and health. Most shore-based recreation is outdoor recreation such as: fishing, hunting, clamming, beach combing, and rock climbing; various forms of boating, swimming, hiking, bicycling, horseback riding, camping, picnicking, watching or

recording activities such as photography, painting, bird watching or viewing of water or shorelines, nature study and related activities.

Recruitment means the number of juvenile fish that survive to a certain size or age class.

Redd refers to a nest built by salmon in a depression at the shallow edge of a stream where the female lays her eggs. Redds are often built in riffles or downstream of deep pools.

Reestablishment as it pertains to natural resources means measures taken to intentionally restore an altered or damaged natural feature or process including:

- Active steps taken to restore damaged wetlands, streams, protected habitat, and/or their buffers to the functioning condition that existed prior to an unauthorized alteration;

- Actions performed to reestablish structural and functional characteristics of the critical area that have been lost by alteration, past management activities, or other events; and

- Restoration of wetland functions and values on a site where wetlands previous existed, but are no longer present due to lack of water or hydric soils.

Refuge means a place that provides shelter or protection from danger or distress.

Rehabilitation means a type of restoration action intended to repair natural or historic functions and processes. Activities could involve breaching a dike to reconnect wetlands to a floodplain or other activities that restore the natural processes, habitats or structures.

Resident Fish means a fish species that completes all stages of its life cycle within fresh water and frequently within a local area.

Residential Development means buildings, earth modifications, subdivision and use of land primarily for human residence including, but not limited to, single-family and multifamily dwellings, mobile homes and mobile home parks, boarding homes, family daycare homes, adult family homes, retirement and convalescent homes, together with accessory uses common to normal residential use. Camping sites or clubs, recreational vehicle parks, motels, hotels and other transient housing are not included in this definition.

Restore, Restoration or Ecological Restoration means the reestablishment or upgrading of impaired ecological processes or functions. This may be accomplished through measures including, but not limited to, revegetation, removal of intrusive structures and removal or treatment of toxic materials. Restoration does not imply a requirement for returning ecological processes, functions or areas to aboriginal or pre-European settlement conditions.

Retention means the portion of rainfall that does not escape a drainage basin as surface runoff; some of the water is retained in local soils and aquifers.

Revetment means a facing (as of stone or concrete) to sustain an embankment.

Riprap means dense, hard, angular rock that can be used for revetments or other flood control works.

Riparian Corridor or Riparian Zone means the area adjacent to a waterbody (stream or lake) that contains vegetation that influences the aquatic ecosystem, nearshore area and/or fish and wildlife habitat by providing shade, fine or large woody material, nutrients, organic debris, sediment filtration, and terrestrial insects (prey production). Riparian areas include those portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e., zone of influence). Riparian zones provide important wildlife habitat. They provide sites for foraging, breeding and nesting; cover to escape predators or weather; and corridors that connect different parts of a watershed for dispersal and migration.

Riparian Vegetation means vegetation that tolerates and/or requires moist conditions and periodic free flowing water, thus creating a transitional zone between aquatic and terrestrial habitats which provides cover, shade and food sources for aquatic and terrestrial insects for fish species. Riparian vegetation and root systems stabilize streambanks, attenuate high water flows, provide wildlife habitat and travel corridors, and provide a source of limbs and other woody debris to terrestrial and aquatic ecosystems, which, in turn, stabilize streambeds.

River Mile means the distance measured from the mouth of a river, traveling upstream.

Riverine means located on or inhabiting the banks of a river.

Runoff means surface waters that flow overland during rain events and storms.

- S -

Salmon or Salmonid is the common name for several species of fish of the family Salmonidae. Typically, salmon are anadromous; they are born in fresh water, migrate to the ocean, then return to fresh water to reproduce.

Scour means the powerful and concentrated clearing and digging action of flowing water or ice, especially the downward erosion by stream water in sweeping away mud and silt on the outside curve of a bend, or during time of floods.

Scrub-shrub Wetland means a class of wetland that is in a transition to becoming a forested wetland. It can have a variety of water regimes and is typified by a mix of woody and shrublike vegetation less than 20 feet tall.

Sediment Load means the material that is moved or carried in a fluid, such as in streams, waves, tides, and currents.

Sediment Transport is the movement and carrying away of sediment by natural agents, especially the conveyance by stream.

Sedimentary Rock means rock resulting from the consolidation of loose sediment that has accumulated in layers.

Seep means an area, generally small, where water percolates slowly to the land surface.

Seismic means of, subject to, or caused by an earthquake.

Shoreline Environment Designation is a mechanism identifying specific shoreline areas for regulatory purposes as specified in WAC 173-26-211.

Shoreline Modification means any human activity that changes the structure, hydrology, habitat, and/or functions of a shoreline. Bulkheads, piers, docks, shoreline stabilization systems, berms, and dikes are all examples of shoreline modifications

Shoreline Planning Area means to integrate the land use patterns, physical and biological characterizations, and relevant regulations and policies to help managers delineate and categorize development opportunities for a shoreline.

Shoreline Stabilization is structural or non-structural modifications to the existing shoreline intended to reduce or prevent erosion of uplands or beaches. They are generally located parallel to the shoreline at or near the OHWM.

Shoreline Vegetation means all of the plants that inhabit a given shoreline. Given their close proximity to sea spray, many marine shoreline plants are salt tolerant.

Shorelands or Shoreland Areas mean those lands extending landward for 200 feet in all directions as measured on a horizontal plane from the OHWM; floodways and contiguous floodplain areas landward 200 feet from such

floodways; and all wetlands and river deltas associated with the streams, lakes and tidal waters which are subject to the provisions of Chapter 90.58 RCW.

Shorelines are all of the water areas of the state as defined in RCW 90.58.030, including reservoirs and their associated shorelands, together with the lands underlying them except:

- Shorelines of statewide significance;

- Shorelines on segments of streams upstream of a point where the mean annual flow is 20 cubic feet per second (cfs) or less and the wetlands associated with such upstream segments; and

- Shorelines on lakes less than 20 acres in size and wetlands associated with such small lakes.

Shoreline Administrator means the director of planning or development services of a local government, or her/his designee, who performs the review functions required in the Shoreline Master Program.

Shoreline Jurisdiction means all shorelines of the state and shorelands.

Shorelines of Statewide Significance means the shorelines identified in RCW 90.58.030 which because of their elevated status require the optimum implementation of the Shoreline Management Act's policies.

Shorelines of the State means the total of all "shorelines" and "shorelines of statewide significance" within the state subject to the Shoreline Management Act and its implementing mechanism, the Shoreline Master Program.

Site means a defined area that can include a parcel or combination of contiguous parcels, or right-of-way under the applicant's ownership.

Slope means the inclined surface of any part of the earth's surface, delineated by establishing its toe and top and measured by averaging the inclination over at least 10 feet of vertical relief.

Smolt means a young salmon or sea trout, about two years old, that is at the stage of development where it assumes the silvery color of the adult and is ready to migrate to the sea.

Smoltification means the process salmon undergo which enables them to adapt from fresh water to salt water as they migrate from freshwater streams and rivers to the ocean.

Snag means a standing, partly or completely dead tree; often it is defined as missing a top or most of the smaller branches in forest ecology, while in freshwater ecology, it refers to trees, branches and other pieces of naturally occurring wood found in a sunken form in rivers and streams.

Soft-shore Armoring means techniques engineered to limit the amount of shoreline erosion by mimicking natural processes such as planting native vegetation, placement of large woody debris, or beach nourishment.

Species of Concern is an informal term, not defined in the federal Endangered Species Act. The term commonly refers to species that are declining or appear to be in need of concentrated conservation actions. Many agencies and organizations maintain lists of these at-risk species.

Spring means a place where groundwater flows naturally from a rock or the soil onto the land surface or into a surface waterbody.

Stormwater means water that accumulates on land as a result of storms and can include runoff from urban areas such as roads and roofs.

Streams are those areas where surface waters produce a defined channel or bed. A defined channel or bed is an area that demonstrates clear evidence of the annual passage of water and includes, but is not limited to, bedrock channels,

gravel beds, sand and silt beds, and defined channel swales. The channel or bed need not contain water year-round. This definition includes drainage ditches or other artificial watercourses where natural streams existed prior to human alteration, and/or the waterway is used by anadromous or resident salmonid or other fish populations.

Substantially Degrade means to cause significant ecological impact.

Substrate means the underlying bed layer that makes up the bottom of a lake or stream, frequently composed of rock, gravel, sand, organic material, or a combination of these materials.

Suspended Solids means insoluble solids that either float on the surface of, or are in suspension in, water, wastewater, or other liquids.

- T -

Talus means rock fragments of any size or shape (usually coarse or angular) derived from and lying at the base of a cliff or very steep, rocky slope.

Threatened means listed and protected under the federal Endangered Species Act, indicating that the described species is likely to become endangered in the foreseeable future.

Tidal means related to or affected by the tides, which are a daily shift in local water heights due to the gravitational pull of the moon.

Toe means the lowest part of a slope or cliff; the downslope end of an alluvial fan, landslide, etc.

Top means the top of a slope; or the highest point of contact above a landslide hazard area.

Total Maximum Daily Load or TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet established water quality standards, and an allocation of that amount to the pollutant's sources. Water quality standards are set by States, Territories, and Tribes. They identify the uses for each waterbody, for example, drinking water supply, contact recreation (swimming), and aquatic life support (fishing), and the scientific criteria to support that use. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and non-point sources.

Tributary means a stream feeding, joining, or flowing into a larger stream or into a lake.

Trophic means of or relating to nutrition. “Trophic level” means the position that an organism occupies in a food chain.

Turbidity means the state, condition, or quality of opaqueness or reduced clarity of a fluid due to the presence of suspended matter.

Type S, F, Np or Ns means water typing system for State of Washington waters. Streams are classified and typed according to WAC 222-16-031 as Type S Waters (Shorelines of the State), Type F Waters (Fish bearing but non-shorelines), Type Np (Non fish bearing, perennial) or Type Ns (Non-fish bearing stream with seasonal or intermittent flow).

- U -

Unconsolidated Material means loosely arranged, not stratified.

Unincorporated means a region of land that is not a part of any municipality. To "incorporate" in this context means to form a municipal corporation, i.e. a city or town with its own government. Thus, an unincorporated area is usually not subject to or taxed by a city government but may be by a county government.

Upland means dry lands landward of OHWM.

Urban Growth Area (UGA) means a local government's regulatory measure for delineating an area for urban growth over a period of time. Land within UGA boundaries is made available for urban levels of development, while land outside the UGA remains primarily for rural farming, forestry, or low-density residential development.

Utilities means all lines and facilities used to distribute, collect, transmit, or control electrical power, natural gas, petroleum products, information (telecommunications), water, and sewage.

- V -

Vegetative Stabilization means planting of vegetation to retain soil and retard erosion, reduce wave action, and retain bottom materials. It also means utilization of temporary structures or netting to enable plants to establish themselves in unstable areas.

Volcaniclastic means all volcanic particles regardless of their origin.

- W -

Water-dependent Use means a use that requires direct access to the water to accomplish its primary function. In other words, 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. Examples include commercial fishing, marinas, aquaculture, shipbuilding yard, ferry terminal.

Water-enjoyment Use means a use that does not require access to the water, but is enhanced by a waterfront location, such as a restaurant or aquarium. This includes uses that facilitate public access to the shoreline as a primary characteristic of the use; or uses that provide for recreational use or aesthetic enjoyment of the shoreline for a substantial number of people. 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 foster shoreline enjoyment.

Water-oriented Use means a use that is water-dependent, water-related, or water-enjoyment, or a combination of such uses.

Water-related Use means a use that does not require direct access to the water, but provides goods or services associated with water-dependent uses (e.g., boater supply, kayak rental). In other words, 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:

(a) 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

(b) 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.

Waterbody means a body of still or flowing water, identified at its outer limits by the OHWM.

Water Quality means the characteristics of water, including flow or amount and related physical, chemical, aesthetic, recreation-related, and biological characteristics.

Watershed means a geographic region within which water drains into a particular river, stream or body of water.

Watershed Characterization means systematically describing a watershed (commonly using GIS) based upon available data including but not limited to vegetation type and cover, water quality, biological processes, habitat connectivity, aquatic integrity, development, nutrients, etc.

Weir means a structure in a stream or river for measuring or regulating streamflow.

Wetlands means areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to, irrigation and drainage ditches, grass lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from non-wetland areas to mitigate the conversion of wetlands.

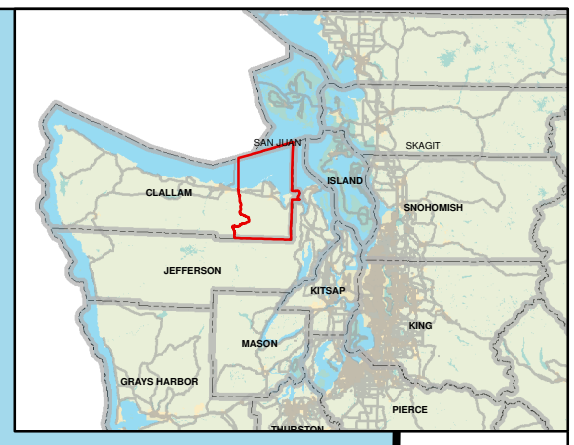
Wetland Buffer means a designated area contiguous or adjacent to a wetland that is required for the continued maintenance, function, and ecological stability of the wetland.

Wetland Class means the general appearance of the wetland based on the dominant vegetative life form or the physiography and composition of the substrate. The uppermost layer of vegetation that possesses an aerial coverage of 30 percent or greater of the wetland constitutes a wetland class. Multiple classes can exist in a single wetland. Types of wetland classes include forest, scrub/shrub, emergent, and open water.

Windthrow means a natural process by which trees are uprooted or sustain severe trunk damage by the wind.

Water Resource Inventory Area (WRIA) means and refers to watersheds within the State of Washington.

APPENDIX A:
SHORELINE INVENTORY MAP FOLIO



Strait of Juan de Fuca

MR-5

Dungeness Spit

Dungeness Bay

MR-4

1.

Green Point

MR-6

Dungeness River Reach 01

Kulakala Point

MR-3

Gibson Spit

MR-1

Diamond Point

Old Olympic Hwy

101

Us Hwy 101

Carlsborg Rd

Cays Rd

Port Williams Rd

Dungeness River Reach 02

McDonald Creek Reach 01

Morse Creek Reach 01

Sequim

Sequim Bay

MR-2

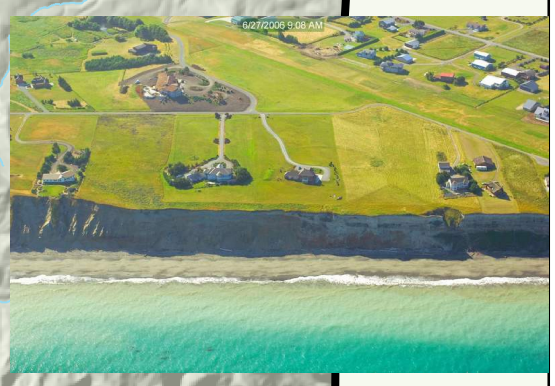
101

Dungeness River Reach 03

Canyon Creek Reach 01

Dungeness River Reach 04

1.



Gray Wolf River Reach 01

Dungeness River Reach 05

Olympic National Park

Silver Creek Reach 01

Dungeness River Reach 06

Little Quilcene River Reach 01

Royal Creek Reach 01

N

0 1 2 4 Miles

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CLALLAM COUNTY

East Region - Shoreline Master Program (SMP) Update
Map 1a Physical Characteristics

Legend

- Planning Region
- Reach Breaks
- 20 cfs upstream limits (Ecology, USGS)
- SMA Streams
- SMA Stream Area
- Reservation Lands (WSDOT, 2007)
- Olympic National Park
- Public Access (Placeholder)
- Major Roads

SSHIAP Stream Confinement
(NW Indian Fisheries & WDFW, 2002)

- Confined
- Moderately Confined

Feeder Bluffs (GCS, 2011)

- Feeder bluff
- Feeder bluff talus
- Feeder bluff exceptional

Clallam Co. Drift Cell (CGS, 2011)

Cell Type

- Transport Zone
- Divergence Zone
- No Appreciable Drift
- Undetermined

Shoreform Type (PSNERP, 2009)

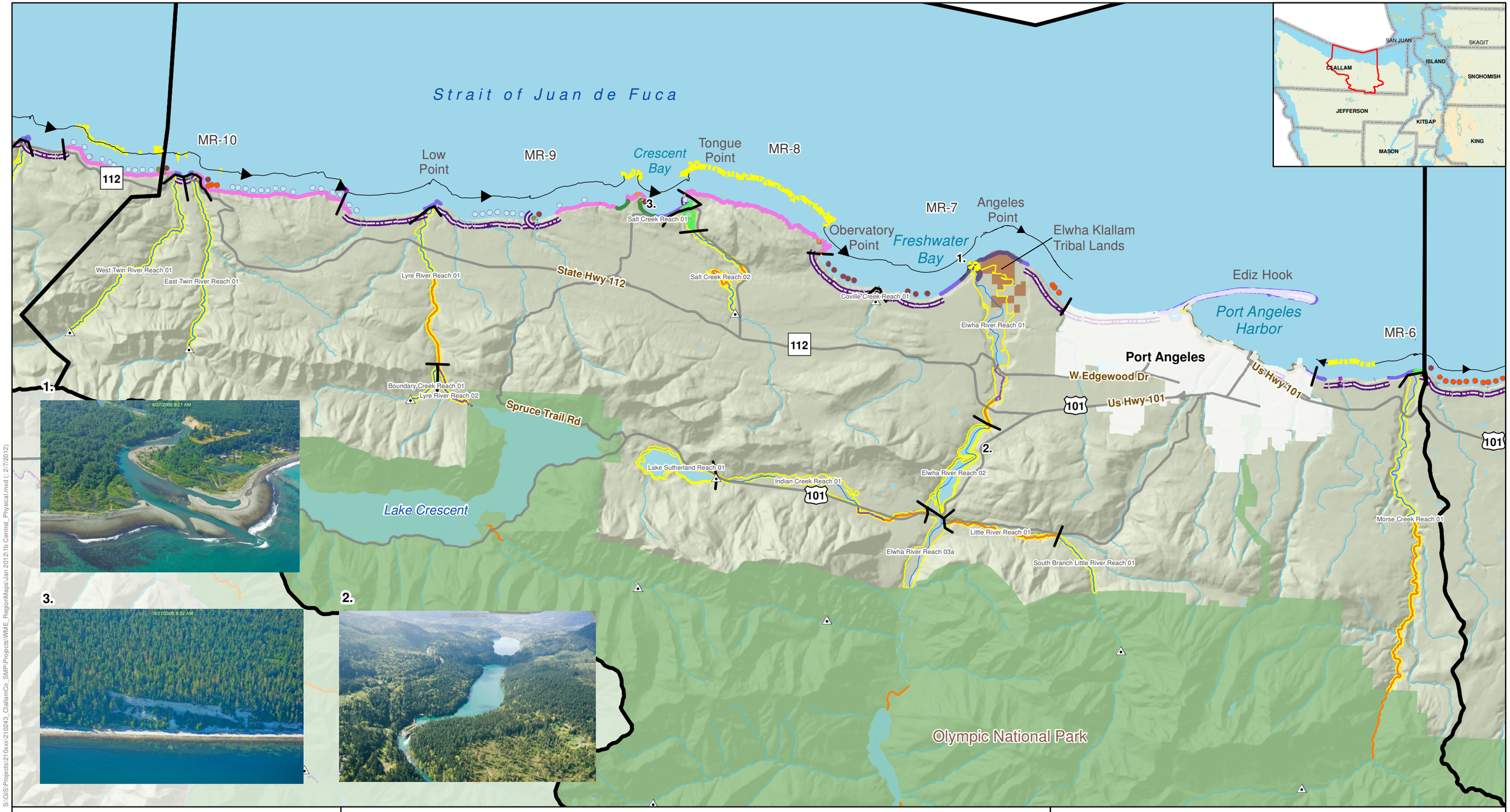
- Artificial
- Barrier Beach
- Barrier Estuary
- Barrier Lagoon
- Bluff-Backed Beach
- Closed Lagoon Marsh
- Delta
- Open Coastal Inlet
- Pocket Beach
- Plunging Rocky Shoreline
- Rocky Platform

Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

NOTE: Inventory includes only portions of WRIAs 17, 18, and 19 under county jurisdiction. Federal Land and Incorporated Areas are excluded. WRIA 20 is covered separately.

ESA



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CLALLAM COUNTY

Central Region - Shoreline Master Program (SMP) Update
Map 1b - Physical Characteristics

Legend

- Planning Region
- Reach Breaks
- 20 cfs upstream limits (Ecology, USGS)
- SMA Stream Area
- SMA Streams
- Reservation Lands (WSDOT, 2007)
- Olympic National Park
- Major Roads

SSHIAP Stream Confinement (NW Indian Fisheries & WDFW, 2002)

- Confined
- Moderately Confined

Feeder Bluffs (GCS, 2011)

- Feeder bluff
- Feeder bluff talus
- Feeder bluff exceptional

Clallam Co. Drift Cell (CGS, 2011) Cell Type

- Transport Zone
- Divergence Zone
- No Appreciable Drift
- Undetermined

Shoreform Type (PSNERP, 2009)

- Artificial
- Barrier Beach
- Barrier Estuary
- Barrier Lagoon
- Bluff-Backed Beach
- Closed Lagoon Marsh
- Delta
- Open Coastal Inlet
- Pocket Beach
- Plunging Rocky Shoreline
- Rocky Platform

0 1.5 3 6 Miles

N

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Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

ESA

Strait of Juan de Fuca

Kydaka Point

Sekiu Point

Clallam Bay

Slip Point

Pillar Point

MR-18

MR-17

MR-16

MR-15

MR-14

MR-13

MR-12

MR-11

MR-10

112

113

Bullman Creek Reach 01

Hoko River Reach 01

Hoko River Reach 02

Hoko River Reach 03

Hoko River Reach 04

Hoko River Reach 05

Hoko River Reach 06

Hoko River Reach 07

Hoko River Reach 08

Sekiu River Reach 01

South Fork Sekiu River Reach 01

North Fork Sekiu River Reach 01

Little Hoko River Reach 01

Brownes Creek Reach 01

North Branch Herman Creek Reach 01

Herman Creek Reach 02

Herman Creek Reach 01

Ellis Creek Reach 01

Old Royal Creek Reach 01

Clallam River Reach 01

Clallam River Reach 02

Clallam River Reach 03

Clallam River Reach 04

Charlie Creek Reach 01

Green Creek Reach 01

Pysht River Reach 01

Pysht River Reach 02

Pysht River Reach 03

Pysht River Reach 04

South Fork Pysht River Reach 01

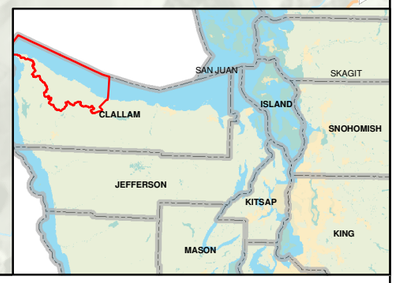
South Fork Pysht River Reach 02

Salmonberry Creek Reach 01

Deep Creek Reach 01

West Twin River Reach 01

Bear Creek Reach 01



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CLALLAM COUNTY

West Region - Shoreline Master Program (SMP) Update
Map 1c - Physical Characteristics

Legend

- Planning Region
- Reach Breaks
- 20 cfs upstream limits (Ecology, USGS)
- SMA Stream Area
- SMA Streams
- Reservation Lands (WSDOT, 2007)
- Olympic National Park
- Major Roads

SSHIAP Stream Confinement (NW Indian Fisheries & WDFW, 2002)

- Confined
- Moderately Confined

Feeder Bluffs (GCS, 2011)

- Feeder bluff
- Feeder bluff talus
- Feeder bluff exceptional

Clallam Co. Drift Cell (CGS, 2011) Cell Type

- Divergence Zone
- Transport Zone
- No Appreciable Drift
- Undetermined

Shoreform Type (PSNERP, 2009)

- Artificial
- Barrier Beach
- Barrier Estuary
- Barrier Lagoon
- Bluff-Backed Beach
- Closed Lagoon Marsh
- Delta
- Open Coastal Inlet
- Pocket Beach
- Plunging Rocky Shoreline
- Rocky Platform

0 1 2 4 Miles

N

NOTE: Inventory includes only portions of WRIAs 17, 18, and 19 under county jurisdiction. Federal Land and Incorporated Areas are excluded. WRIA 20 is covered separately.

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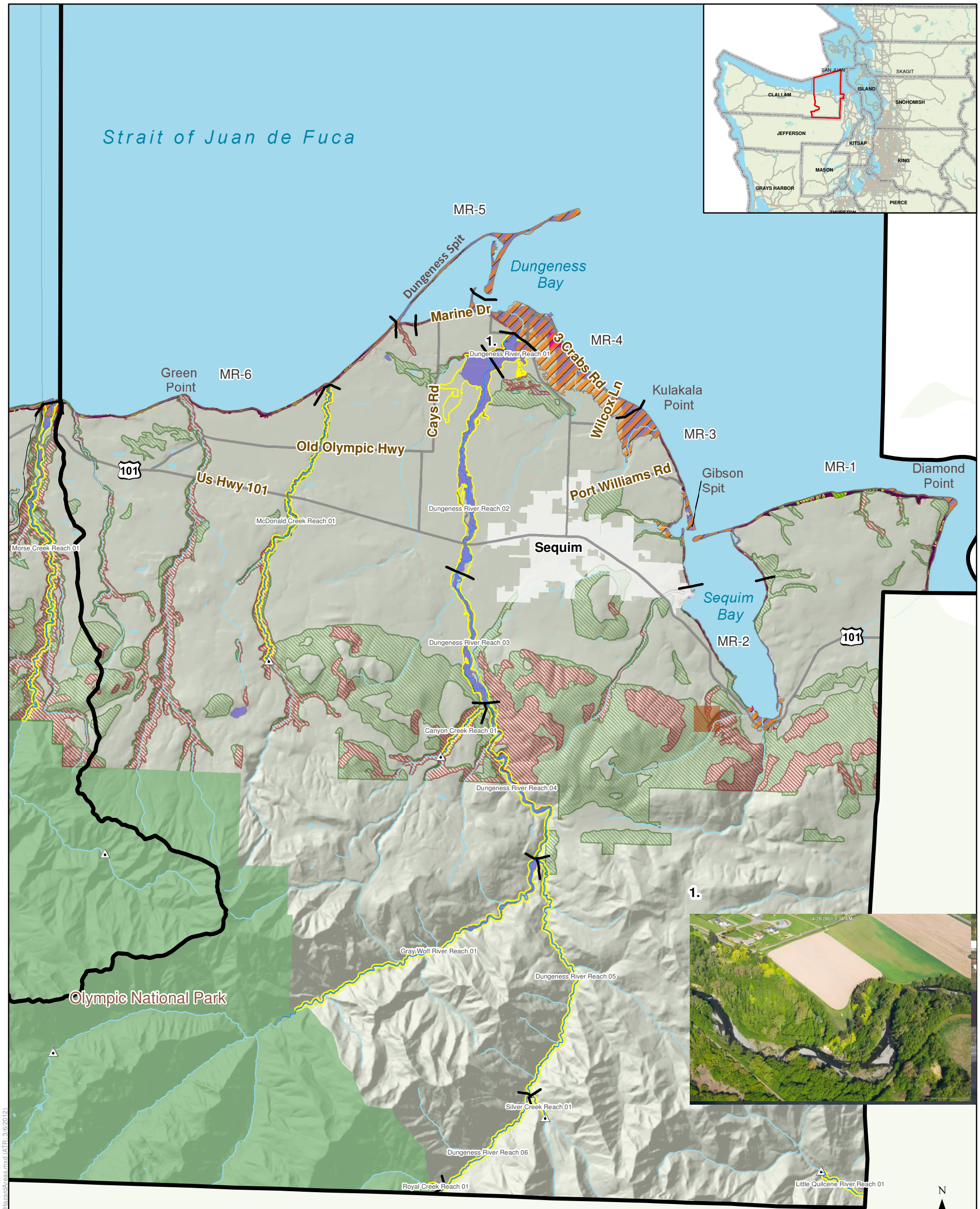
Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

ESA



CLALLAM COUNTY

East Region - Shoreline Master Program (SMP) Update Map 2a Hazard Areas

Legend

- Planning Region
- Reach Breaks
- SMA Stream Area
- SMA Streams
- Major Roads

Shoreline Slope Stability (Ecology)

- Unstable-recent slide
- Unstable-old slide
- Unstable slope
- Modified

- 20 cfs upstream limits (Ecology, USGS)
- Tsunami Hazard Areas (Clallam Co)
- 1% Chance Annual Flood (FEMA)
- Reservation Lands (WSDOT, 2007)
- Olympic National Park

Geohazards (Clallam Co.)

- Erosion
- Landslide

Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

NOTE: Inventory includes only portions of WRIAs 17, 18, and 19 under county jurisdiction. Federal Land and Incorporated Areas are excluded. WRIA 20 is covered separately.

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Strait of Juan de Fuca
MR-10
MR-9
MR-8
MR-7
MR-6
Low Point
Crescent Bay
Tongue Point
Obervatory Point
Freshwater Bay
Angeles Point
Elwha Klallam Tribal Lands
Ediz Hook
Port Angeles Harbor
112
101
West Twin River Reach 01
East Twin River Reach 01
Lyre River Reach 01
Lyre River Reach 02
Boundary Creek Reach 01
State Hwy 112
Salt Creek Reach 01
Salt Creek Reach 02
Elwha River Reach 01
Elwha River Reach 02
Elwha River Reach 03
Port Angeles
W Edgewood Dr
S N St
W 5th St
S C St
W 8th St
E 8th St
Black Diamond Rd
Spruce Trail Rd
Lake Sutherland Reach 01
Indian Creek Reach 01
Little River Reach 01
Little River Rd
Morse Creek Reach 01
South Branch Little River Reach 01
Lake Crescent
Olympic National Park

CLALLAM COUNTY
Central Region - Shoreline Master Program (SMP) Update
Map 2b - Hazard Areas

Legend

- Planning Region Boundary
- Reach Breaks
- SMA Stream Area
- SMA Streams
- Major Roads
- Reservation Lands (WSDOT, 2007)
- Olympic National Park
- 20 cfs upstream limits (Ecology, USGS)
- Tsunami Hazard Areas (Clallam Co)
- 1% Chance Annual Flood (FEMA)

Geohazards (Clallam Co.)

- Erosion
- Landslide

Shoreline Slope Stability (Ecology)

- Unstable-recent slide
- Unstable-old slide
- Unstable slope
- Modified

0 1 2 4 Miles

N

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Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

ESA

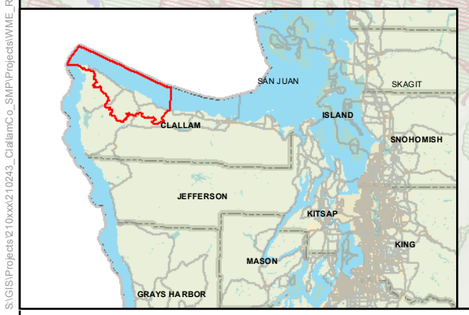
Strait of Juan de Fuca

MR-18
MR-17
MR-16
MR-15
MR-14
MR-13
MR-12
MR-11
MR-10

Kydaka Point
Sekiu Point
Clallam Bay
Slip Point
Pillar Point

112
113

Bullman Creek Reach 01
Hoko River Reach 01
Hoko River Reach 02
Hoko River Reach 03
Hoko River Reach 04
Hoko River Reach 05
Hoko River Reach 06
Hoko River Reach 07
Hoko River Reach 08
Little Hoko River Reach 01
Hoko Ozette Rd
Sekiu River Reach 01
North Fork Sekiu River Reach 01
South Fork Sekiu River Reach 01
Browns Creek Reach 01
North Branch Herman Creek Reach 01
Old Royal Creek Reach 01
Herman Creek Reach 01
Herman Creek Reach 02
Ellis Creek Reach 01
Bear Creek Reach 01
Clallam River Reach 01
Clallam River Reach 02
Clallam River Reach 03
Clallam River Reach 04
Last Creek Reach 01
Charlie Creek Reach 01
Pysht River Reach 01
Pysht River Reach 02
Pysht River Reach 03
Pysht River Reach 04
Green Creek Reach 01
South Fork Pysht River Reach 01
South Fork Pysht River Reach 02
Deep Creek Reach 01
Salmonberry Creek Reach 01



CLALLAM COUNTY

West Region - Shoreline Master Program (SMP) Update
Map 2c - Hazard Areas

Legend

- Planning Region Boundary
- Reach Breaks
- SMA Stream Area
- SMA Streams
- Major Roads
- Reservation Lands (WSDOT, 2007)
- Olympic National Park
- 20 cfs upstream limits (Ecology, USGS)
- Tsunami Hazard Areas (Clallam Co)
- 1% Chance Annual Flood (FEMA)

Geohazards (Clallam Co.)

- Erosion
- Landslide

Shoreline Slope Stability (Ecology)

- Unstable-recent slide
- Unstable-old slide
- Unstable slope
- Modified

0 1 2 4 Miles

N

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Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

ESA

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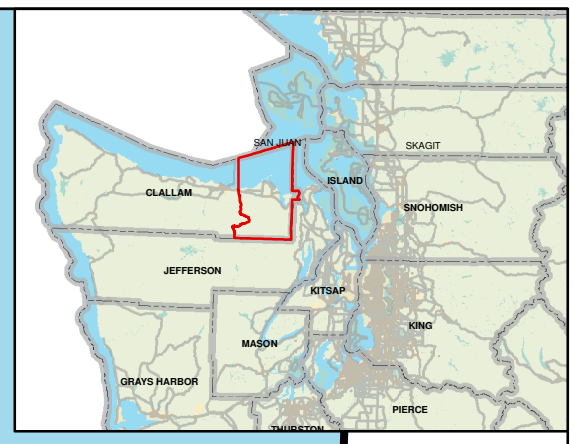


Strait of Juan de Fuca

MR-5

Dungeness Spit

Dungeness Bay

MR-4

Marine Dr

Dungeness River Reach 01

3 Crabs Rd

Green Point

MR-6

Cays Rd

Wilcox Ln

Kulakala Point

MR-3

Old Olympic Hwy

CHMF, HMS, CHSP, COHO, PINK, STWI

Sequim Dungeness Way

Port Williams Rd

Gibson Spit

MR-1

Diamond Point

101

COHO, STSU, STWI

Carlsborg Rd

Dungeness River Reach 02

McDonald Creek Reach 01

Us Hwy 101

Sequim

COHO, STSU, STWI

CCT, COHO, DBT, PINK, SOCK, STSU, STWI

Sequim Bay

MR-2

Dungeness River Reach 03

COHO, DBT, PINK

Canyon Creek Reach 01

Dungeness River Reach 04

Gray Wolf River Reach 01

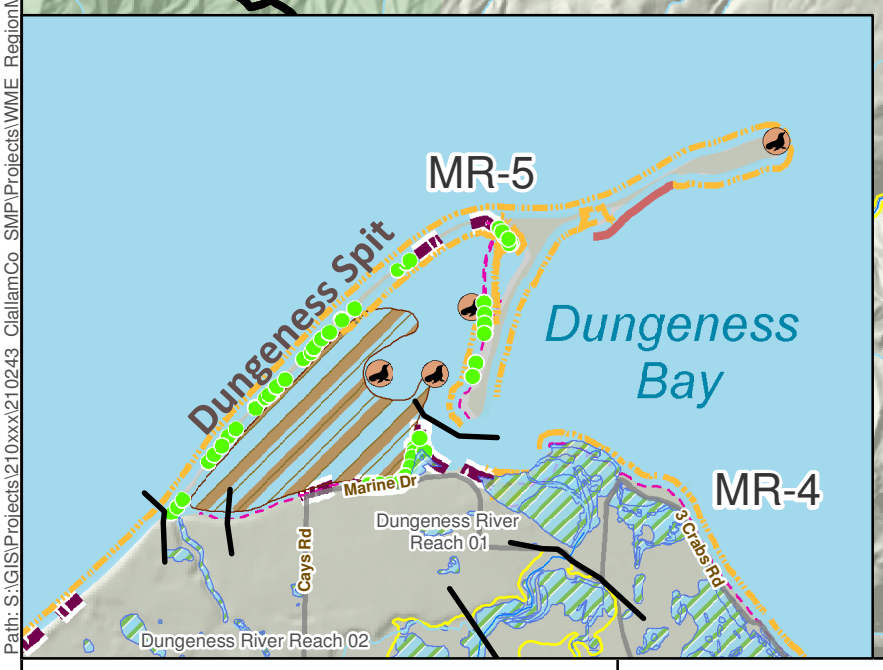
Dungeness River Reach 05

Silver Creek Reach 01

Dungeness River Reach 06

N

0 1 2 4 Miles



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CLALLAM COUNTY

East Region - Shoreline Master Program (SMP) Update
Map 3a Ecological Characteristics - Marine

Legend

- Planning Region
- 20 cfs upstream limits (Ecology, USGS)
- SMA Streams
- SMA Stream Area
- Reach Breaks
- Reservation Lands (WSDOT, 2007)
- Olympic National Park
- Major Roads
- Wetlands (Clallam Co & NWI)
- Herring Holding Areas
- Herring Spawing Areas
- Marine Mammal Haulout Area (WDFW, 2010)
- Sand Lance Spawning (WDFW, 2010)
- Smelt Spawning Areas (WDFW, 2010)

WDNR Kelp

- CONTINUOUS
- PATCHY

WDNR Eelgrass

- CONTINUOUS
- PATCHY

Priority Fish Distribution (WDFW, 2010)

- Presence/Migration
- Known Juvenile Rearing
- Known Spawning

CCT, Resident Cutthroat
CHFA, Fall Chinook
CHMF, Fall Chum
CHMS, Summer Chum
CHSP, Spring Chinook
COHO, Coho Salmon
DBT, Dolly Varden , Bull Trout
PINK, Pink Salmon
RBT, Rainbow Trout
SOCK, Sockeye
STSU, Summer Steelhead
STWI, Winter Steelhead

Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

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ESA

1.

2.

Strait of Juan de Fuca

Crescent Bay

MR-10

MR-9

MR-8

MR-7

MR-6

Obervatory Point

Freshwater Bay

Angeles Point

Elwha Klallam Tribal Lands

Ediz Hook

Port Angeles Harbor

Port Angeles

West Twin River Reach 01

COHO

CCT, CHMF, COHO, STSU, STWI

COHO, STWI

CHMF, COHO, STWI

CHMF, COHO, STSU, STWI

East Twin River Reach 01

Lyre River Reach 01

CCT, CHFA, CHMF, RBT, STSU

CHMF, COHO, STWI

State Hwy 112

Salt Creek Reach 01

COHO

CCT, CHFA, CHMF

Salt Creek Reach 02

COHO, STWI

Coville Creek Reach 01

Coville Creek

CCT, CHMF, STSU, STWI

COHO

Elwha River Reach 01

CHFA, COHO

CCT, CHFA, CHMF, CHSP, COHO, DBT, PINK, RBT, STSU, STWI

CHFA, CHMF, COHO, PINK, SOCK, STWI

W Edgewood Dr

Morse Creek Reach 01

CHFA, CHMF, COHO, PINK, STWI

Hwy 101

CCT, CHFA, CHMF, CHSP, COHO, DBT, PINK, RBT, STSU, STWI

N

0 0.5 1 2 Miles

SAN JUAN ISLAND

CLALLAM

JEFFERSON

KITSAP

1.

2.

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CLALLAM COUNTY

Central Region - Shoreline Master Program (SMP) Update

Map 3b - Marine Ecological Characteristics

Legend

- Planning Region Boundary
- SMA Stream Area
- Reach Breaks
- SMA Streams
- 20 cfs upstream limits (Ecology, USGS)
- Major Roads
- Reservation Lands (WSDOT, 2007)
- Olympic National Park
- Wetlands (Clallam Co & NWI)

WDNR Eelgrass

- CONTINUOUS
- PATCHY

WDNR Kelp

- CONTINUOUS
- PATCHY

- Sand Lance Spawning (WDFW, 2010)
- Herring Spawing Areas
- Herring Holding Areas
- Smelt Spawning Areas (WDFW, 2010)
- Marine Mammal Haulout Area (WDFW, 2010)

Priority Fish Distribution (WDFW, 2010)

- Presence/Migration
- Known Juvenile Rearing
- Known Spawning

CCT, Resident Cutthroat
CHFA, Fall Chinook
CHMF, Fall Chum
CHMS, Summer Chum
CHSP, Spring Chinook
COHO, Coho Salmon
DBT, Dolly Varden , Bull Trout
PINK, Pink Salmon
RBT, Rainbow Trout
SOCK, Sockeye
STSU, Summer Steelhead
STWI, Winter Steelhead

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Map data shown here are property of the listed sources. Inaccuracies may exist, and ESA implies no warranties or guarantees regarding any aspect of data depiction.

Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

ESA

1.

Strait of Juan de Fuca

MR-18

MR-17

MR-16

MR-15

MR-14

Kydaka Point

Sekiu Point

Clallam Bay

Slip Point

Bullman Creek Reach 01

COHO, STWI

CHFA, CHMF

CHFA, COHO

CHFA, CHMF, COHO, STWI

Sekiu River Reach 01

CCT, STWI

Hoko River Reach 01

Hoko River Reach 02

State Hwy 112

CHFA, CHMF, COHO, STWI

CHFA, CHMF, COHO, STWI

Little Hoko River Reach 01

CCT, CHFA, CHMF, COHO, STWI

CCT

Clallam River Reach 01

CHMF, COHO, STWI

Last Creek Reach 01

Clallam River Reach 02

CCT, CHMF, STWI

Clallam River Reach 03

Charlie Creek Reach 01

COHO

0 0.5 1 2 Miles

N

2.

Strait of Juan de Fuca

MR-14

MR-13

MR-12

MR-11

MR-10

Pillar Point

Pysht River Reach 01

CHFA, COHO

CHFA, CHMF, COHO, STWI

Pysht River Reach 02

CCT, CHFA, CHMF, STWI

State Hwy 112

CHFA, COHO, STWI

Deep Creek Reach 01

CCT, CHFA, CHMF, COHO, STWI

COHO

0 0.5 1 2 Miles

N

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CLALLAM COUNTY

West Region - Shoreline Master Program (SMP) Update

Map 3c - Marine Ecological Characteristics

Legend

- Planning Region Boundary
- SMA Stream Area
- Reach Breaks
- SMA Streams
- 20 cfs upstream limits (Ecology, USGS)
- Major Roads
- Reservation Lands (WSDOT, 2007)
- Olympic National Park
- **WDNR Eelgrass**
  - CONTINUOUS
  - PATCHY
- **WDNR Kelp**
  - CONTINUOUS
  - PATCHY
- Wetlands (Clallam Co & NWI)
- Sand Lance Spawning (WDFW, 2010)
- Herring Spawing Areas
- Herring Holding Areas
- Smelt Spawning Areas (WDFW, 2010)
- Marine Mammal Haulout Area (WDFW, 2010)

Priority Fish Distribution (WDFW, 2010)

- Presence/Migration
- Known Juvenile Rearing
- Known Spawning

CCT, Resident Cutthroat
CHFA, Fall Chinook
CHMF, Fall Chum
CHMS, Summer Chum
CHSP, Spring Chinook
COHO, Coho Salmon
DBT, Dolly Varden , Bull Trout
PINK, Pink Salmon
RBT, Rainbow Trout
SOCK, Sockeye
STSU, Summer Steelhead
STWI, Winter Steelhead

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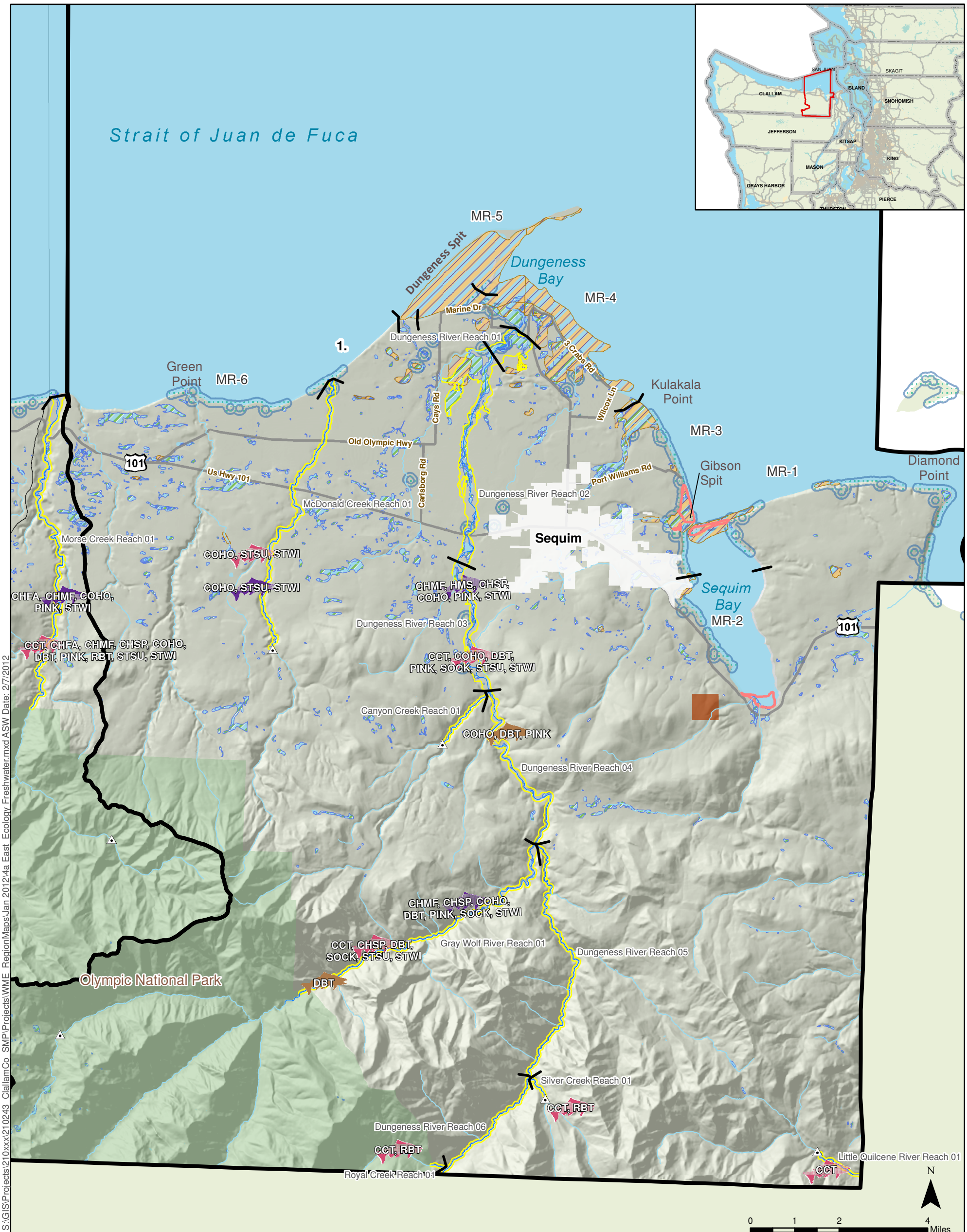
Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

ESA



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CLALLAM COUNTY

East Region - Shoreline Master Program (SMP) Update
Map 4a Ecological Characteristics - Freshwater

Legend

- Planning Region
- 20 cfs upstream limits (Ecology, USGS)
- SMA Streams
- SMA Stream Area
- Reach Breaks
- Reservation Lands (WSDOT, 2007)
- Olympic National Park
- Major Roads
- Wetlands (Clallam Co & NWI)
- Bald Eagle Habitat (Clallam Co)
- Waterfowl Habitat (Clallam Co)
- Shorebird Concentrations (WDFW, 2010)

Priority Fish Distribution (WDFW, 2010)

- Presence/Migration
- Known Juvenile Rearing
- Known Spawning

CCT, Resident Cutthroat
CHFA, Fall Chinook
CHMF, Fall Chum
CHMS, Summer Chum
CHSP, Spring Chinook
COHO, Coho Salmon
DBT, Dolly Varden , Bull Trout
PINK, Pink Salmon
RBT, Rainbow Trout
SOCK, Sockeye
STSU, Summer Steelhead
STWI, Winter Steelhead

Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

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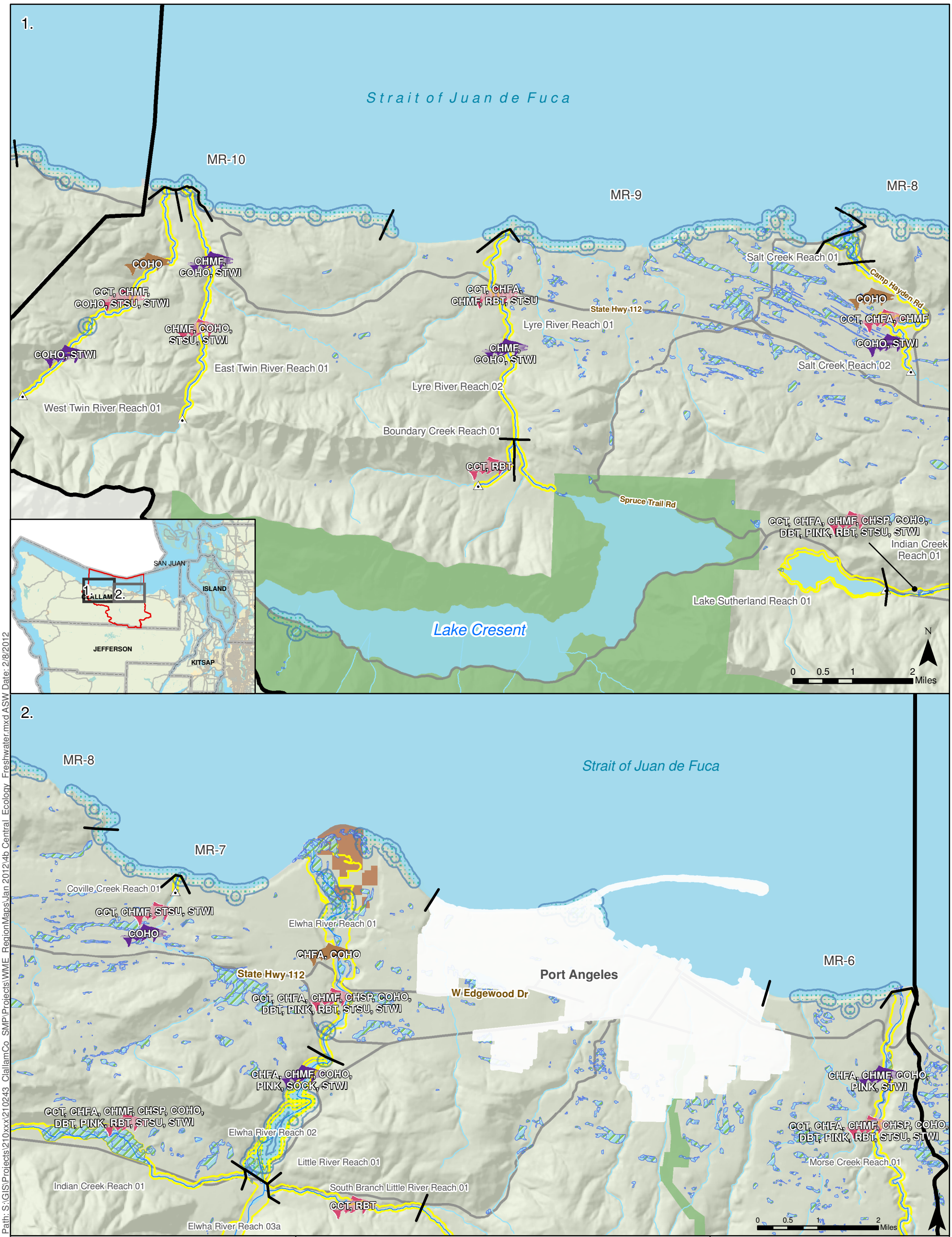

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CLALLAM COUNTY

Central Region - Shoreline Master Program (SMP) Update
Map 4b Ecological Characteristics - Freshwater

Legend

- Planning Region
- 20 cfs upstream limits (Ecology, USGS)
- SMA Streams
- SMA Stream Area
- Reach Breaks
- Reservation Lands (WSDOT, 2007)
- Olympic National Park
- Major Roads
- Wetlands (Clallam Co & NWI)
- Bald Eagle Habitat (Clallam Co)
- Waterfowl Habitat (Clallam Co)
- Shorebird Concentrations (WDFW, 2010)

Priority Fish Distribution (WDFW, 2010)

- Presence/Migration
- Known Juvenile Rearing
- Known Spawning

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CHFA, Fall Chinook
CHMF, Fall Chum
CHMS, Summer Chum
CHSP, Spring Chinook
COHO, Coho Salmon
DBT, Dolly Varden , Bull Trout
PINK, Pink Salmon
RBT, Rainbow Trout
SOCK, Sockeye
STSU, Summer Steelhead
STWI, Winter Steelhead

Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

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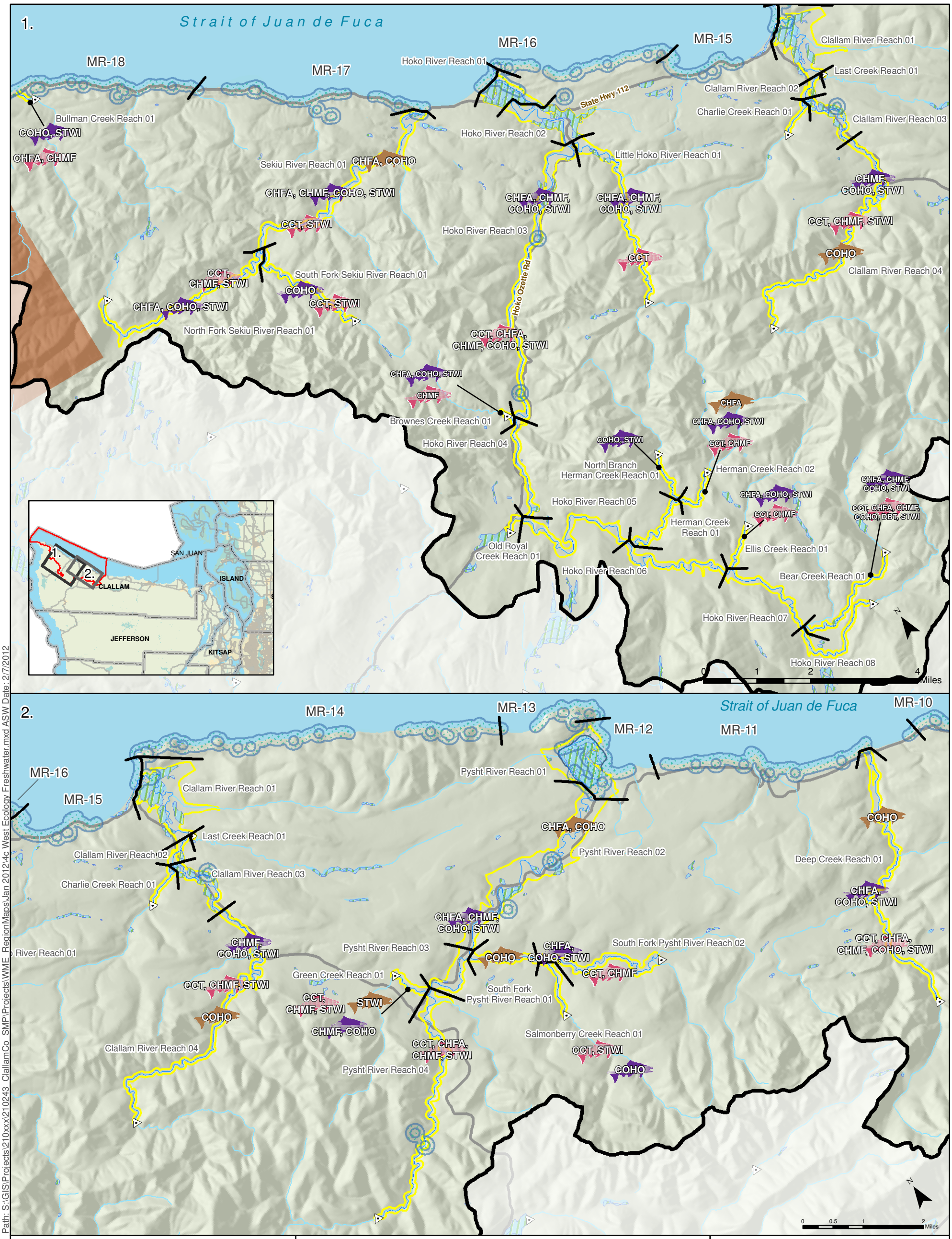

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CLALLAM COUNTY

West Region - Shoreline Master Program (SMP) Update
Map 4c Ecological Characteristics - Freshwater

Legend

- Planning Region
- 20 cfs upstream limits (Ecology, USGS)
- SMA Streams
- SMA Stream Area
- Reach Breaks
- Reservation Lands (WSDOT, 2007)
- Olympic National Park
- Major Roads
- Wetlands (Clallam Co & NWI)
- Bald Eagle Habitat (Clallam Co)
- Waterfowl Habitat (Clallam Co)
- Shorebird Concentrations (WDFW, 2010)

Priority Fish Distribution (WDFW, 2010)

- Presence/Migration
- Known Juvenile Rearing
- Known Spawning

CCT, Resident Cutthroat	DBT, Dolly Varden , Bull Trout
CHFA, Fall Chinook	PINK, Pink Salmon
CHMF, Fall Chum	RBT, Rainbow Trout
CHMS, Summer Chum	SOCK, Sockeye
CHSP, Spring Chinook	STSU, Summer Steelhead
COHO, Coho Salmon	STWI, Winter Steelhead

Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

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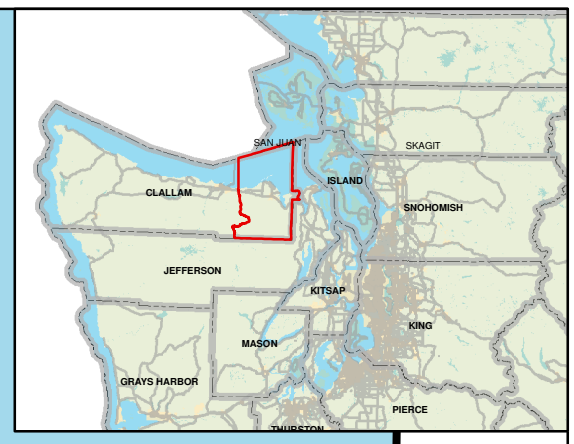
ESA



Strait of Juan de Fuca

MR-5

Dungeness Spit

Dungeness Bay

Marine Dr

3 Crabs Rd

MR-4

Cays Rd

Dungeness River Reach 01

Green Point

MR-6

Kulakala Point

Wilcox Ln

Sequim Dungeness Way

MR-3

Old Olympic Hwy

101

Us Hwy 101

Port Williams Rd

Gibson Spit

MR-1

Diamond Point

Dungeness River Reach 02

McDonald Creek Reach 01

Morse Creek Reach 01

1.

Sequim

Sequim Bay

MR-2

101

Dungeness River Reach 03

Canyon Creek Reach 01

Dungeness River Reach 04

1.

Gray Wolf River Reach 01

Dungeness River Reach 05

Olympic National Park

Silver Creek Reach 01

Dungeness River Reach 06

Royal Creek Reach 01

Little Quilcene River Reach 01

N

0 1 2 4 Miles

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CLALLAM COUNTY

East Region - Shoreline Master Program (SMP) Update
Map 5a Land Use

Legend

- Planning Region
- SMA Streams
- SMA Stream Area
- Major Roads
- Olympic National Park
- Reservation Lands (WSDOT, 2007)
- 20 cfs upstream limits (Ecology, USGS)
- Publicly Owned Tidelands (WDNR)

Commercial Forest Zoned Land
(Clallam Co, PSNERP 2009)

- Private
- Public

Existing Land Use - Clallam

- Agricultural
- Commercial
- Exempt
- Lodging
- Residential
- Manufactured Home
- Mobile Home Park
- Open Space
- Public
- Public Open Space
- Quasi-Public
- Road
- Timber
- Tribe
- Unknown
- Utilities
- Vacant
- Water

Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

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ESA

Strait of Juan de Fuca

MR-10

MR-9

MR-8

MR-7

MR-6

Low Point

Crescent Bay

Tongue Point

Obervatory Point

Freshwater Bay

Angeles Point

Elwha Klallam Tribal Lands

Ediz Hook

Port Angeles Harbor

Port Angeles

112

101

West Twin River Reach 01

East Twin River Reach 01

Lyre River Reach 01

Lyre River Reach 02

Boundary Creek Reach 01

Salt Creek Reach 01

Salt Creek Reach 02

Elwha River Reach 01

Elwha River Reach 02

Elwha River Reach 03

Lake Sutherland Reach 01

Indian Creek Reach 01

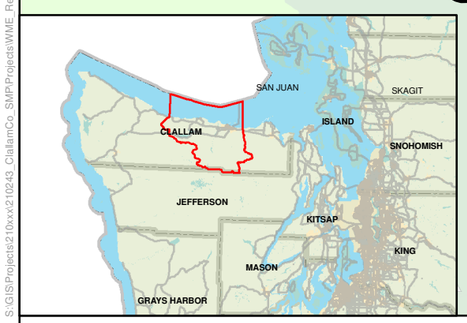
Little River Reach 01

South Branch Little River Reach 01

Morse Creek Reach 01

Lake Crescent

Olympic National Park



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CLALLAM COUNTY

Central Region - Shoreline Master Program (SMP) Update
Map 5b - Land Use

Legend

- Planning Region Boundary
- Reach Breaks
- SMA Stream Area
- SMA Streams
- Major Roads
- Olympic National Park
- Reservation Lands (WSDOT, 2007)
- 20 cfs upstream limits (Ecology, USGS)

Commercial Forest Zoned Land
(Clallam Co, PSNERP 2009)

- Private
- Public
- Publicly Owned Tidelands (WDNR)

Existing Land Use - Clallam

- Agricultural
- Commercial
- Exempt
- Lodging
- Residential
- Manufactured Home
- Mobile Home Park
- Open Space
- Public
- Public Open Space
- Quasi-Public
- Road
- Timber
- Tribe
- Unknown
- Utilities
- Vacant
- Water

0 1 2 4 Miles

N

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Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

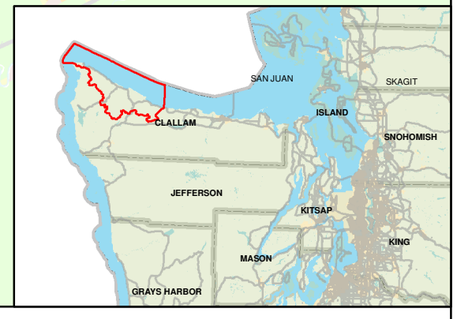
ESA

Strait of Juan de Fuca

MR-18
MR-17
Kydaka Point
MR-16
Sekiu Point
MR-15
Clallam Bay
Slip Point
MR-14
MR-13
Pillar Point
MR-12
MR-11
MR-10

112
112
113

Bullman Creek Reach 01
Hoko River Reach 01
Hoko River Reach 02
Hoko River Reach 03
Hoko River Reach 04
Hoko River Reach 05
Hoko River Reach 06
Hoko River Reach 07
Hoko River Reach 08
Sekiu River Reach 01
South Fork Sekiu River Reach 01
North Fork Sekiu River Reach 01
Hoko Ozette Rd
Little Hoko River Reach 01
Charlie Creek Reach 01
Clallam River Reach 01
Clallam River Reach 02
Clallam River Reach 03
Clallam River Reach 04
Last Creek Reach 01
Pysht River Reach 01
Pysht River Reach 02
Pysht River Reach 03
Pysht River Reach 04
Green Creek Reach 01
South Fork Pysht River Reach 01
South Fork Pysht River Reach 02
Salmonberry Creek Reach 01
Deep Creek Reach 01
Browns Creek Reach 01
North Branch Herman Creek Reach 01
Old Royal Creek Reach 01
Herman Creek Reach 02
Herman Creek Reach 01
Ellis Creek Reach 01
Bear Creek Reach 01



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CLALLAM COUNTY

West Region - Shoreline Master Program (SMP) Update
Map 5c - Land Use

Legend

- Planning Region Boundary
- Reach Breaks
- SMA Stream Area
- SMA Streams
- Major Roads
- Olympic National Park
- 20 cfs upstream limits (Ecology, USGS)
- Publicly Owned Tidelands (WDNR)

Commercial Forest Zoned Land
(Clallam Co, PSNERP 2009)

- Private
- Public

Existing Land Use

- Agricultural
- Commercial
- Exempt
- Lodging
- Residential
- Manufactured Home
- Mobile Home Park
- Open Space
- Public
- Public Open Space
- Quasi-Public
- Road
- Timber
- Tribe
- Unknown
- Utilities
- Vacant
- Water

0 1 2 4 Miles

N

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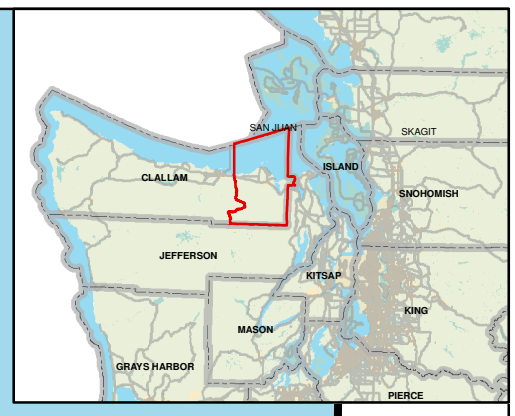
Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

ESA



Strait of Juan de Fuca

Dungeness Spit

MR-5

Dungeness Bay

1.

MR-6

MR-4

Dungeness River Reach 01

Green Point

Kulakala Point

Cays Rd

Sequim Dungeness Way

MR-3

Old Olympic Hwy

101

Port Williams Rd

Gibson Spit

MR-1

Diamond Point

Dungeness River Reach 02

McDonald Creek Reach 01

Horse Creek Reach 01

Sequim

Sequim Bay

MR-2

101

Dungeness River Reach 03

Canyon Creek Reach 01

Dungeness River Reach 04

1.

Gray Wolf River Reach 01

Dungeness River Reach 05

Olympic National Park

Silver Creek Reach 01

Dungeness River Reach 06

Royal Creek Reach 01

Little Quilcene River Reach 01

N

0 1 2 4 Miles

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CLALLAM COUNTY

East Region - Shoreline Master Program (SMP) Update
Map 6a Shoreline Modification

Legend

- Planning Region
- Reach Breaks
- 20 cfs upstream limits (Ecology, USGS)
- Shoreline Armoring (PSNERP, Battelle)
- Nearshore Fill (PSNERP, 2009)
- Tidal Barriers

Fish Passage Barriers (PSNERP, 2009)

- Bridge
- Culvert
- Fill/Debris
- Misc Obstruction
- Washout

- Breakwaters and Jetties (PSNERP, 2009)
- Overwater Marine Structures (Clallam Co, 2009)
- Overwater Structures Lakes & Rivers (WDNR, 2009)
- Major Roads
- SMA Streams
- SMA Stream Area
- Reservation Lands (WSDOT, 2007)
- Olympic National Park

Levees & Riprap (Clallam Co)

- Bank/Hydromodification
- Dike/Levee

Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007, 2009

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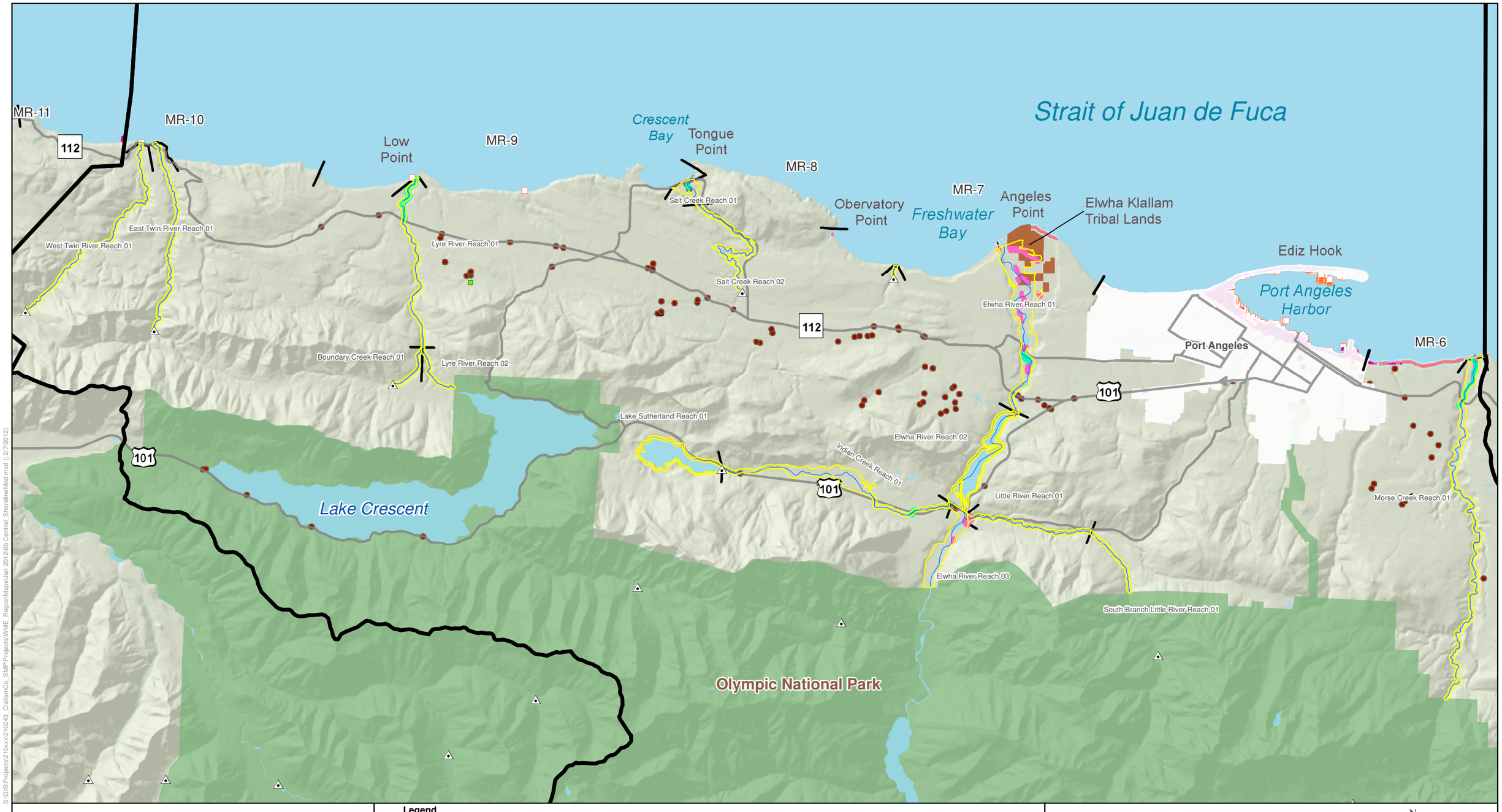
ESA



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CLALLAM COUNTY

Central Region - Shoreline Master Program (SMP) Update
Map 6b - Shoreline Modifications

Legend

- Planning Region Boundary
- Reach Breaks
- SMA Stream Area
- SMA Streams
- Major Roads
- Reservation Lands (WSDOT, 2007)
- Olympic National Park
- 20 cfs upstream limits (Ecology, USGS)
- Bank/Hydromodification
- Dike/Levee
- Overwater Structures Lakes & Rivers (WDNR, 2009)
- Overwater Marine Structures (Clallam Co, 2009)
- Breakwaters and Jetties (PSNERP, 2009)
- Tidal Barriers
- Nearshore Fill (PSNERP, 2009)
- Shoreline Armoring (PSNERP, Battelle)

Fish Passage Barriers (PSNERP, 2009)

- Bridge
- Culvert
- Fill/Debris
- Misc Obstruction
- Washout

0 1 2 4 Miles

N

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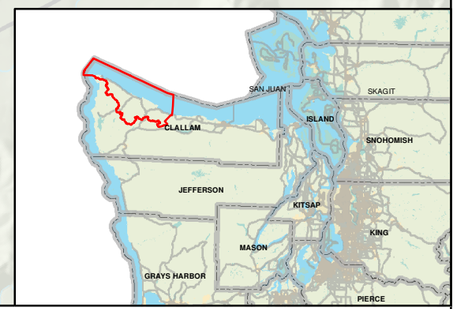
Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

ESA

MR-18
MR-17
MR-16
MR-15
MR-14
MR-13
MR-12
MR-11
MR-10
Kydaka Point
Sekiu Point
Clallam Bay
Slip Point
Pillar Point
112
113
Bullman Creek Reach 01
Hoko River Reach 01
Hoko River Reach 02
Sekiu River Reach 01
Little Hoko River Reach 01
Clallam River Reach 01
Last Creek Reach 01
Clallam River Reach 02
Charlie Creek Reach 01
Clallam River Reach 03
Clallam River Reach 04
Pysht River Reach 01
Pysht River Reach 02
Deep Creek Reach 01
West Twin River Reach 01
South Fork Pysht River Reach 01
South Fork Pysht River Reach 02
Pysht River Reach 03
Pysht River Reach 04
Green Creek Reach 01
Salmonberry Creek Reach 01
Hoko River Reach 03
Makah Indian Reservation
North Fork Sekiu River Reach 01
South Fork Sekiu River Reach 01
Browns Creek Reach 01
Hoko River Reach 04
North Branch Herman Creek Reach 01
Herman Creek Reach 02
Old Royal Creek Reach 01
Hoko River Reach 05
Herman Creek Reach 01
Ellis Creek Reach 01
Hoko River Reach 06
Hoko River Reach 07
Bear Creek Reach 01
Hoko River Reach 08



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CLALLAM COUNTY

West Region - Shoreline Master Program (SMP) Update
Map 6c - Shoreline Modifications

Legend

- Planning Region Boundary
- Reach Breaks
- SMA Stream Area
- SMA Streams
- Major Roads
- Reservation Lands (WSDOT, 2007)
- Olympic National Park
- 20 cfs upstream limits (Ecology, USGS)
- Bank/Hydromodification
- Dike/Levee
- Overwater Structures Lakes & Rivers (WDNR, 2009)
- Overwater Marine Structures (Clallam Co, 2009)
- Breakwaters and Jetties (PSNERP, 2009)
- Tidal Barriers
- Nearshore Fill (PSNERP, 2009)

Fish Passage Barriers (PSNERP, 2009)

- Bridge
- Culvert
- Fill/Debris
- Misc Obstruction
- Washout

0 1.5 3 6 Miles

N

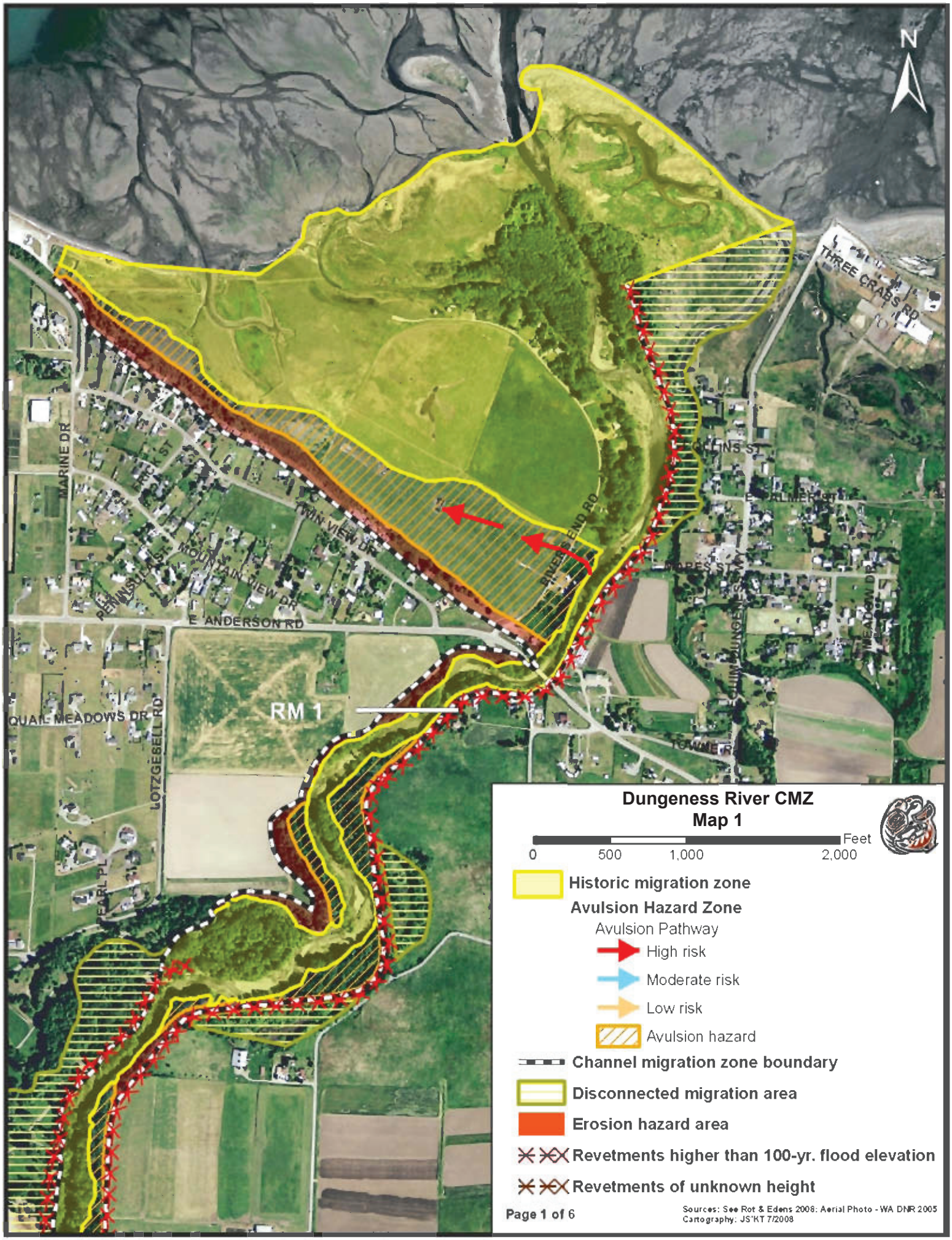
NOTE: Map data shown here are the property of the sources listed below. Inacuracies may exist, and ESA implies no warranties or guarantees regarding any aspect of data depiction.

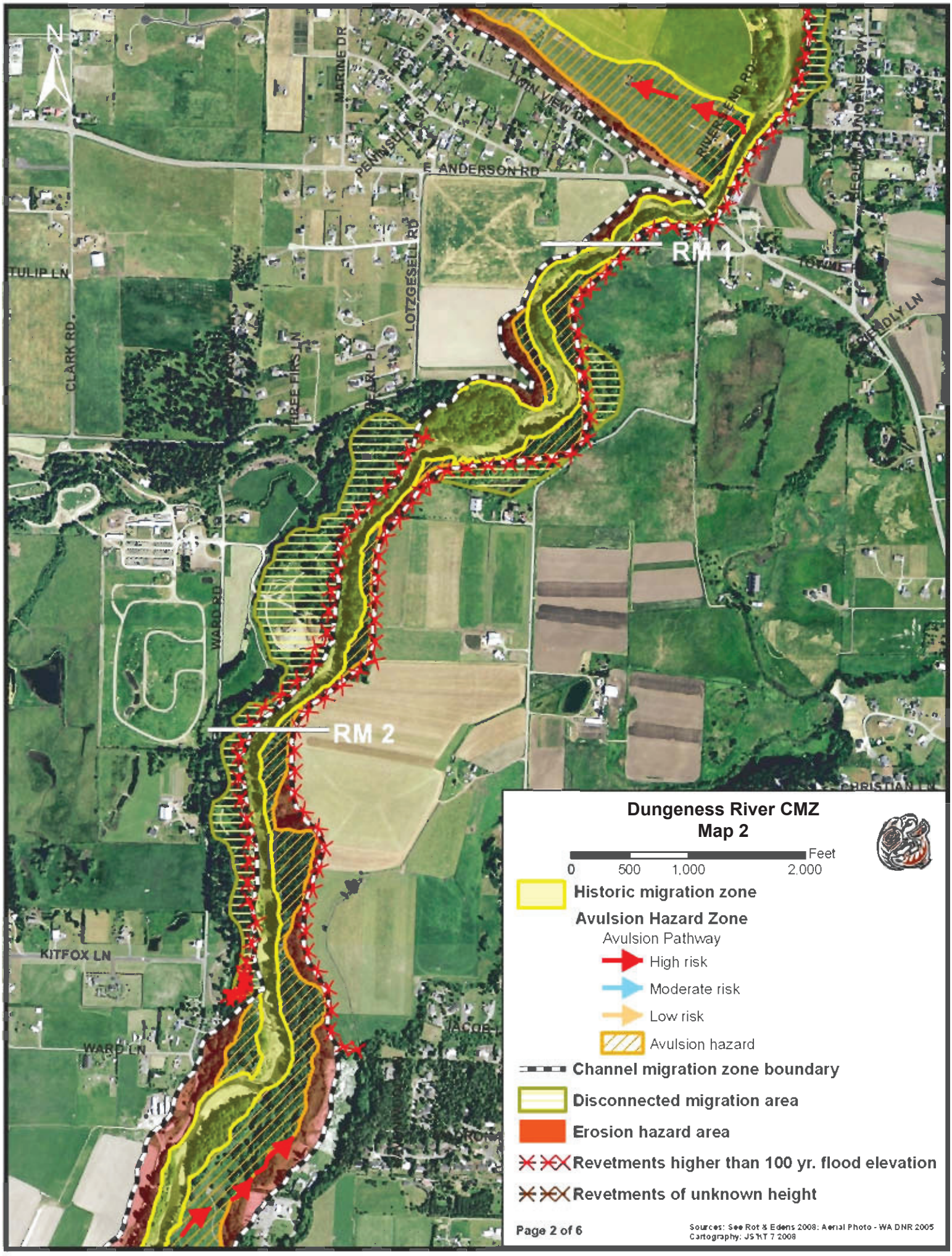
Coordinate System: State Plane NAD 1983 (Ft) Washington North FIPS 4602

Data Sources: Clallam County, 2010 (2006); Ecology, 2009; WDNR, 2007

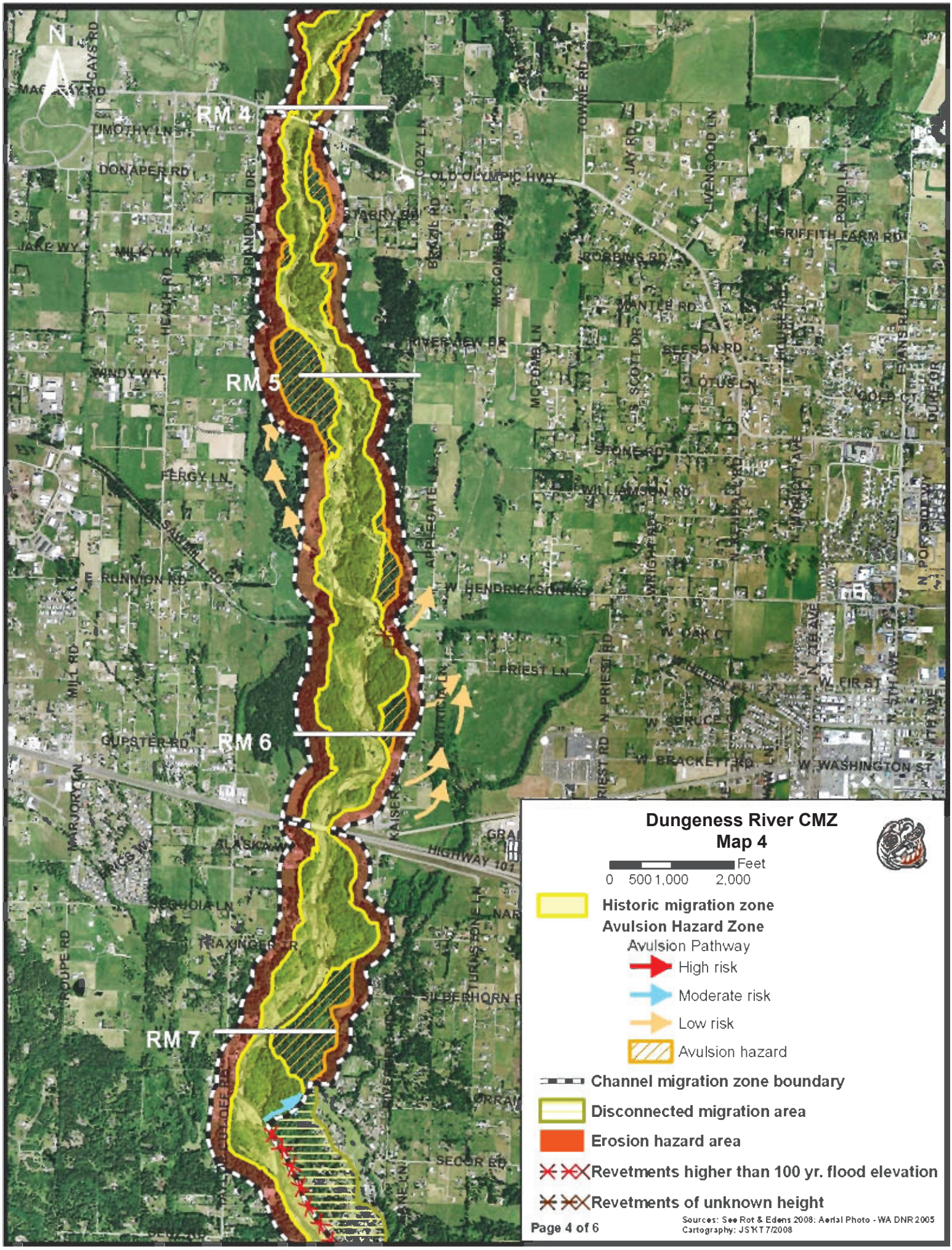
ESA

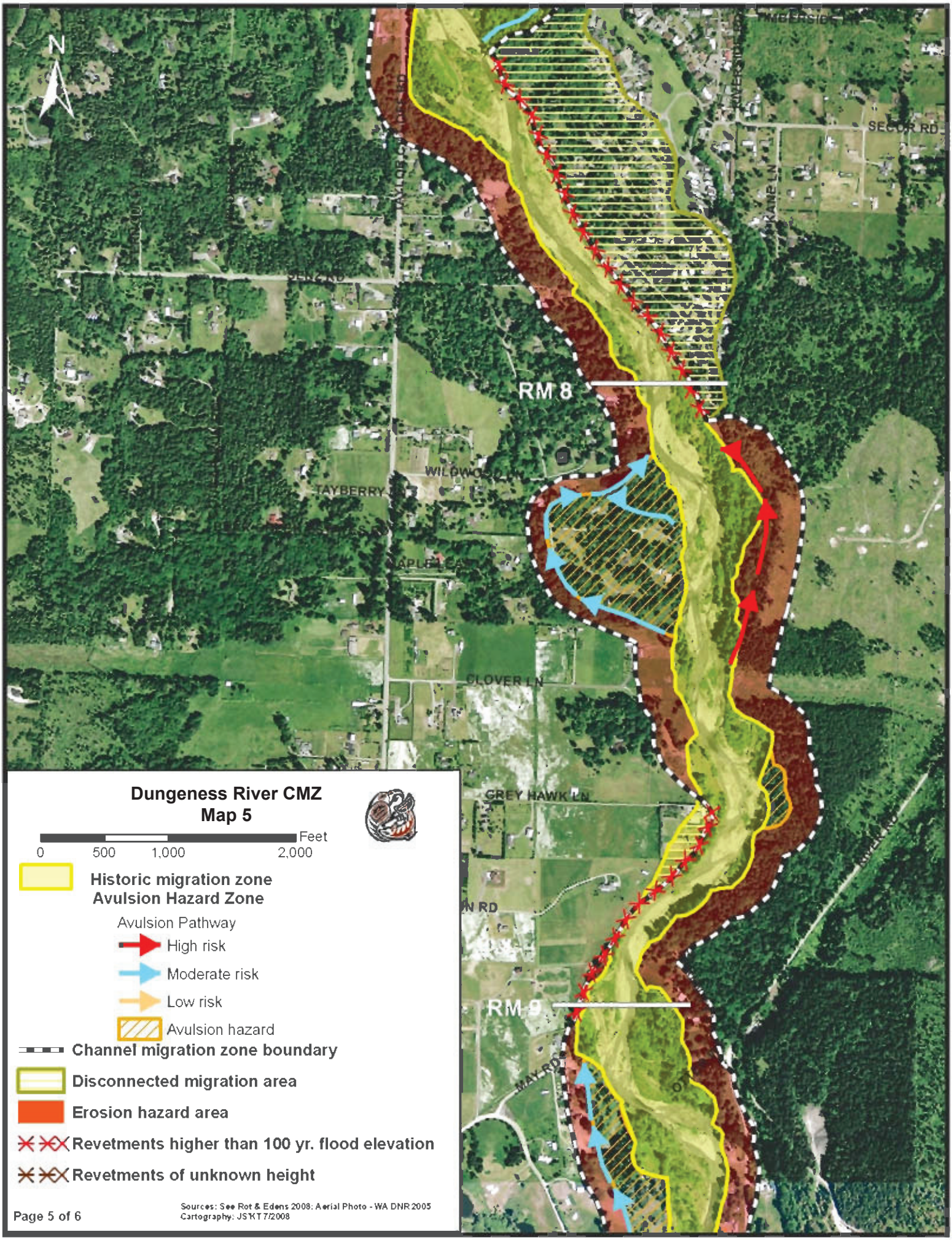
APPENDIX B:
CHANNEL MIGRATION ZONE MAP FOLIO

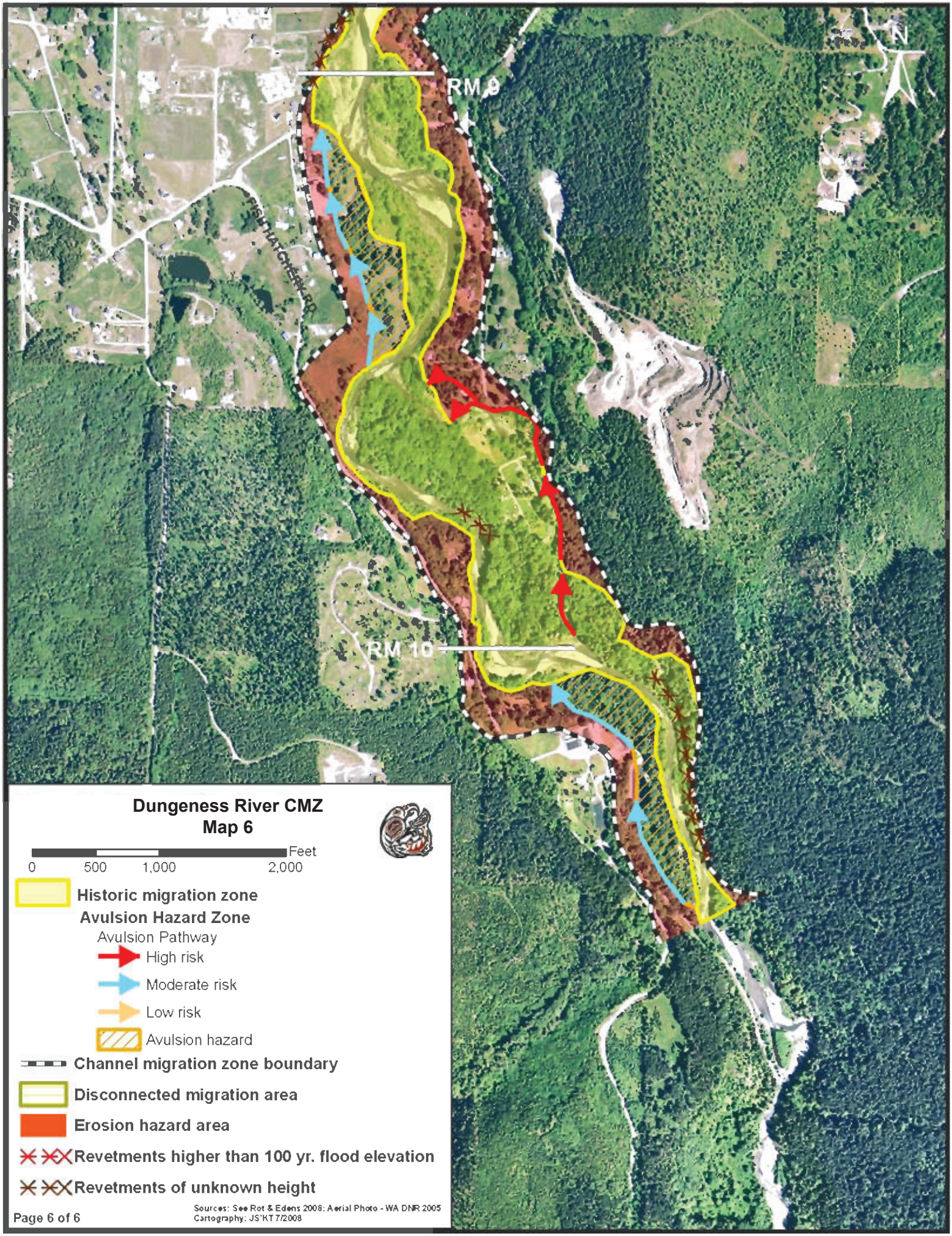

N
THREE CRABS RD
MARINE DR
TWIN VIEW DR
MOUNTAIN VIEW DR
PENINSULA ST
E ANDERSON RD
QUAIL MEADOWS DR
LOTZGESELL RD
PEARL PL
RM 1
Dungeness River CMZ
Map 1
Feet
0
500
1,000
2,000
Historic migration zone
Avulsion Hazard Zone
Avulsion Pathway
High risk
Moderate risk
Low risk
Avulsion hazard
Channel migration zone boundary
Disconnected migration area
Erosion hazard area
Revetments higher than 100-yr. flood elevation
Revetments of unknown height
Page 1 of 6
Sources: See Rot & Edens 2008; Aerial Photo - WA DNR 2005
Cartography: JS'KT 7/2008


N
MARINE DR
PENINSULA RD
MAIN VIEW DR
E ANDERSON RD
RIVERSIDE RD
TULIP LN
CLARK RD
LOTZGESELL RD
PEARL PL
THREE FIRS LN
RM 1
RM 2
WARD RD
KITFOX LN
WARD LN
JACOB
CHRISTIAN
Dungeness River CMZ
Map 2
Feet
0
500
1,000
2,000
Historic migration zone
Avulsion Hazard Zone
Avulsion Pathway
High risk
Moderate risk
Low risk
Avulsion hazard
Channel migration zone boundary
Disconnected migration area
Erosion hazard area
Revetments higher than 100 yr. flood elevation
Revetments of unknown height
Page 2 of 6
Sources: See Rot & Edens 2008; Aerial Photo - WA DNR 2005
Cartography: JS KT 7 2008


N
KITFOX LN
WARD LN
RM 3
WARD RD
TERRITORY RD
WOODCOCK RD
DANDELION
RM 4
GRANDVIEW LN
GRANDVIEW DR
SCENIC PL
Dungeness River CMZ
Map 3
Feet
0 250 500 1,000
Historic migration zone
Avulsion Hazard Zone
Avulsion Pathway
High
Moderate
Low
Avulsion hazard
Channel migration zone boundary
Disconnected migration area
Erosion hazard area
Revetments higher than 100 yr. flood elevation
Revetments of unknown height
Page 3 of 6
Sources: See Rot & Edens 2008; Aerial Photo - WA DNR 2005
Cartography: JS'KT 7 2008


N
RM 4
RM 5
RM 6
RM 7
TIMOTHY LN
DONAPER RD
OLD OLYMPIC HWY
STARRY RD
JAKE WY
MILKY WY
WINDY WY
RIVERVIEW DR
MANTLE RD
BEESON RD
LOTUS LN
STONE RD
WILLIAMSON RD
FERGY LN
E RUNNION RD
W HENDRICKSON RD
W OAK CT
PRIEST LN
W FIR ST
W SPRUCE CT
W BRACKETT RD
W WASHINGTON ST
GUPSTER RD
MILL RD
ALASKA LN
HIGHWAY 101
SEQUOIA LN
TRAXINGER TR
SECOR RD
ROBBINS RD
GRIFFITH FARM RD
Dungeness River CMZ
Map 4
Feet
0 500 1,000 2,000
Historic migration zone
Avulsion Hazard Zone
Avulsion Pathway
High risk
Moderate risk
Low risk
Avulsion hazard
Channel migration zone boundary
Disconnected migration area
Erosion hazard area
Revetments higher than 100 yr. flood elevation
Revetments of unknown height
Sources: See Rot & Edens 2008; Aerial Photo - WA DNR 2005
Cartography: JSKT 7/2008


N
SECOR RD
RM 8
WILDWOOD LN
TAYBERRY
CLOVER LN
GREY HAWK LN
RM 9
MAY RD
Dungeness River CMZ
Map 5
Feet
0
500
1,000
2,000
Historic migration zone
Avulsion Hazard Zone
Avulsion Pathway
High risk
Moderate risk
Low risk
Avulsion hazard
Channel migration zone boundary
Disconnected migration area
Erosion hazard area
Revetments higher than 100 yr. flood elevation
Revetments of unknown height
Sources: See Rot & Edens 2008; Aerial Photo - WA DNR 2005
Cartography: JSKT 7/2008

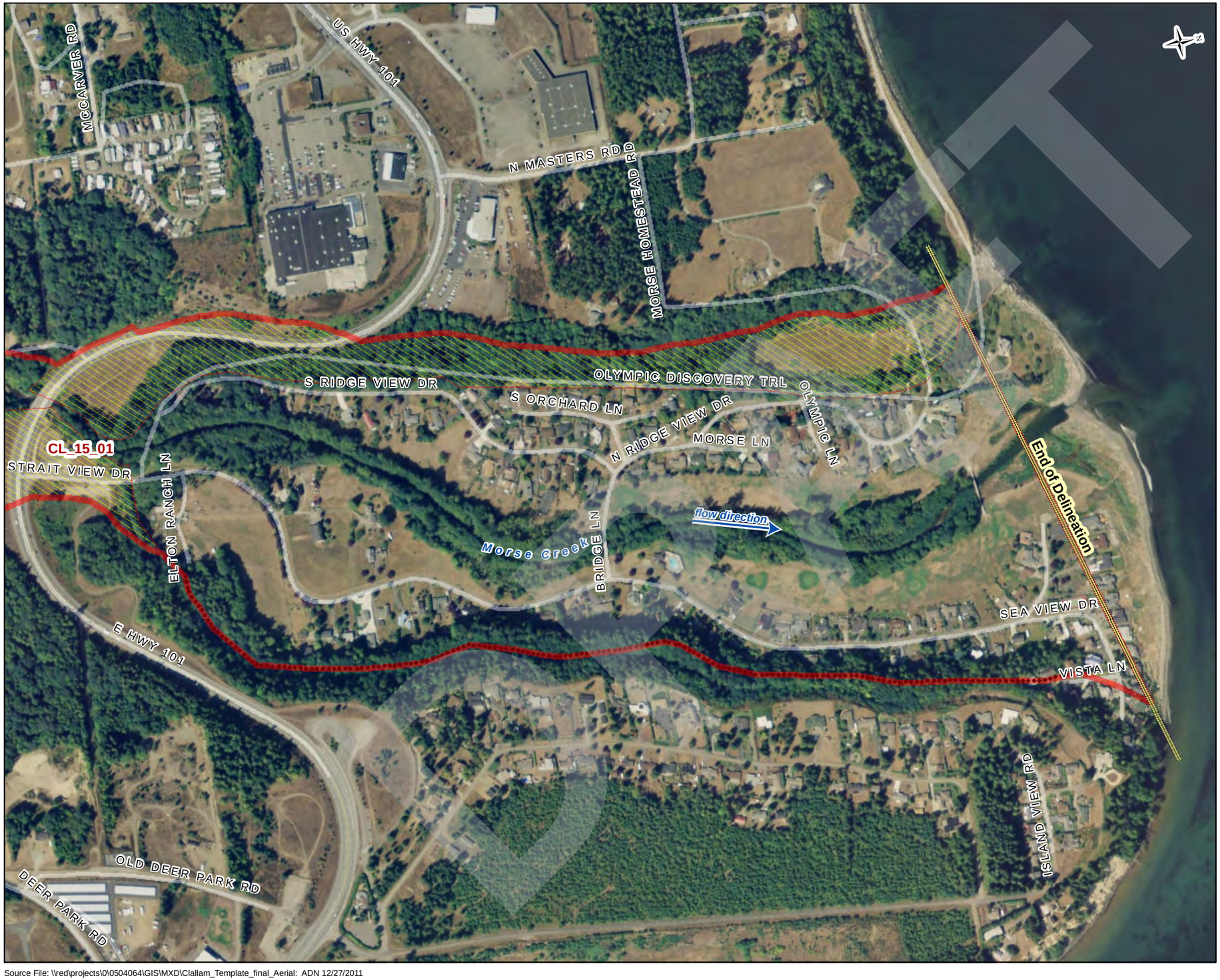


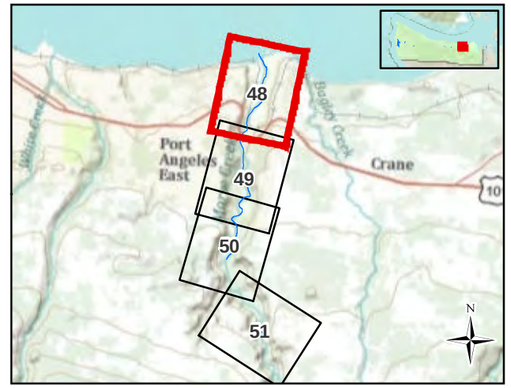
Dungeness River CMZ
Map 6

0 500 1,000 2,000 Feet

- Historic migration zone
- Avulsion Hazard Zone
  - Avulsion Pathway
    - High risk
    - Moderate risk
    - Low risk
  - Avulsion hazard
- Channel migration zone boundary
- Disconnected migration area
- Erosion hazard area
- Revetments higher than 100 yr. flood elevation
- Revetments of unknown height

Sources: See Rot & Edens 2008; Aerial Photo - WA DNR 2005
Cartography: JS'KT 7/2008

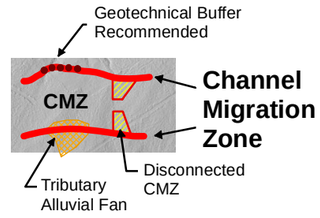




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
River miles calculated from NHD stream alignment (USGS)
Roads from TIGER (US Census Bureau)
Coordinate System: State Plane Washington North

Analyzed by: Andrew Nelson (GeoEngineers)
Reviewed by: Mary Ann Reinhart, LG, LEG (GeoEngineers)

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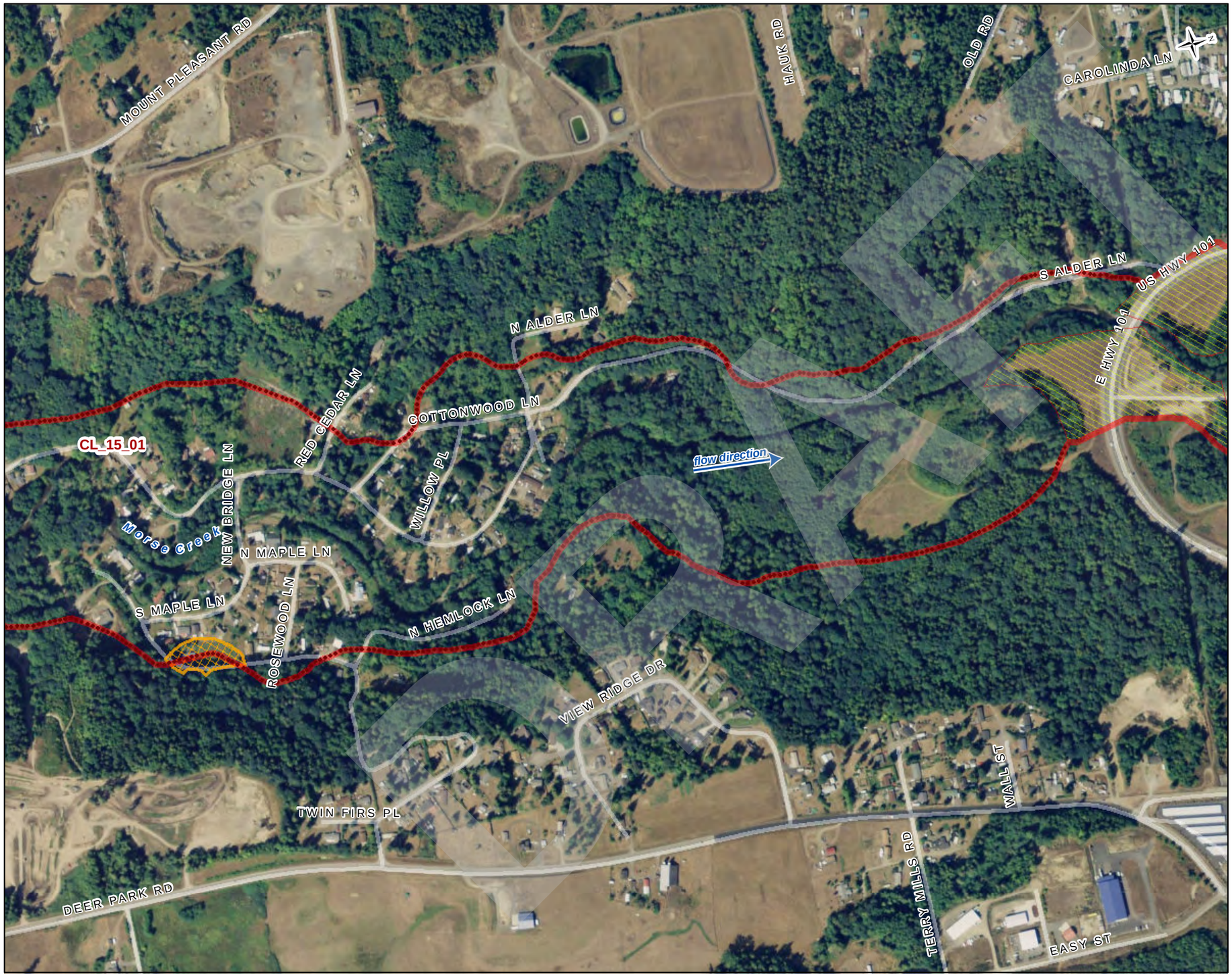
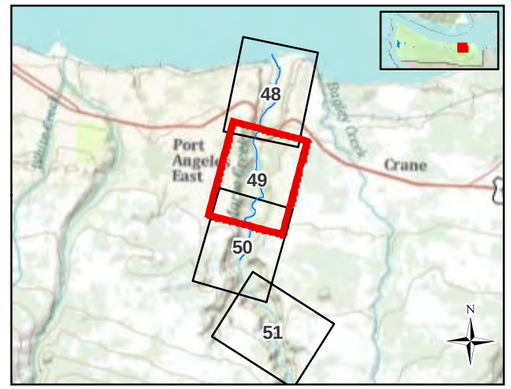
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Morse Creek **Map 48**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

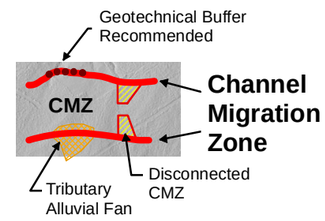




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
River miles calculated from NHD stream alignment (USGS)
Roads from TIGER (US Census Bureau)
Coordinate System: State Plane Washington North

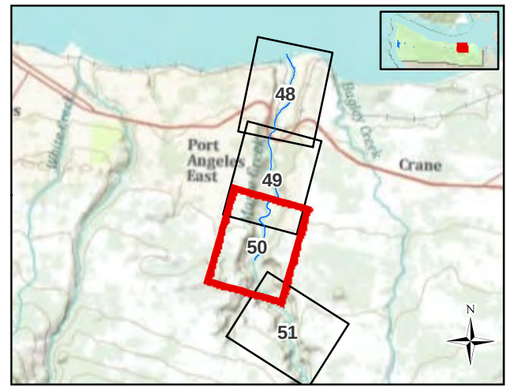
Analyzed by: Andrew Nelson (GeoEngineers)
Reviewed by: Mary Ann Reinhart, LG, LEG (GeoEngineers)

Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Morse Creek Map 49

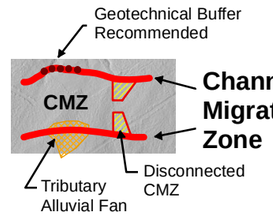
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011



River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
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Analyzed by: Andrew Nelson (GeoEngineers)
Reviewed by: Mary Ann Reinhart, LG, LEG (GeoEngineers)

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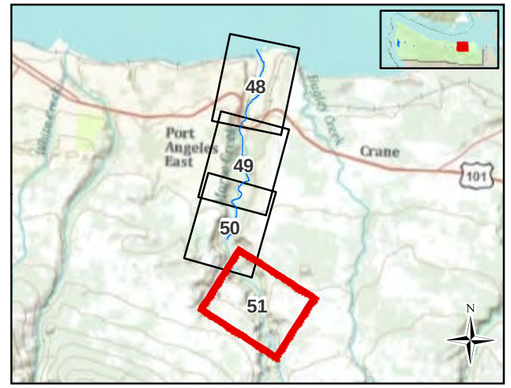
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Morse Creek **Map 50**

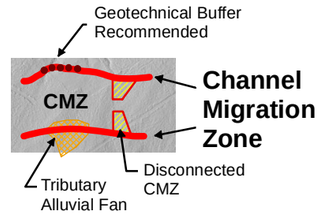
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011



River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
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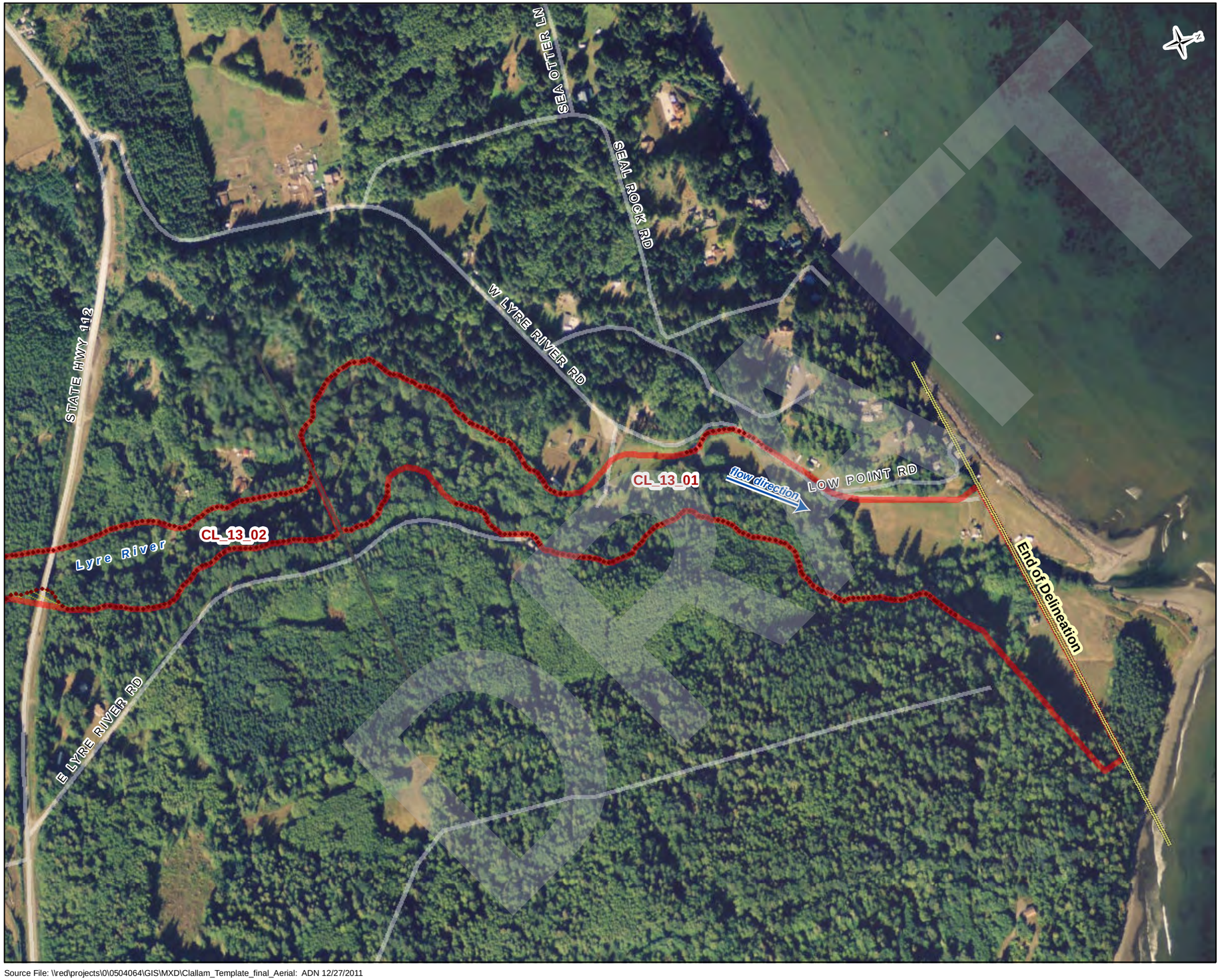
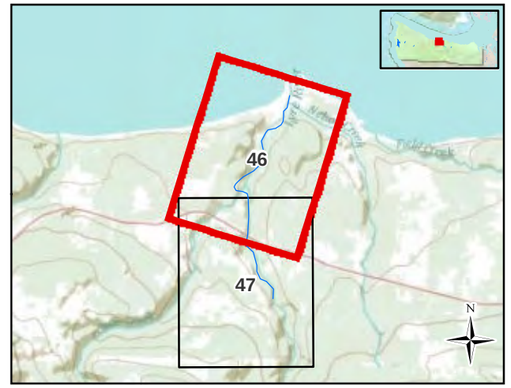
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Morse Creek **Map 51**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

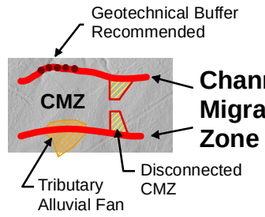




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
River miles calculated from NHD stream alignment (USGS)
Roads from TIGER (US Census Bureau)
Coordinate System: State Plane Washington North

Analyzed by: Andrew Nelson (GeoEngineers)
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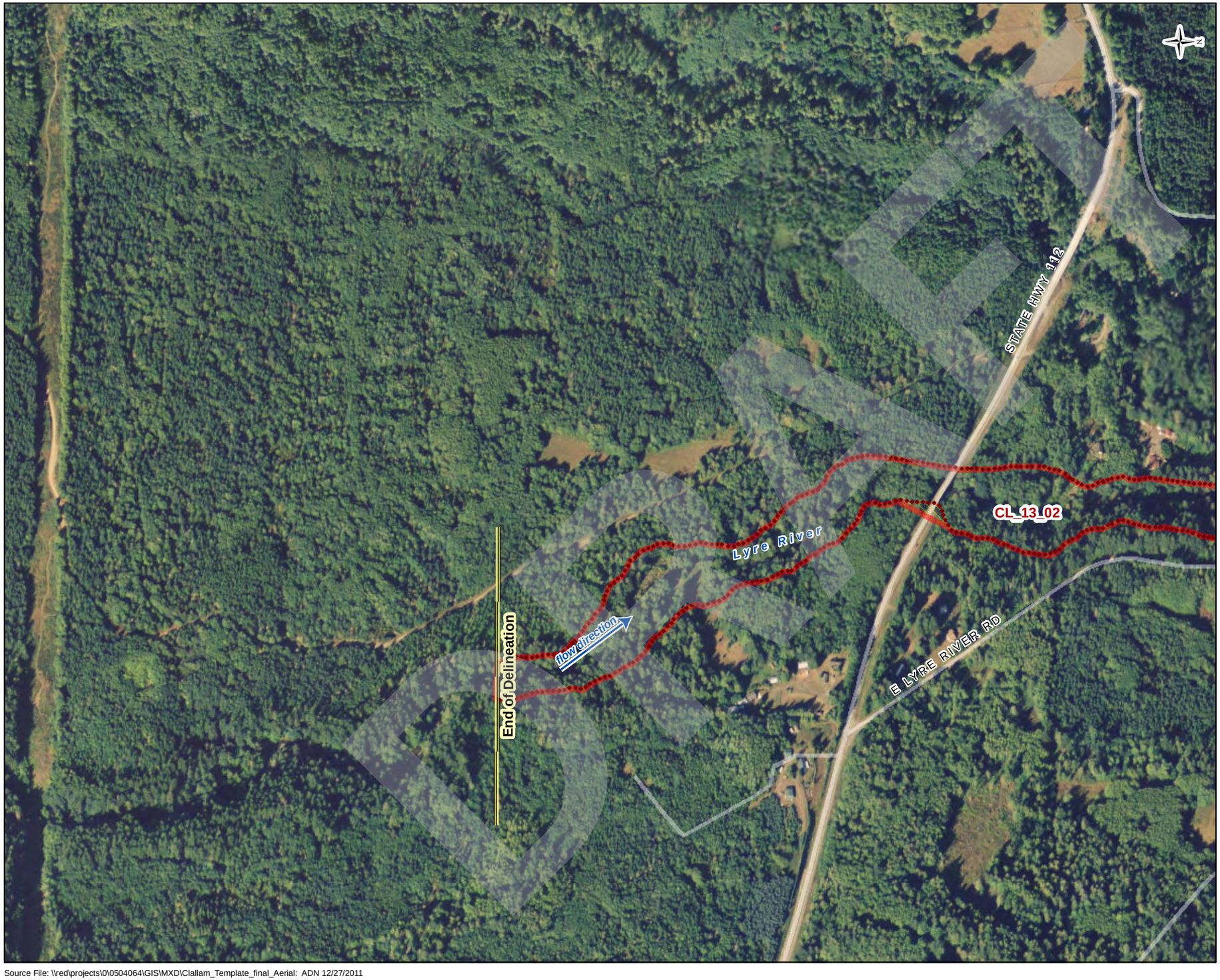
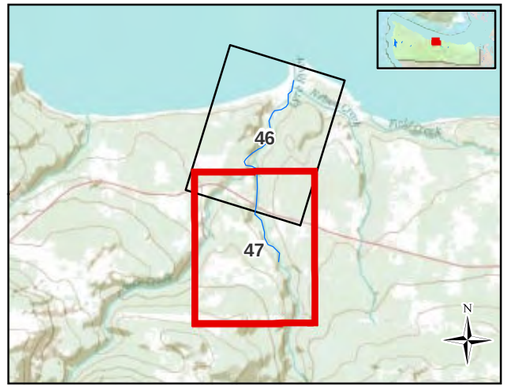
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Lyre River **Map 46**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

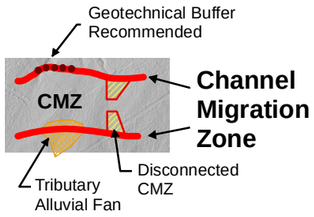




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
River miles calculated from NHD stream alignment (USGS)
Roads from TIGER (US Census Bureau)
Coordinate System: State Plane Washington North

Analyzed by: Andrew Nelson (GeoEngineers)
Reviewed by: Mary Ann Reinhart, LG, LEG (GeoEngineers)

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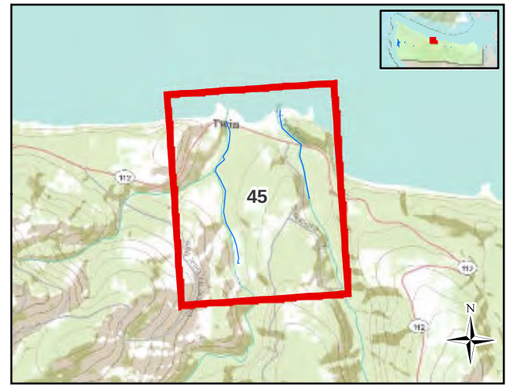
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Lyre River **Map 47**

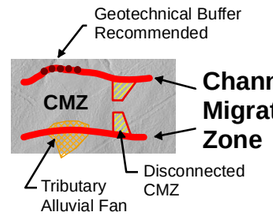
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011



River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
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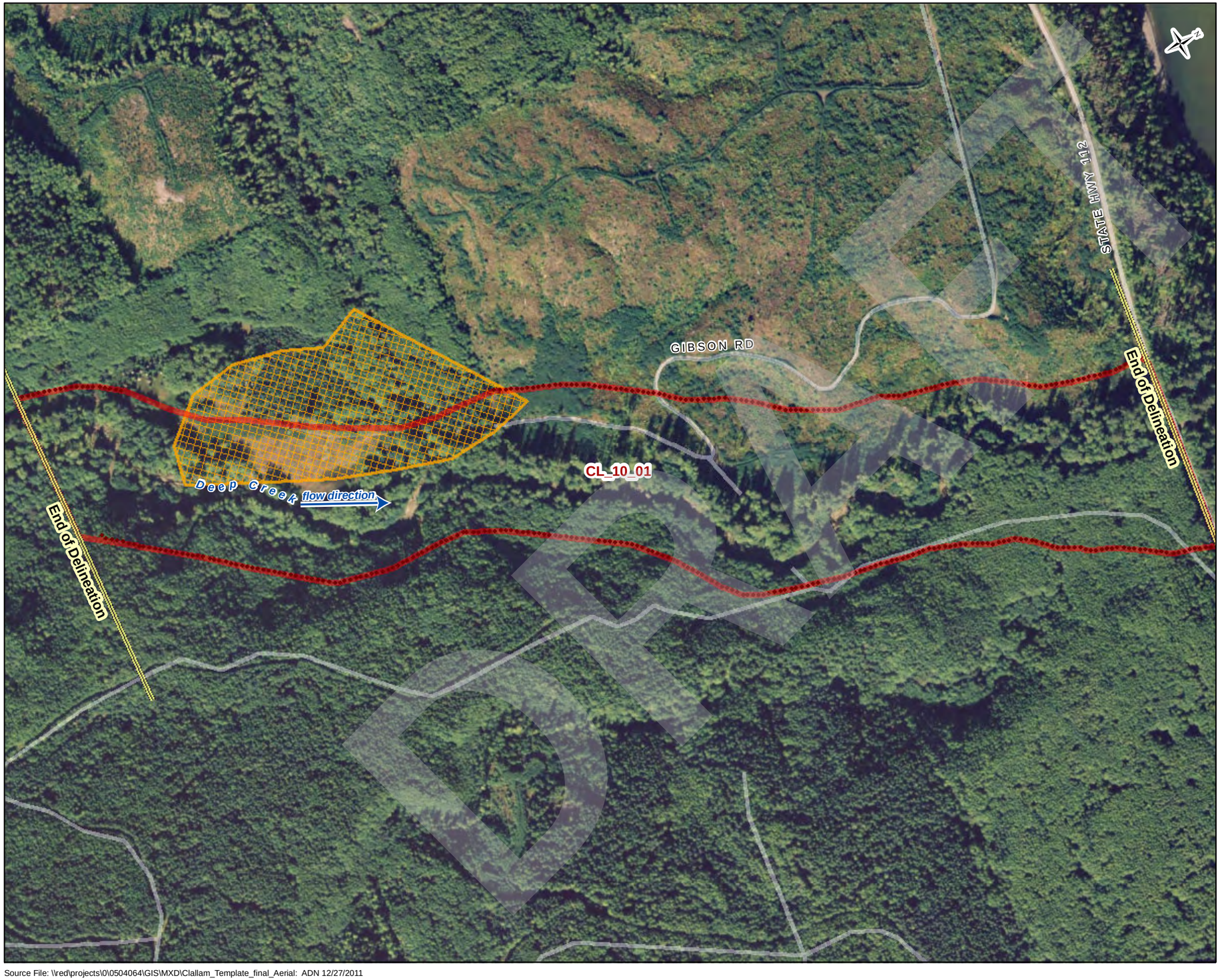
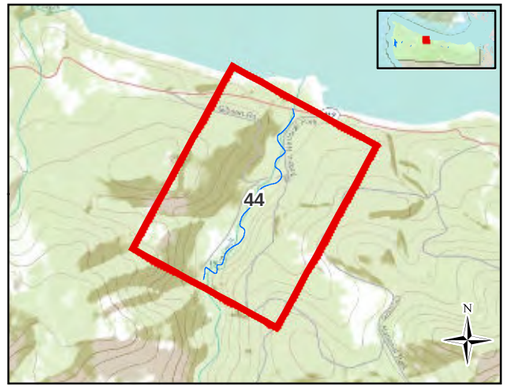
Clallam County, Washington

E. & W. Twin Rivers Map 45

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

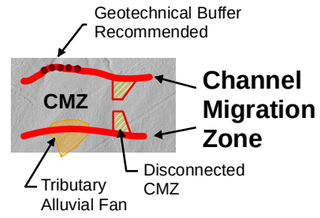




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
River miles calculated from NHD stream alignment (USGS)
Roads from TIGER (US Census Bureau)
Coordinate System: State Plane Washington North

Analyzed by: Andrew Nelson (GeoEngineers)
Reviewed by: Mary Ann Reinhart, LG, LEG (GeoEngineers)

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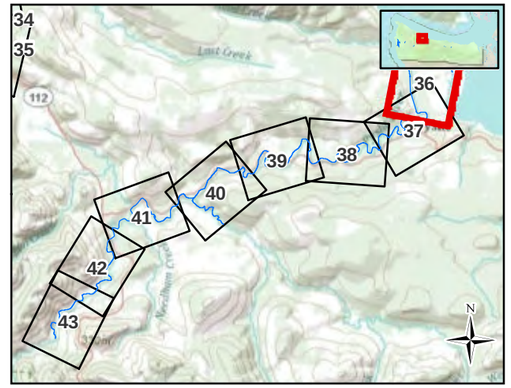
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Deep Creek **Map 44**

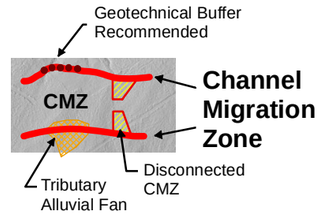
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011



River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
River miles calculated from NHD stream alignment (USGS)
Roads from TIGER (US Census Bureau)
Coordinate System: State Plane Washington North

Analyzed by: Andrew Nelson (GeoEngineers)
Reviewed by: Mary Ann Reinhart, LG, LEG (GeoEngineers)

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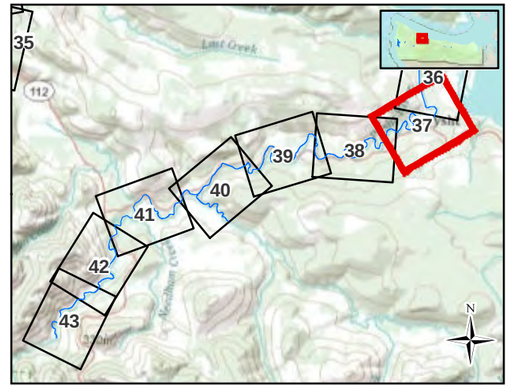
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Pysht River **Map 36**

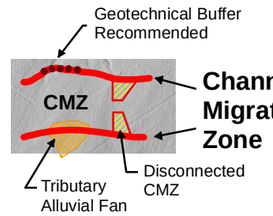
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011



River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
River miles calculated from NHD stream alignment (USGS)
Roads from TIGER (US Census Bureau)
Coordinate System: State Plane Washington North

Analyzed by: Andrew Nelson (GeoEngineers)
Reviewed by: Mary Ann Reinhart, LG, LEG (GeoEngineers)

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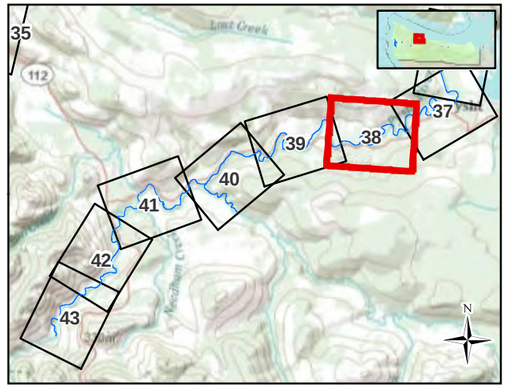
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Pysht River **Map 37**

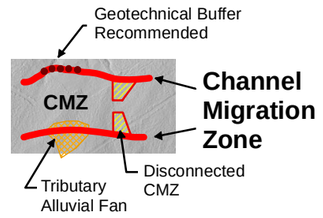
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011



River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
River miles calculated from NHD stream alignment (USGS)
Roads from TIGER (US Census Bureau)
Coordinate System: State Plane Washington North

Analyzed by: Andrew Nelson (GeoEngineers)
Reviewed by: Mary Ann Reinhart, LG, LEG (GeoEngineers)

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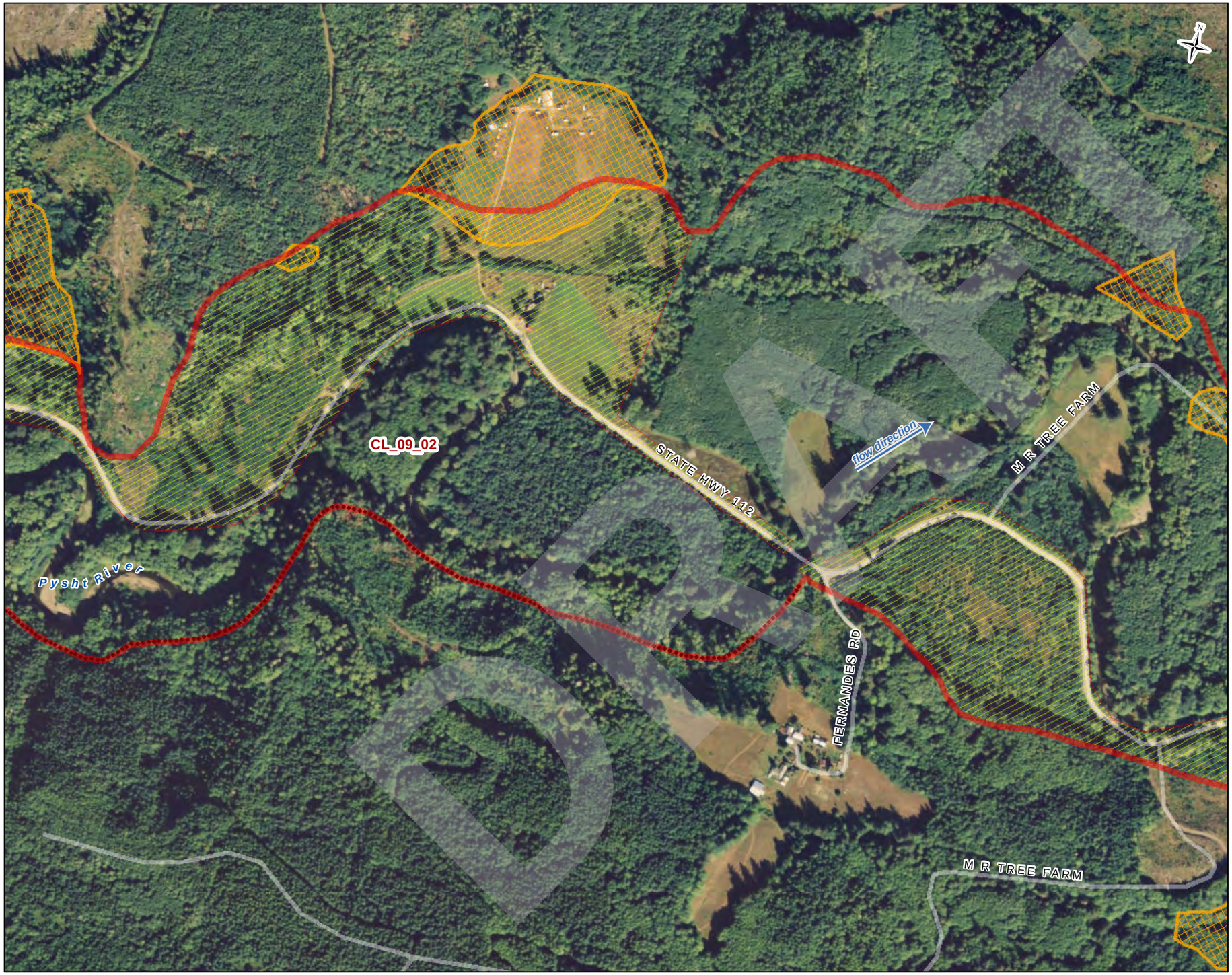
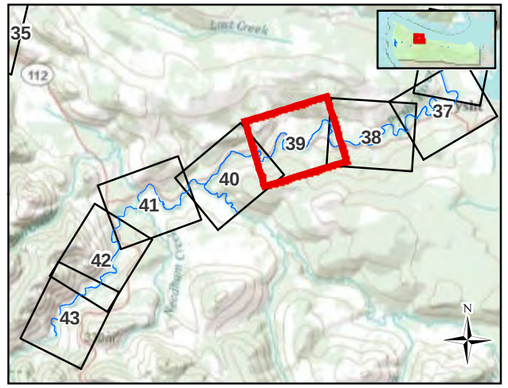
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Pysht River **Map 38**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

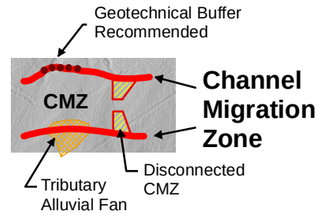




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
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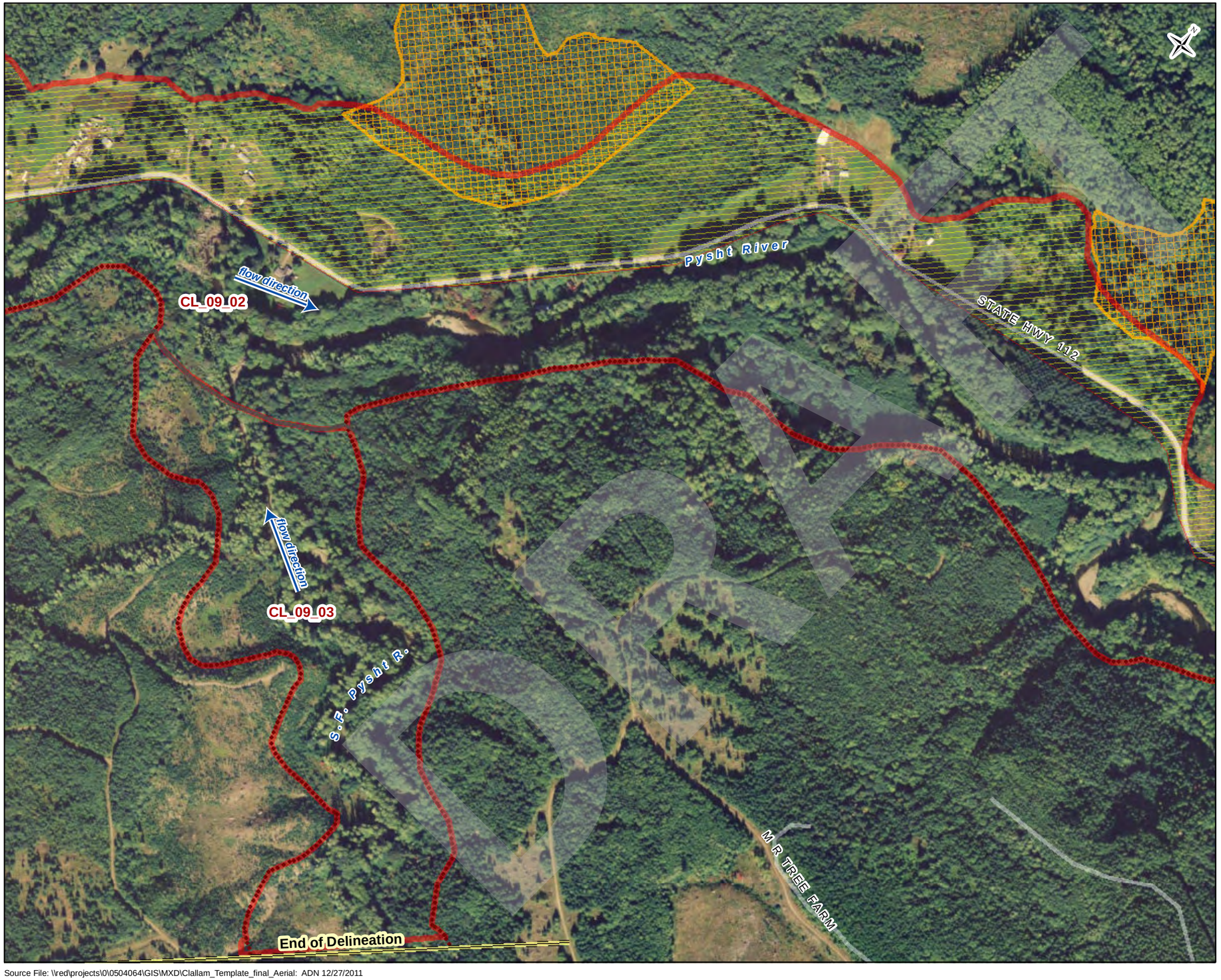
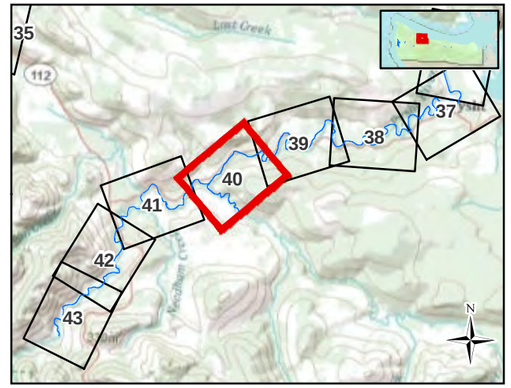
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Pysht River **Map 39**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

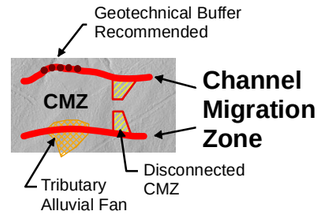




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
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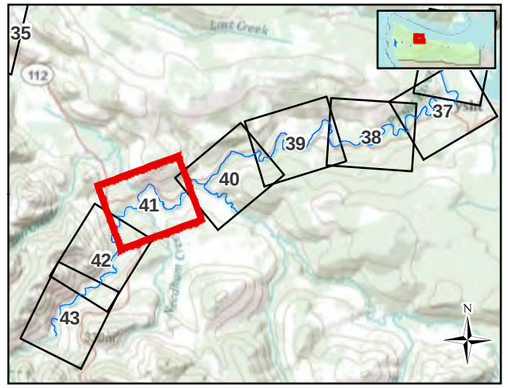
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Pysht River **Map 40**

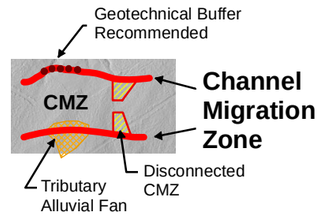
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011



River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
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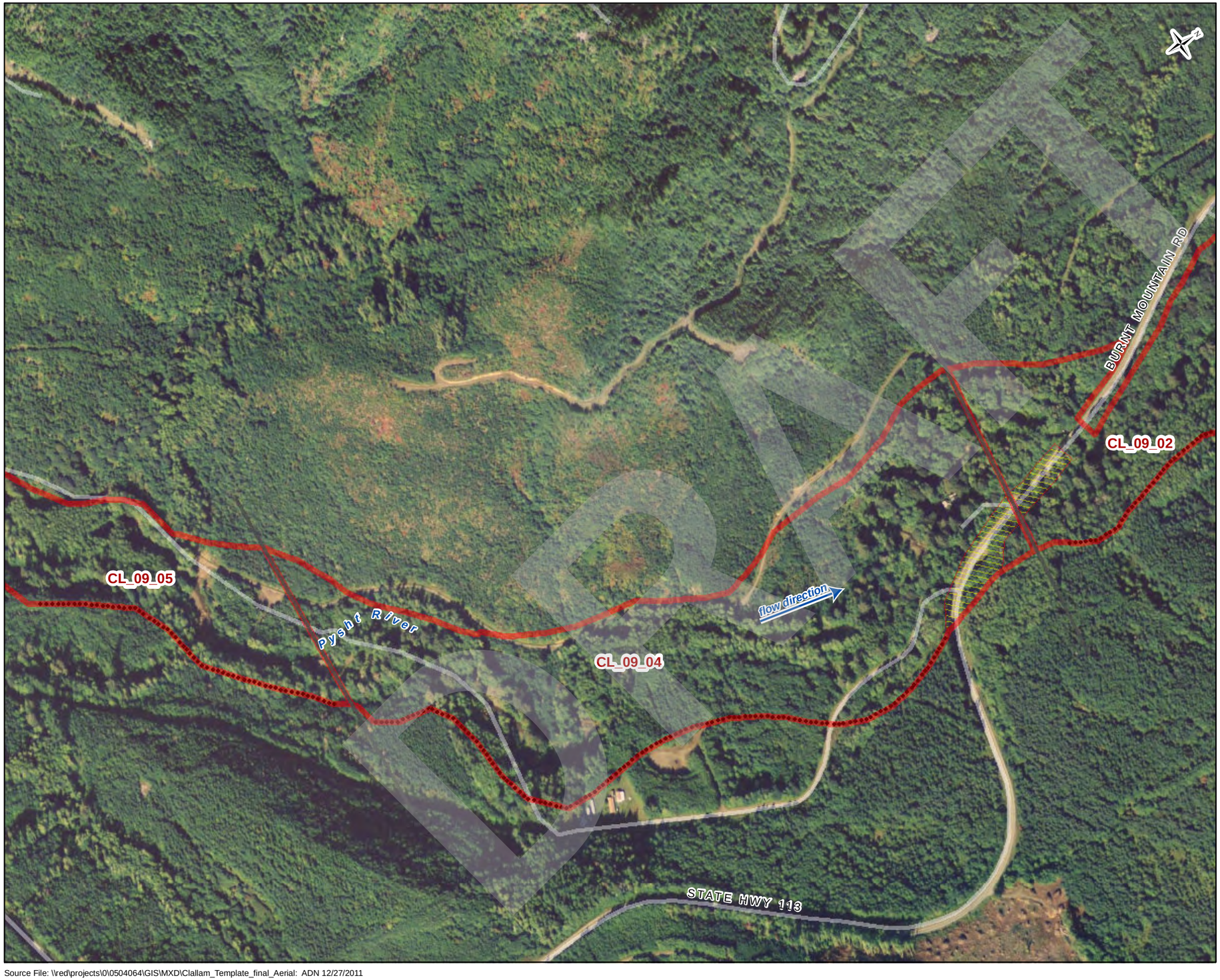
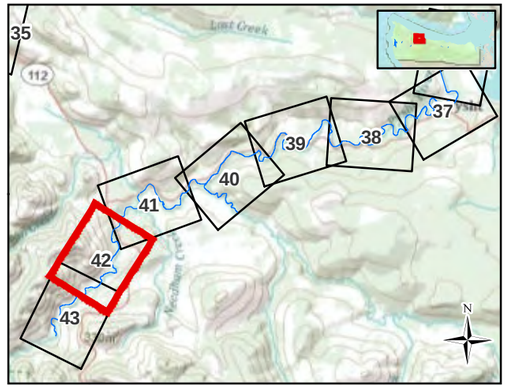
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Pysht River **Map 41**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

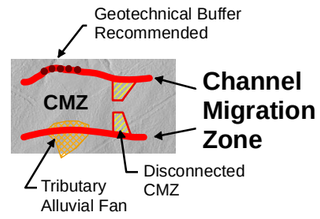




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
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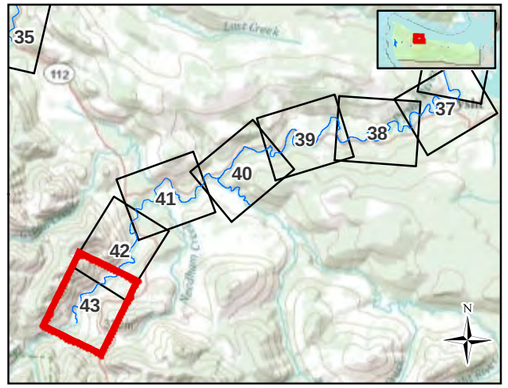
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Pysht River **Map 42**

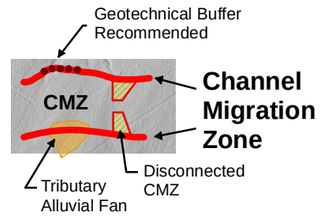
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011



River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

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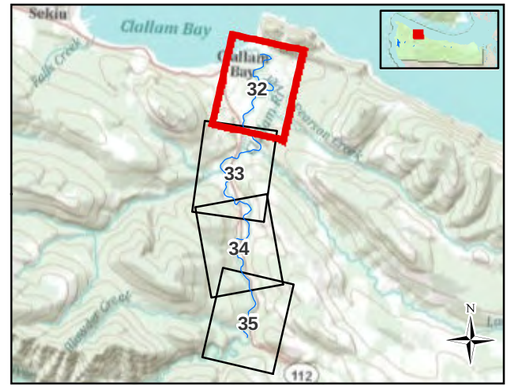
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Pysht River **Map 43**

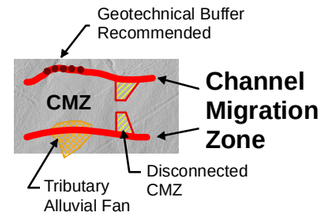
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011



River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
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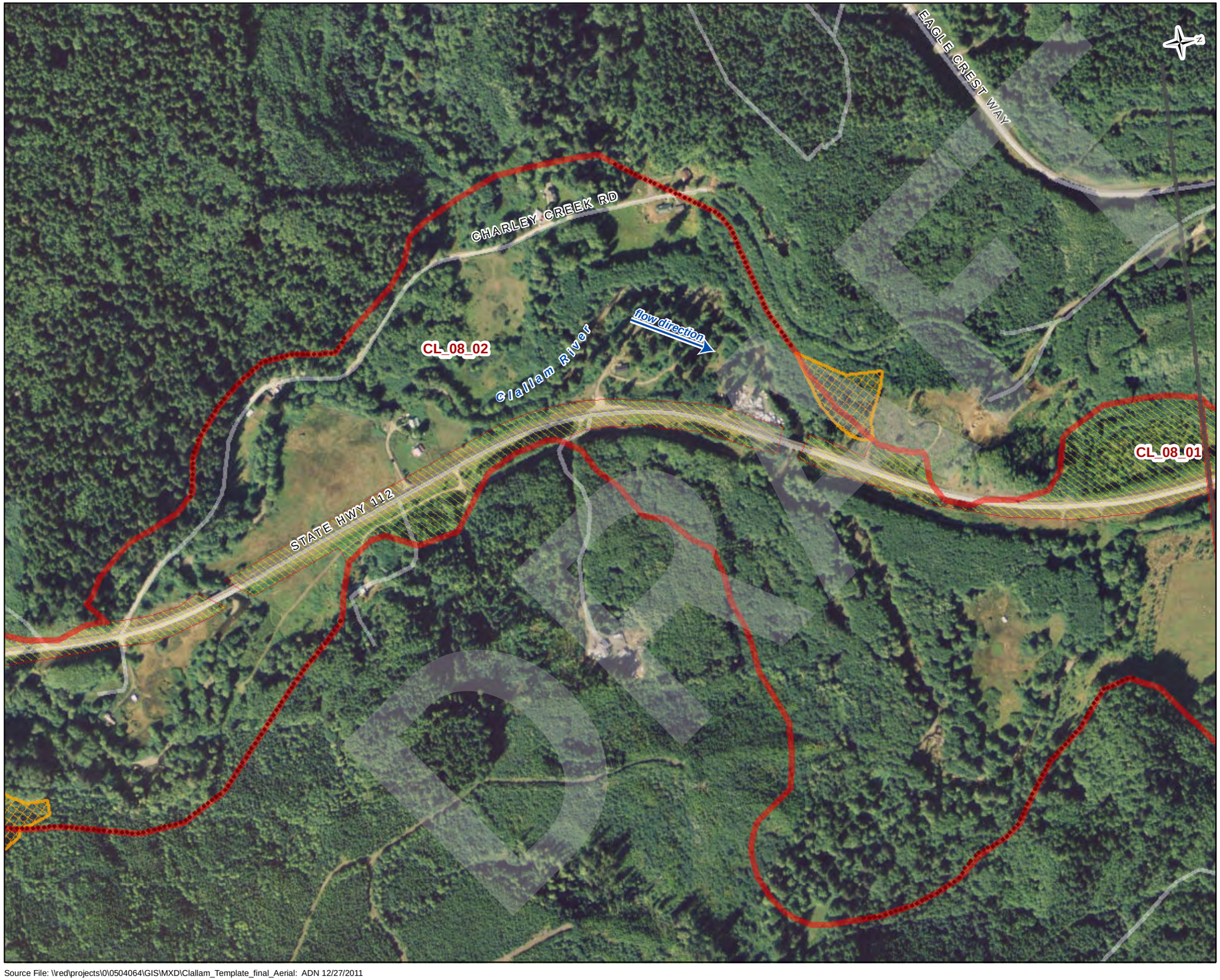
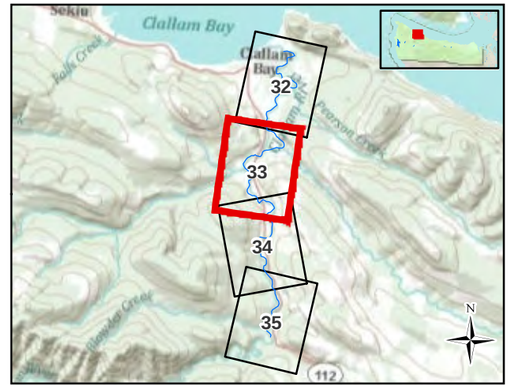
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Clallam River **Map 32**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

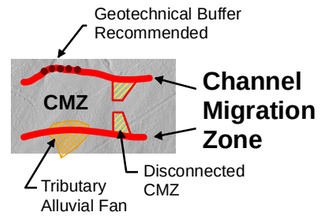




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
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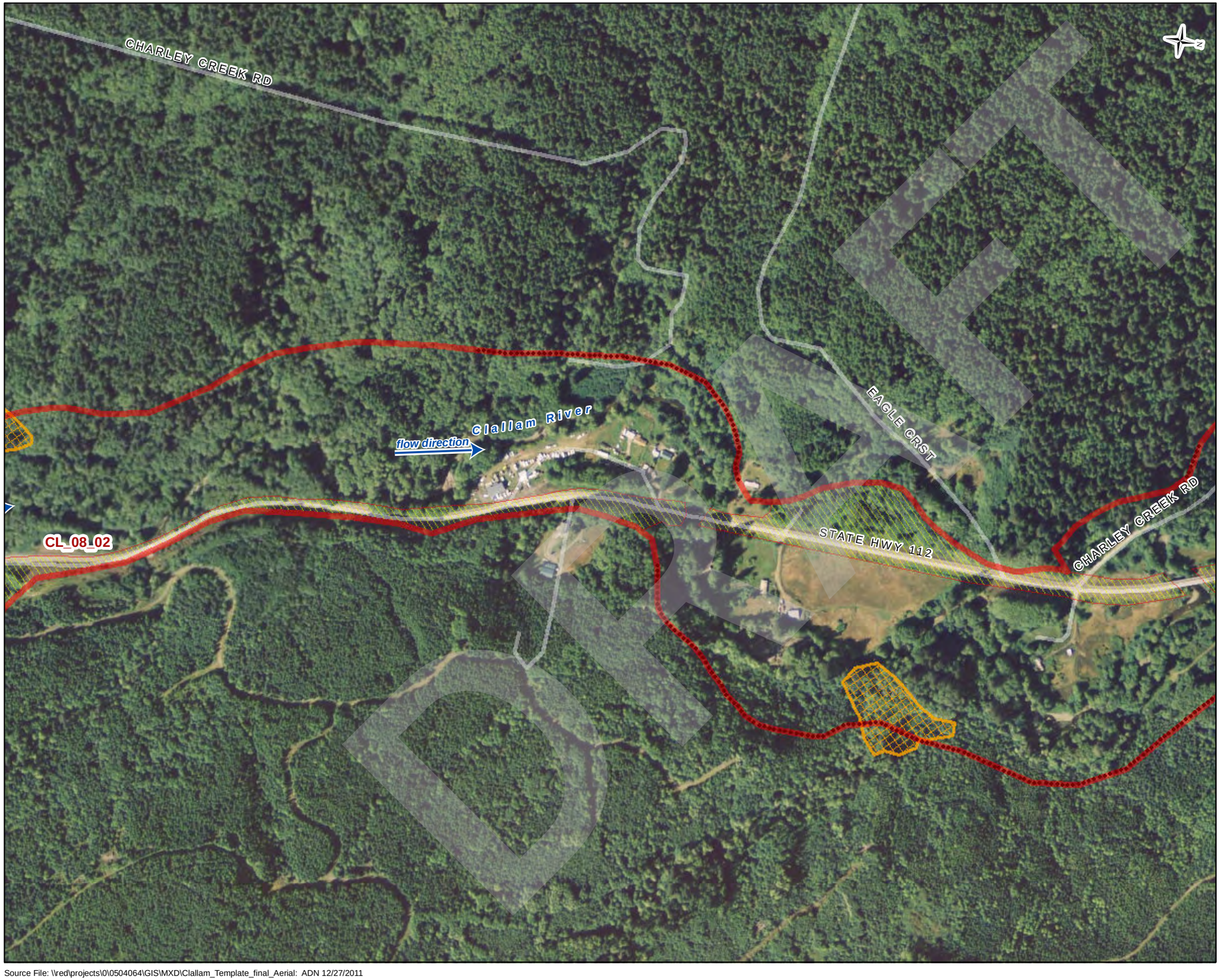
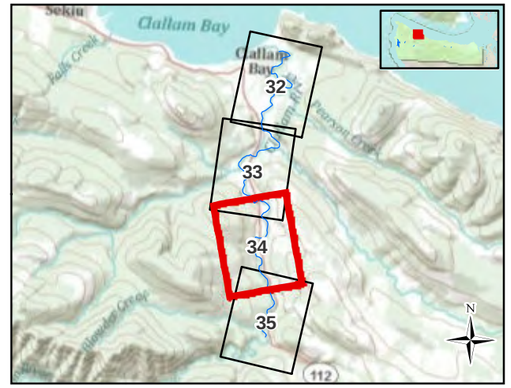
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Clallam River **Map 33**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

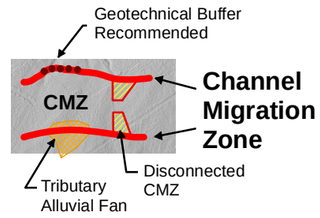




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
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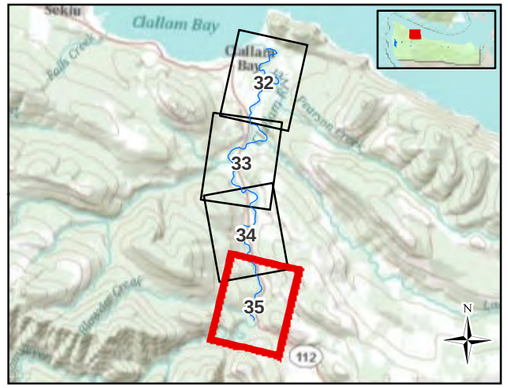
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Clallam River **Map 34**

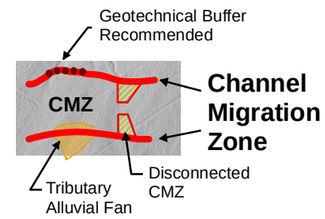
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011



River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
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WA State Dept of Nat. Resources 1:100,000 Geology
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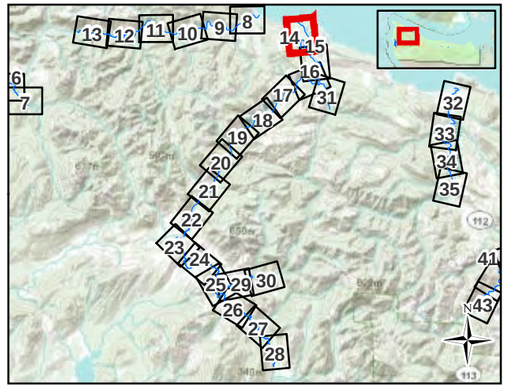
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Clallam River **Map 35**

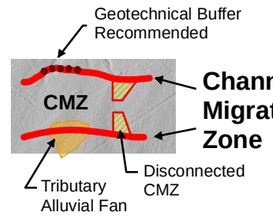
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011



River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
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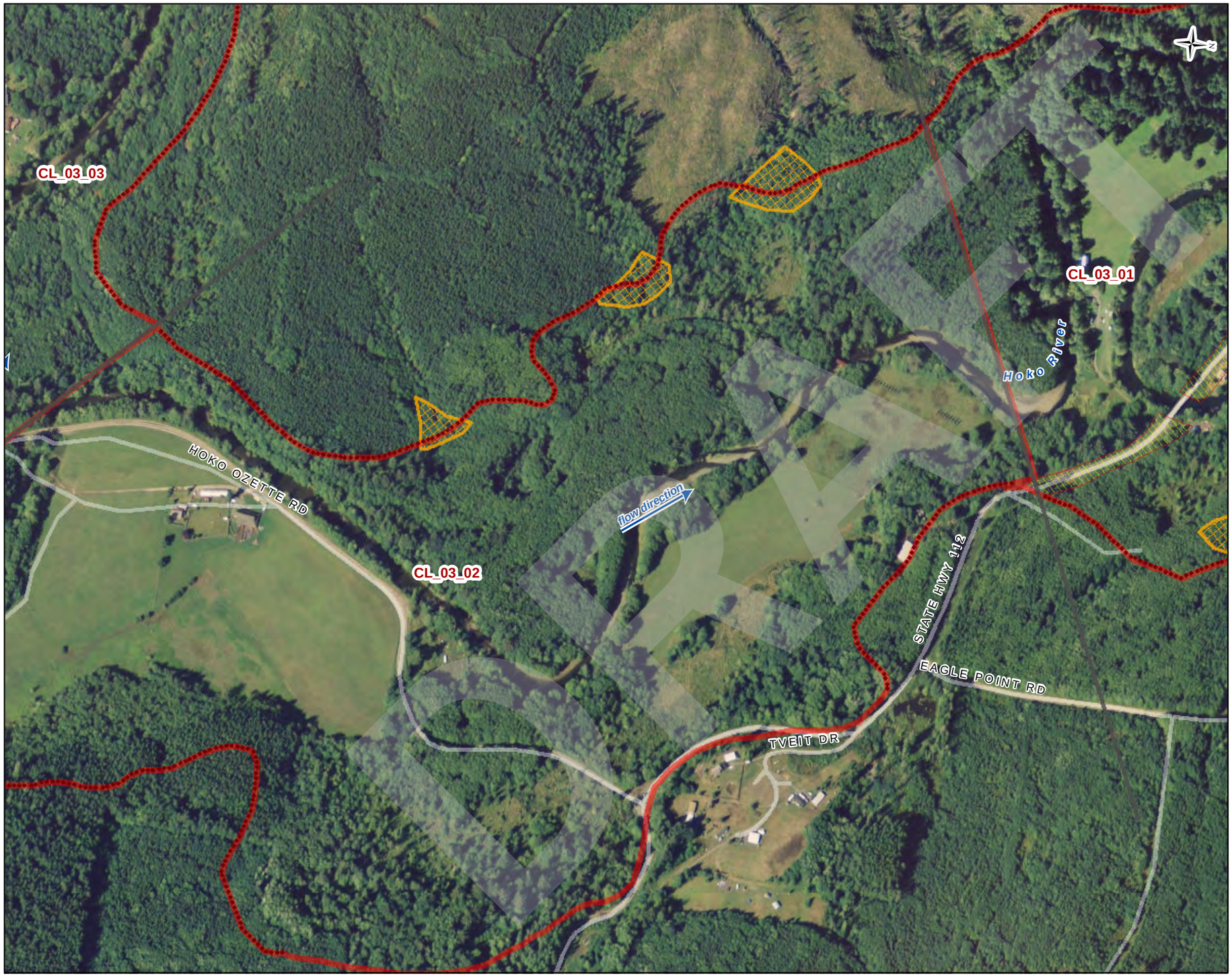
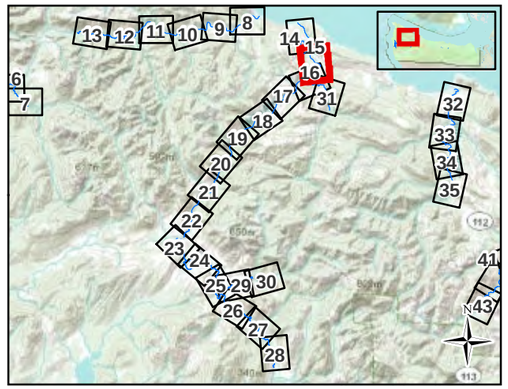
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Hoko River **Map 14**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

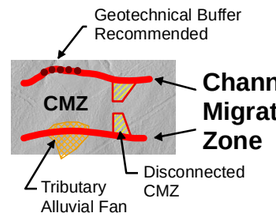




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
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WA State Dept of Nat. Resources 1:100,000 Geology
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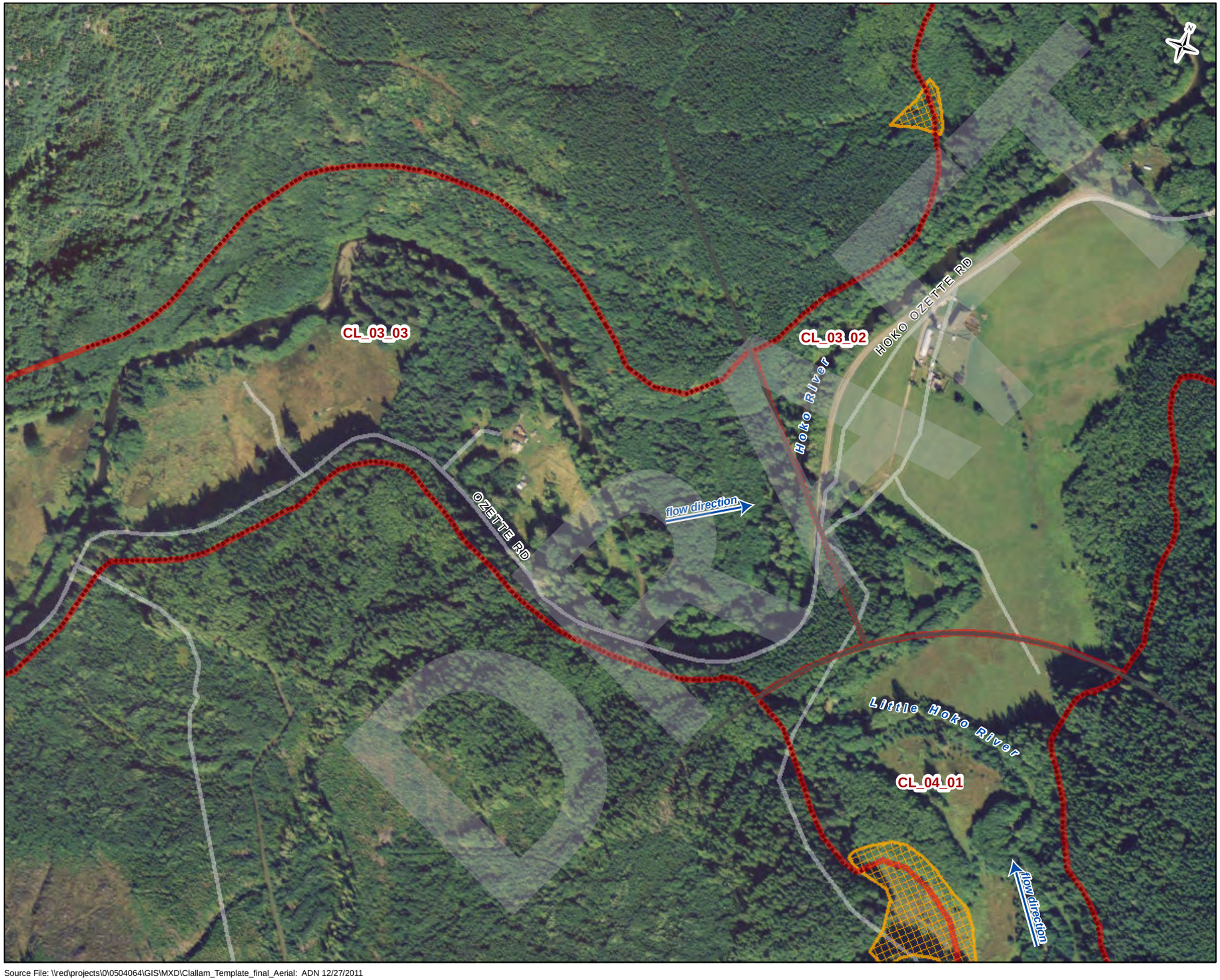
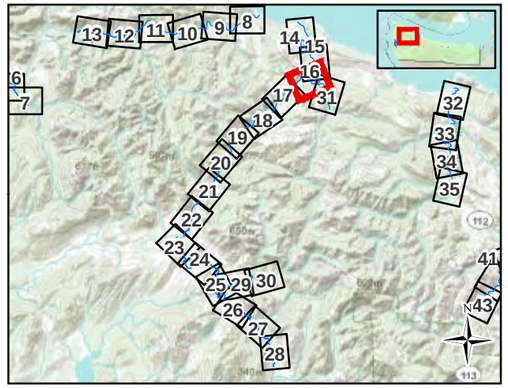
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Hoko River **Map 15**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

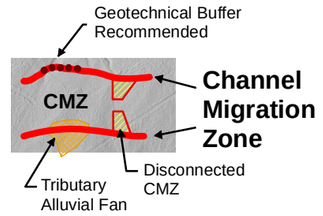




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
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Analyzed by: Andrew Nelson (GeoEngineers)
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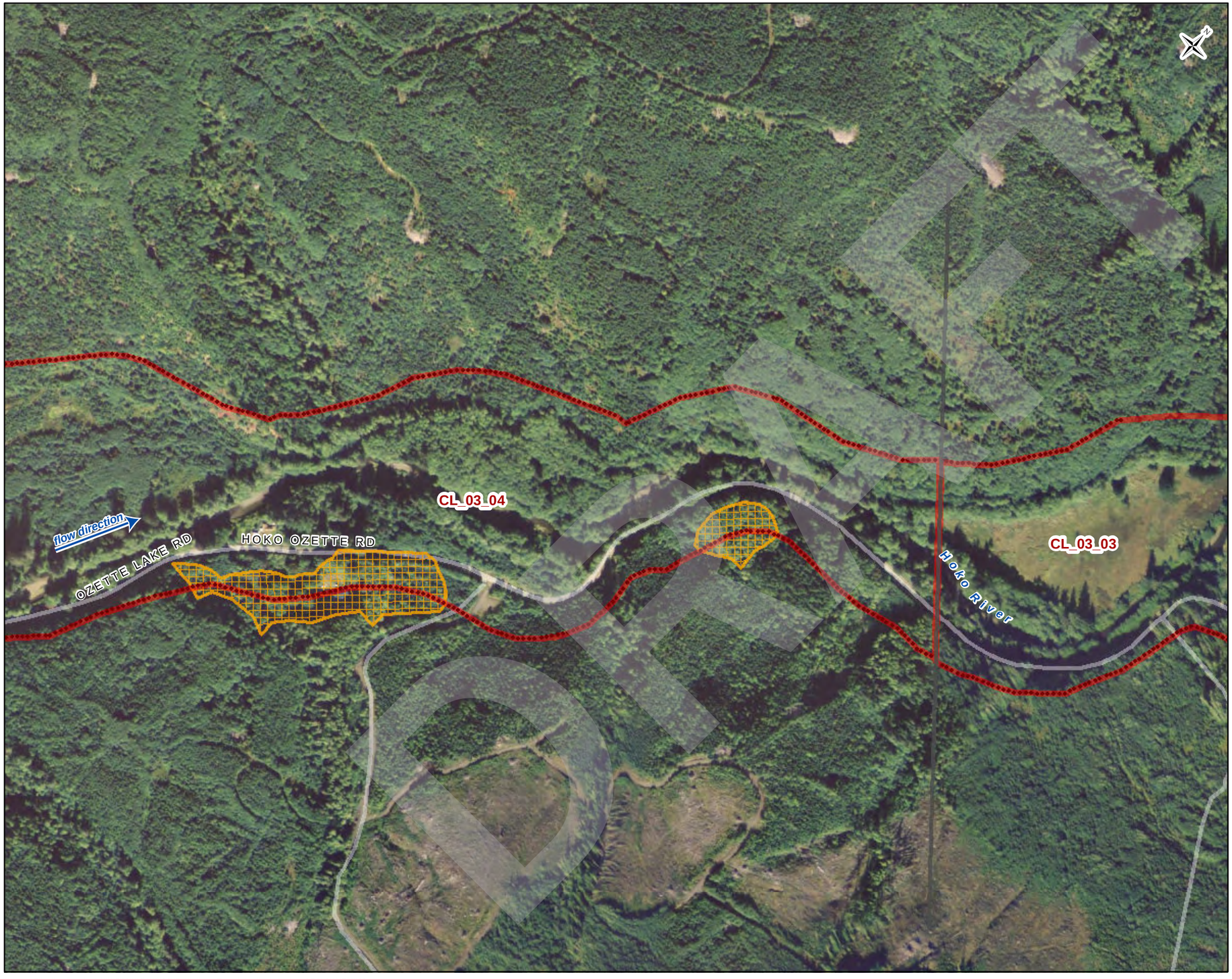
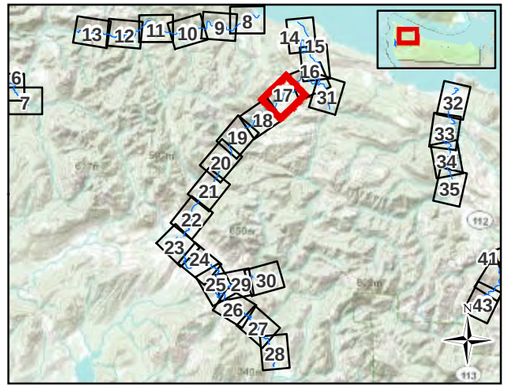
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Hoko River **Map 16**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

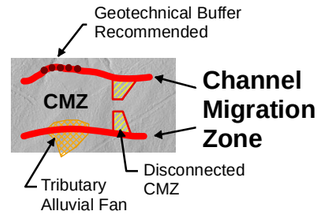




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
River miles calculated from NHD stream alignment (USGS)
Roads from TIGER (US Census Bureau)
Coordinate System: State Plane Washington North

Analyzed by: Andrew Nelson (GeoEngineers)
Reviewed by: Mary Ann Reinhart, LG, LEG (GeoEngineers)

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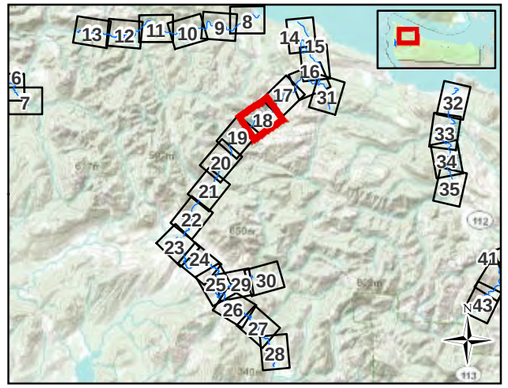
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Hoko River **Map 17**

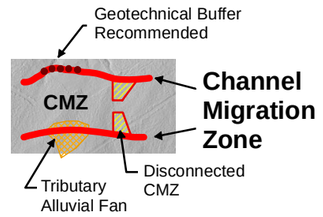
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011



River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
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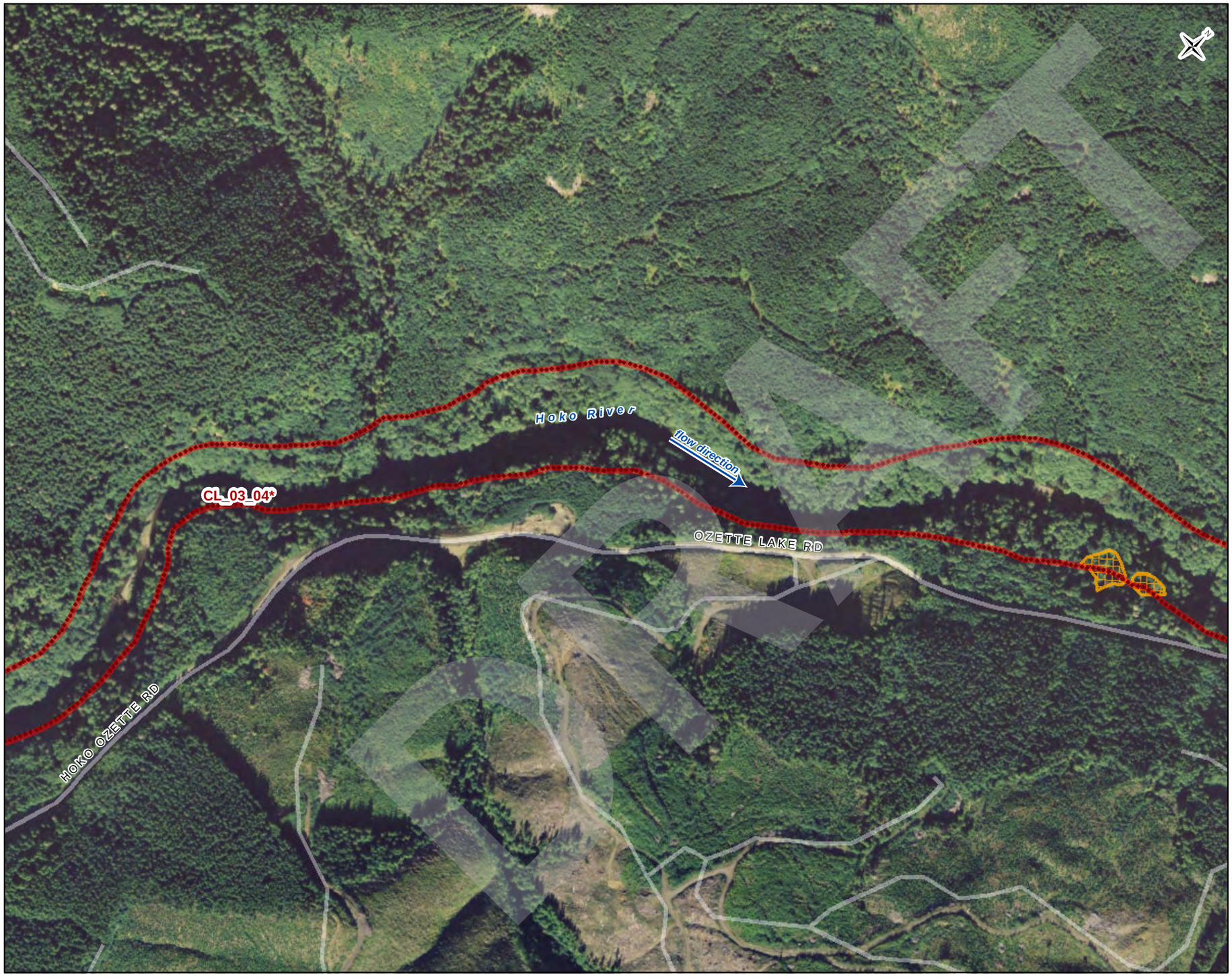
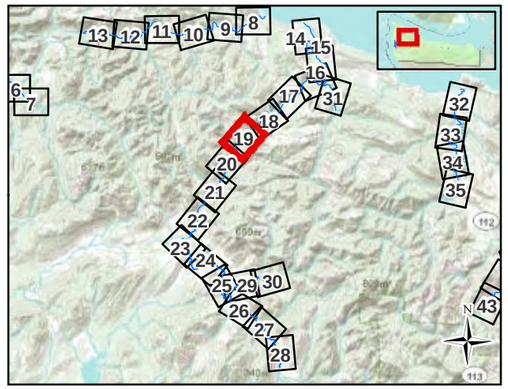
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Hoko River **Map 18**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

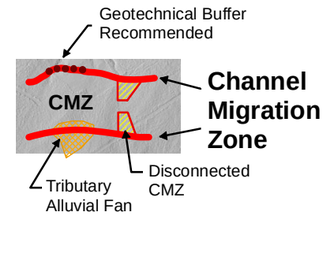




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
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WA State Dept of Nat. Resources 1:100,000 Geology
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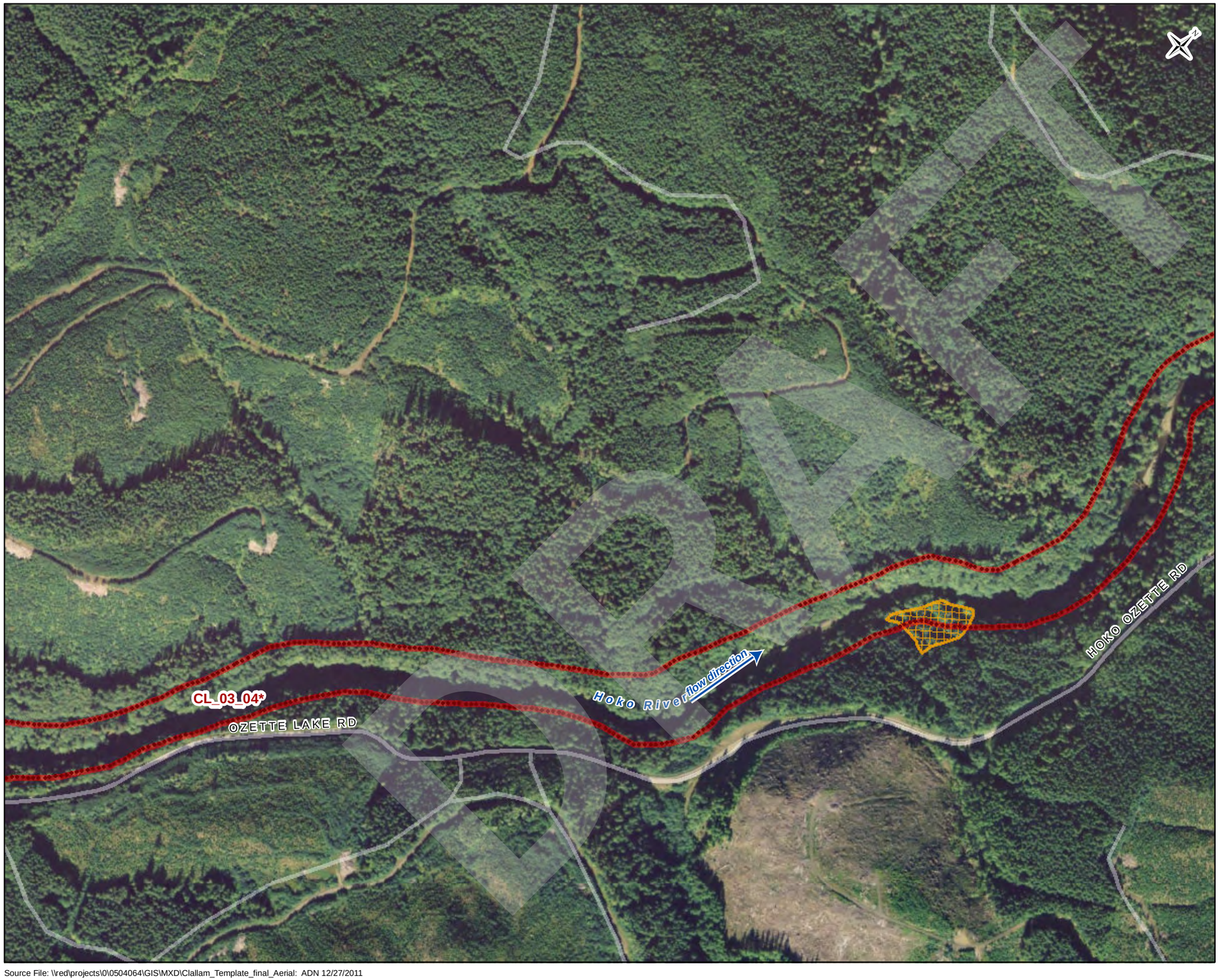
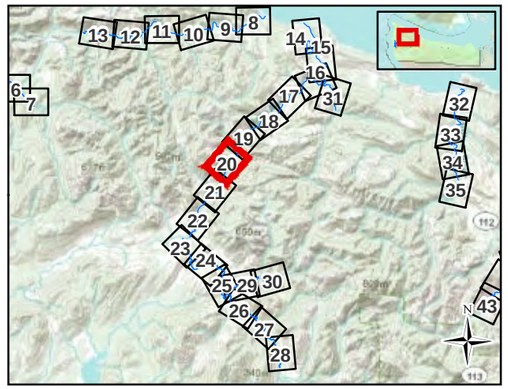
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Hoko River **Map 19**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

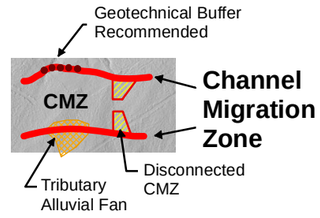




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
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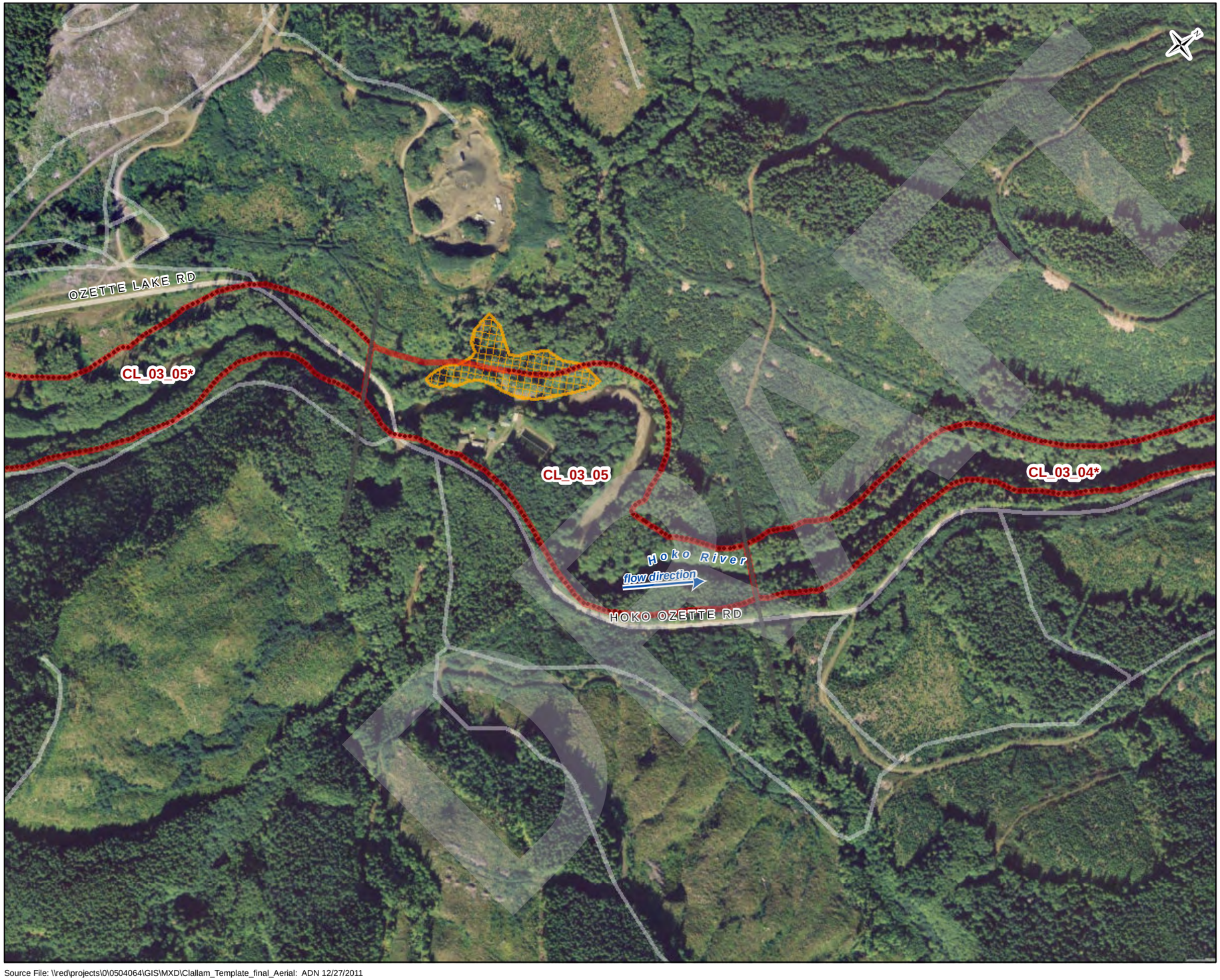
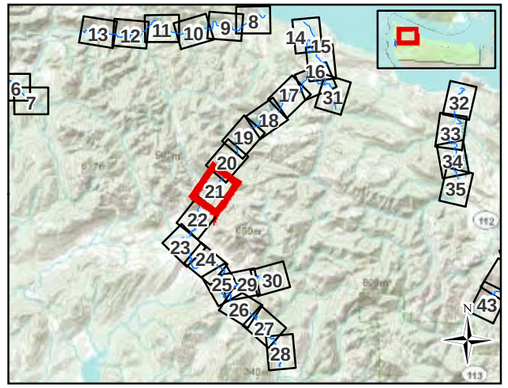
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Hoko River **Map 20**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

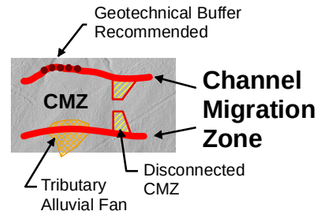


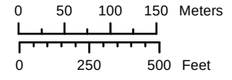


River Mile Marker

SK_##_## Reach_ID

Segment Boundary





2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
River miles calculated from NHD stream alignment (USGS)
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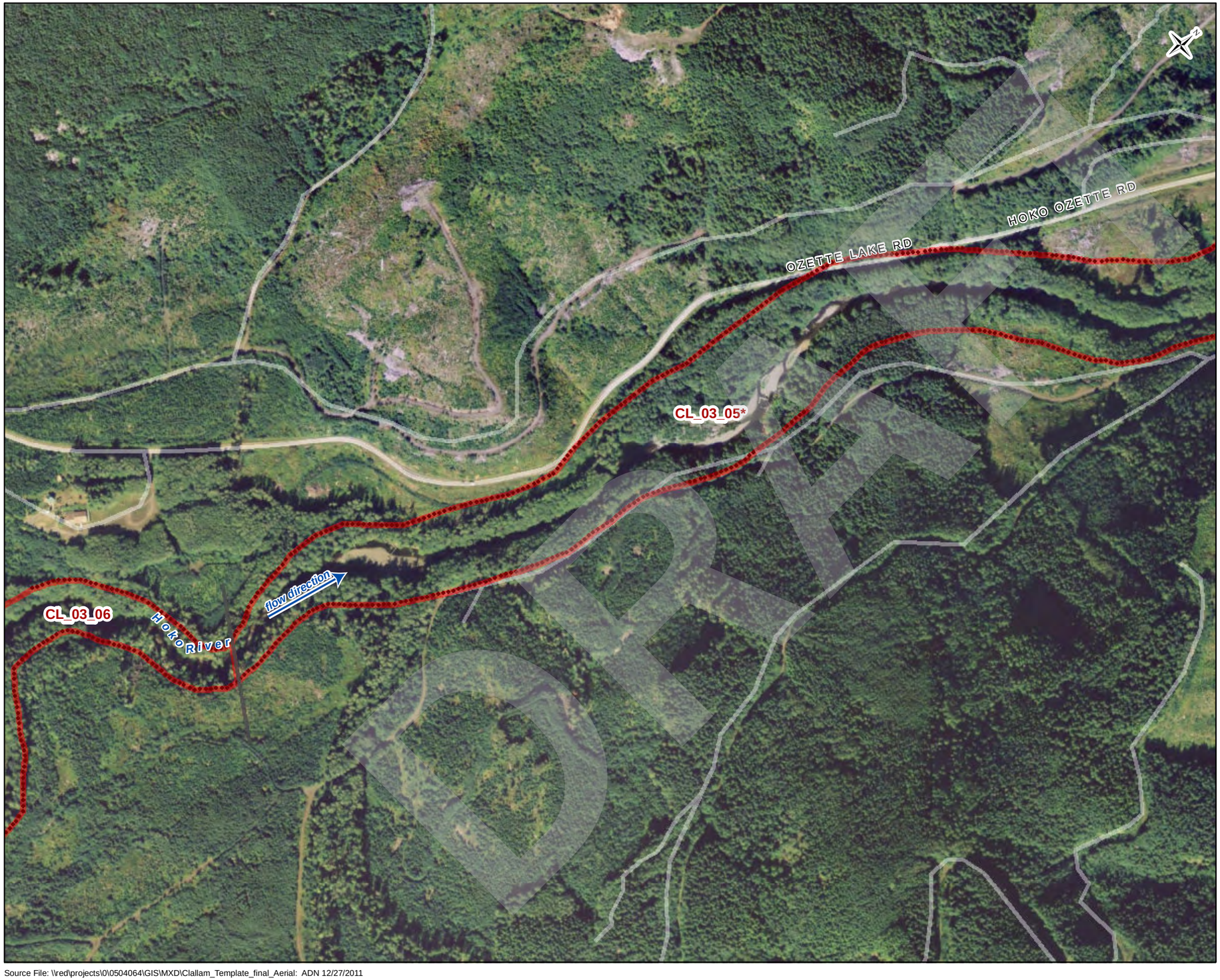
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Hoko River **Map 21**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011



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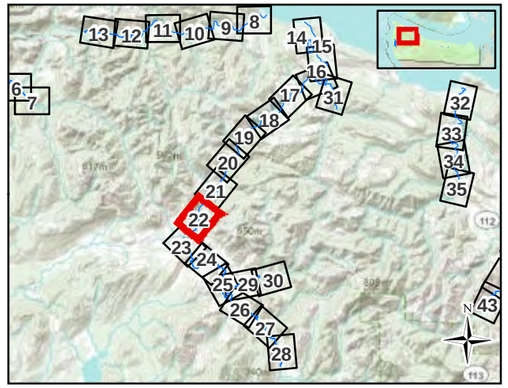
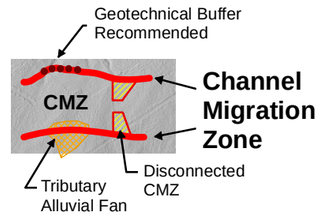
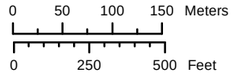


River Mile Marker

SK_##_## Reach_ID

Segment Boundary





2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
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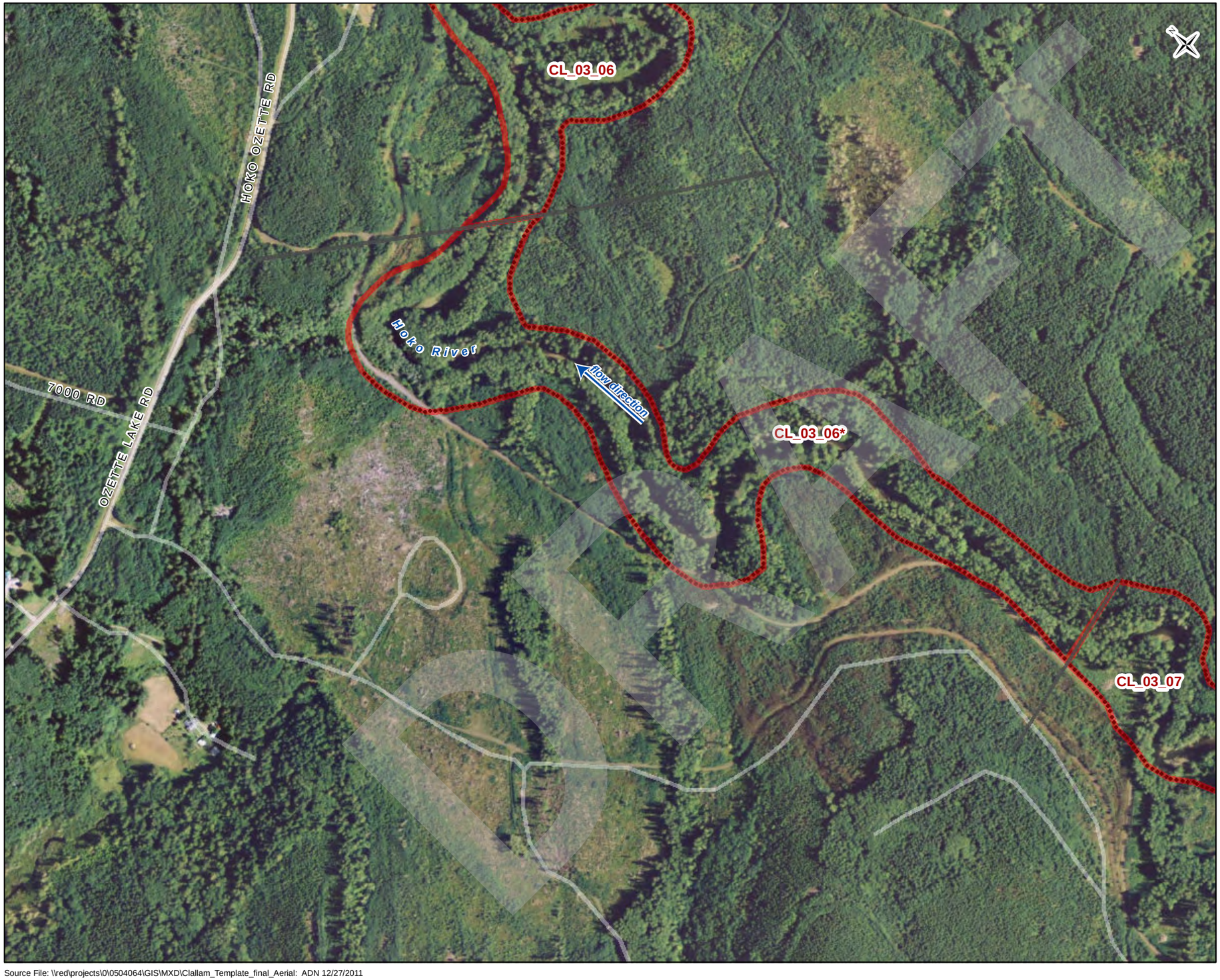
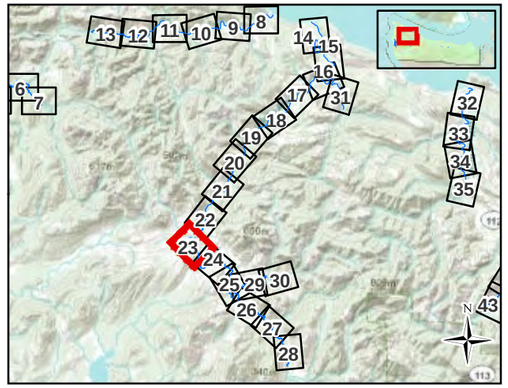
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Hoko River **Map 22**

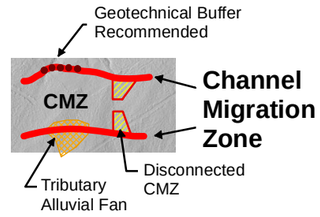




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
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Roads from TIGER (US Census Bureau)
Coordinate System: State Plane Washington North

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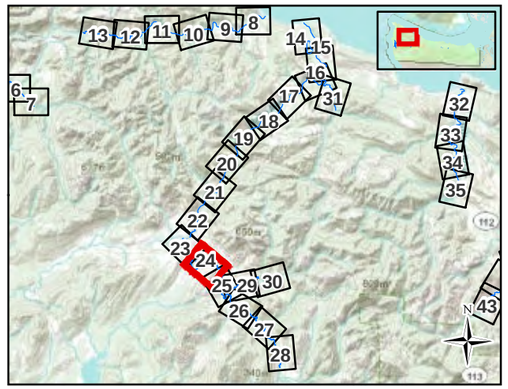
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

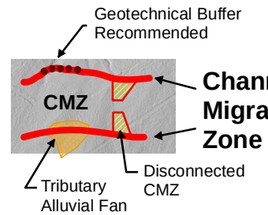
Hoko River **Map 23**



River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
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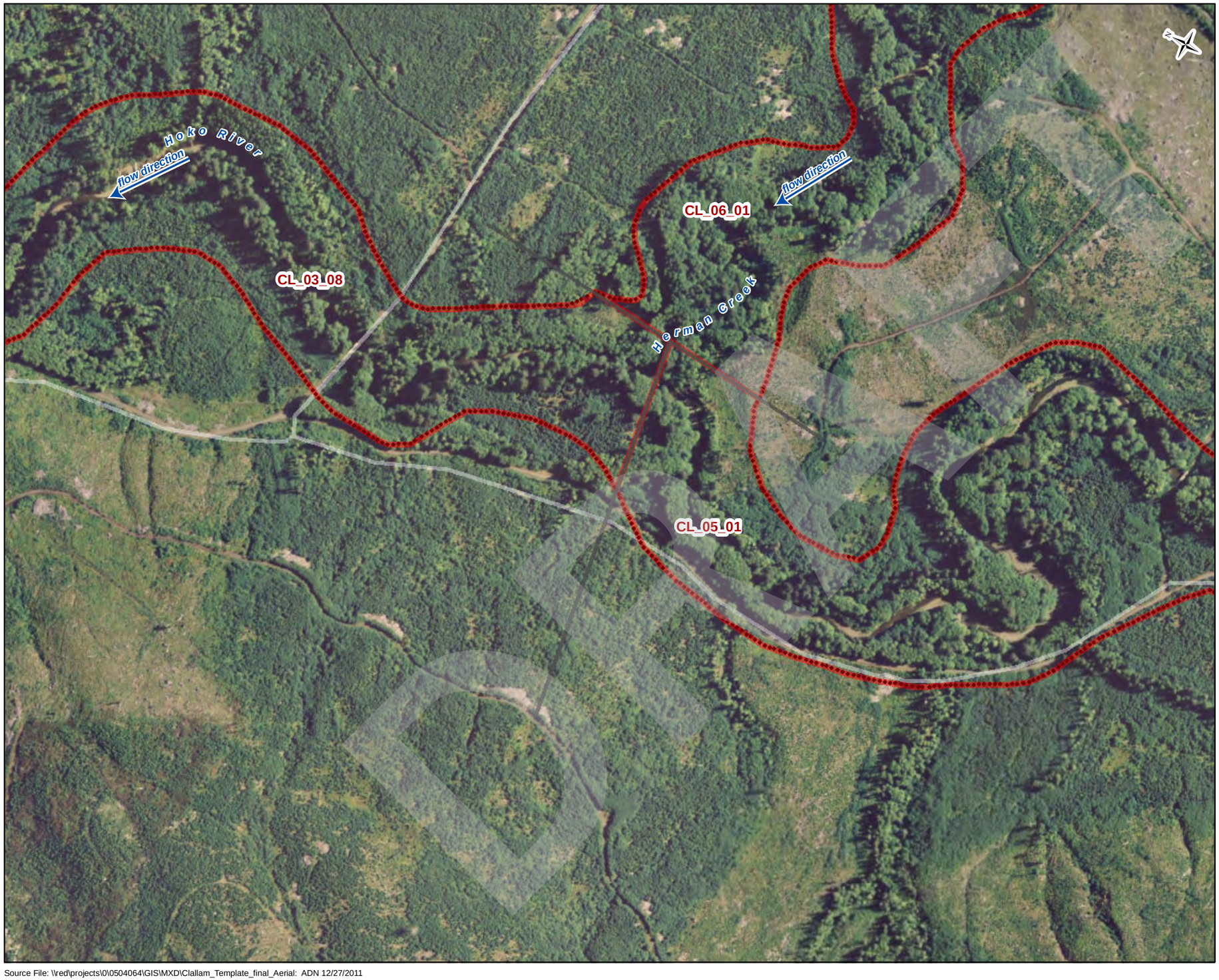
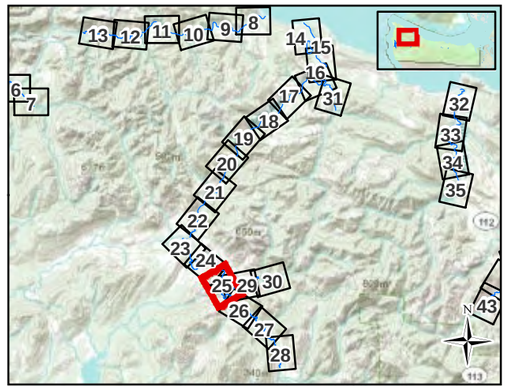
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Hoko River **Map 24**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

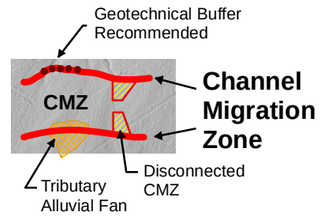




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
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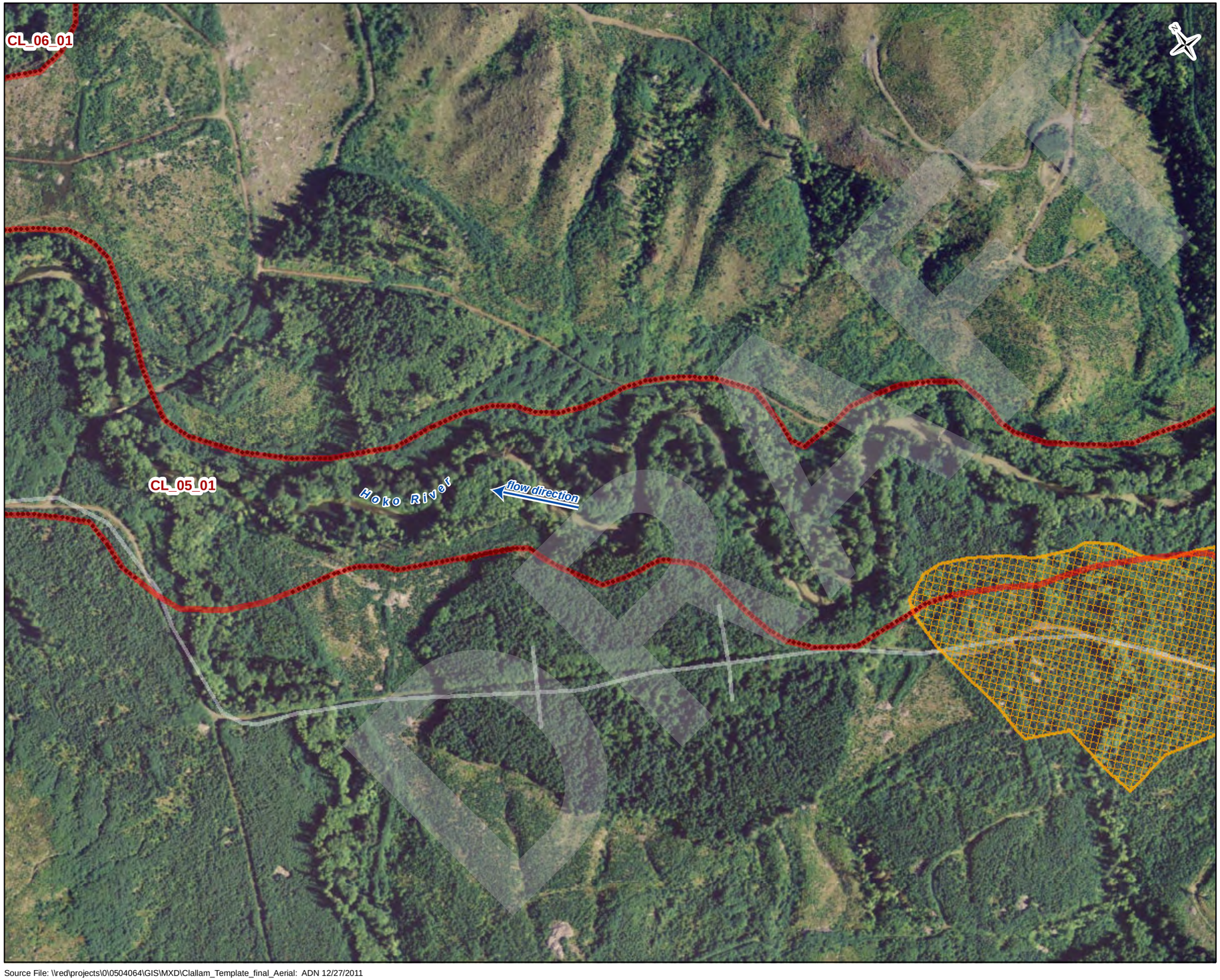
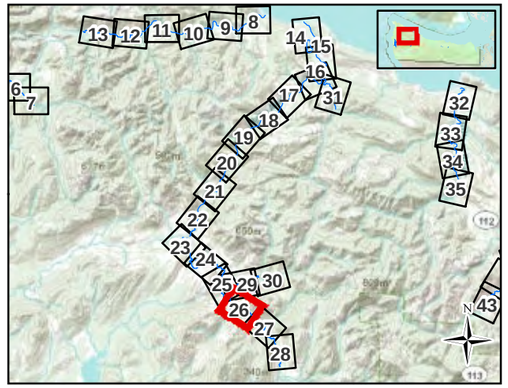
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Hoko River **Map 25**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

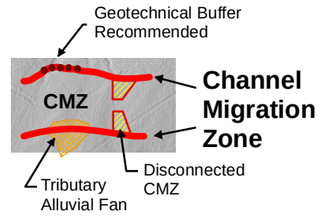




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
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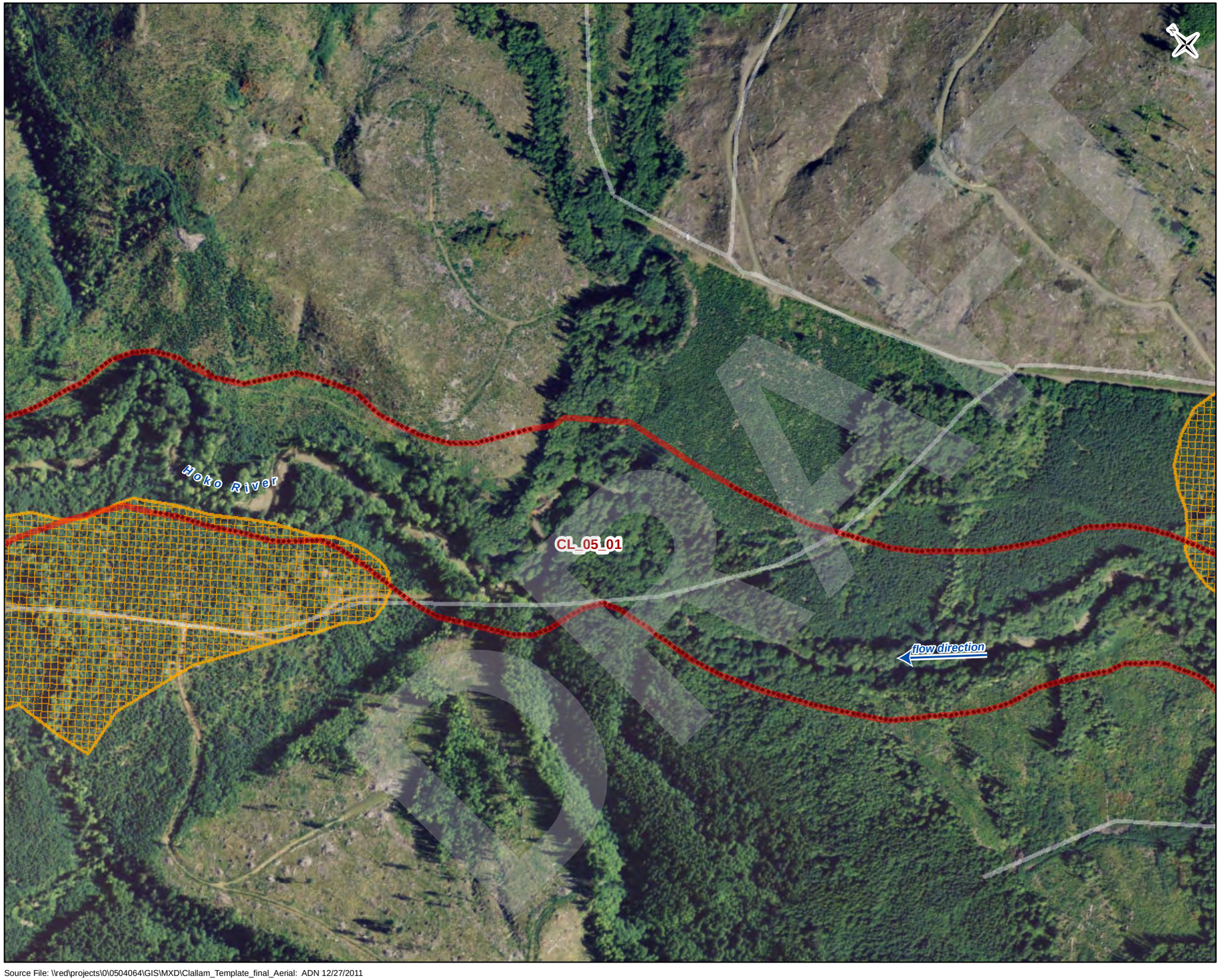
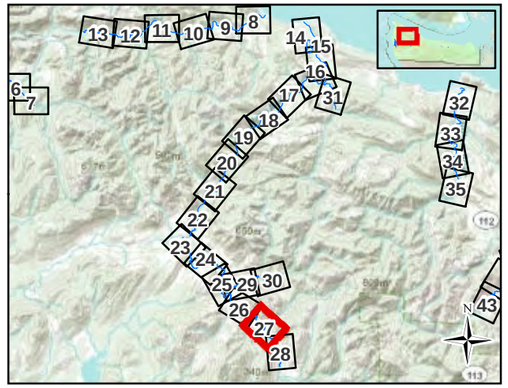
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Hoko River **Map 26**

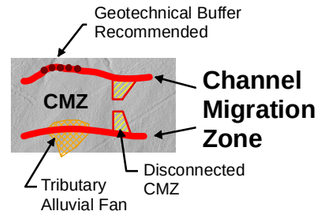


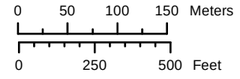


River Mile Marker

SK_##_## Reach_ID

Segment Boundary





2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
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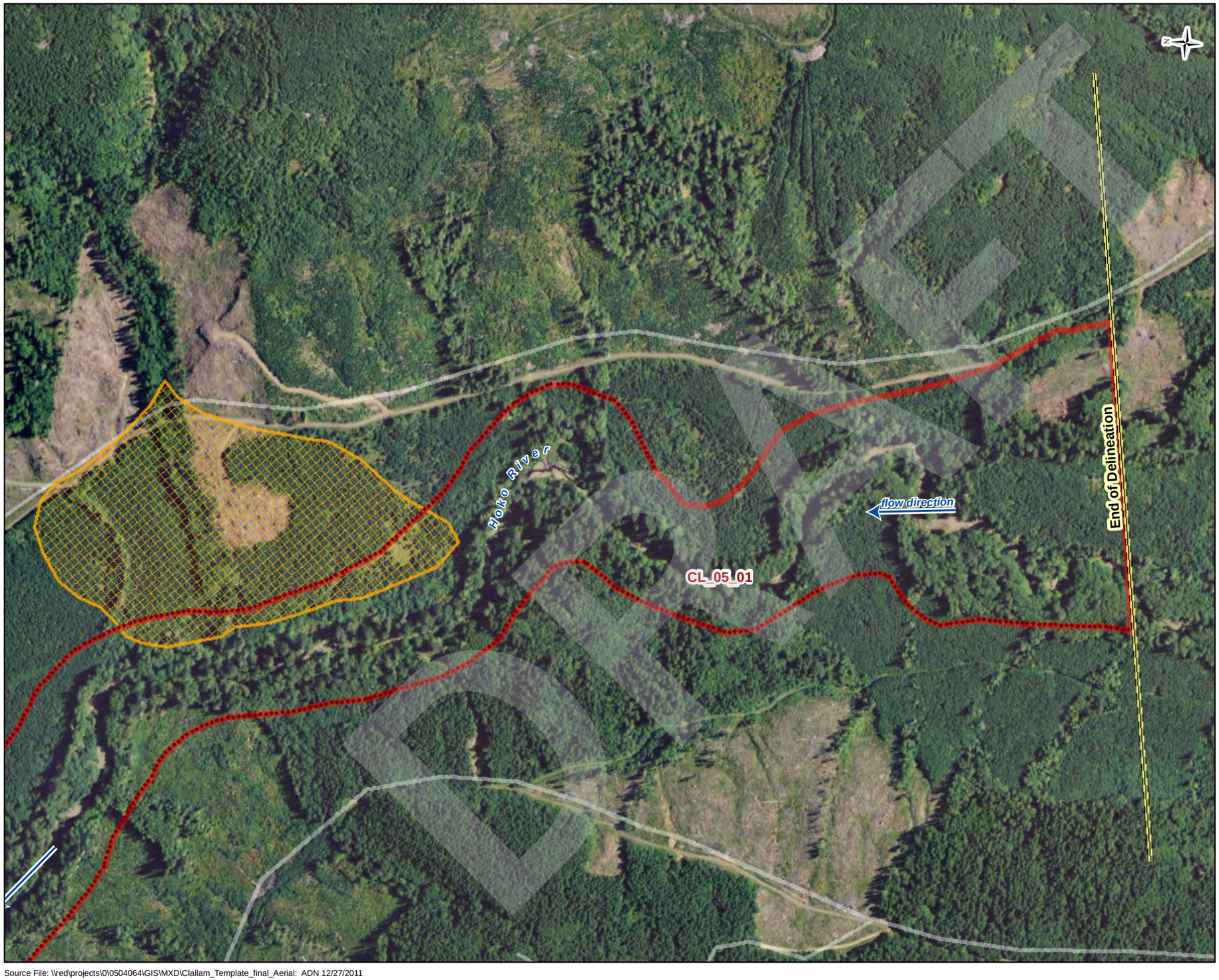
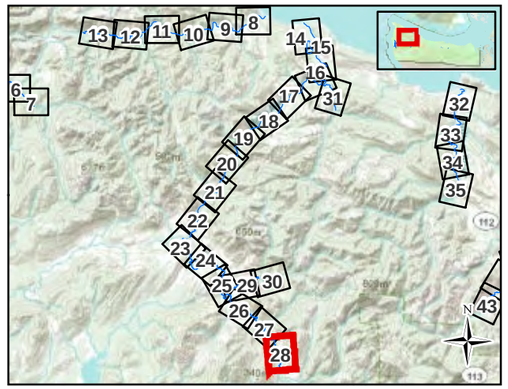
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Hoko River **Map 27**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

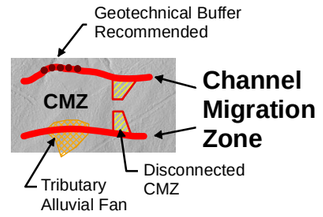




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
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Roads from TIGER (US Census Bureau)
Coordinate System: State Plane Washington North

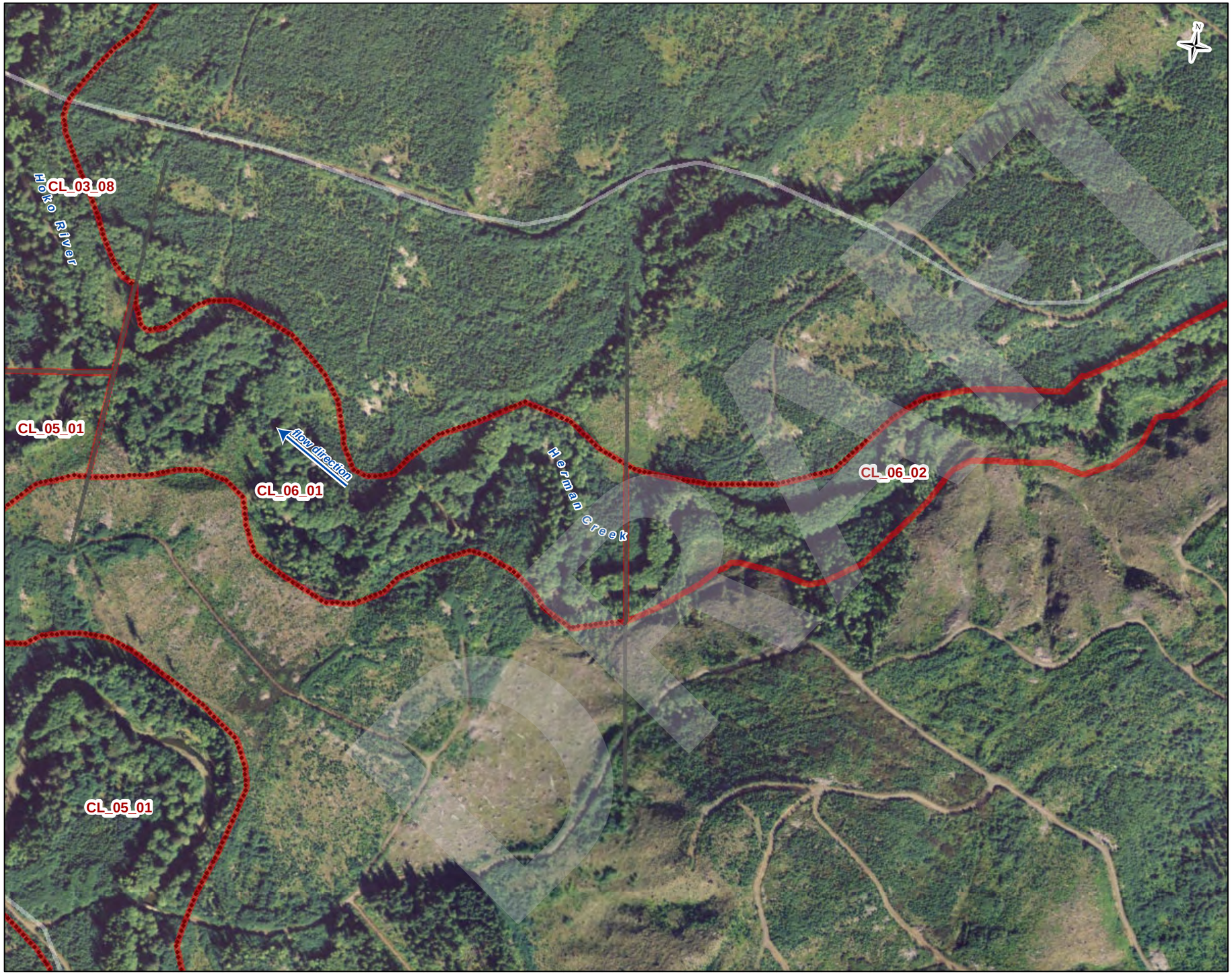
Analyzed by: Andrew Nelson (GeoEngineers)
Reviewed by: Mary Ann Reinhart, LG, LEG (GeoEngineers)

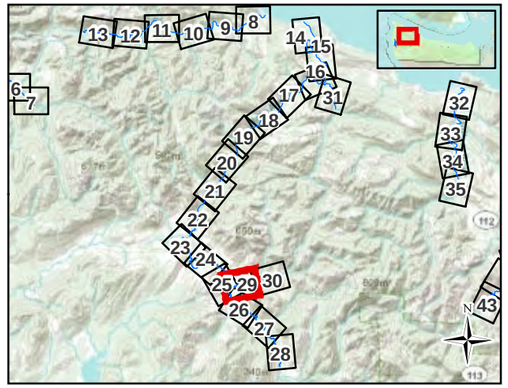
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Hoko River **Map 28**

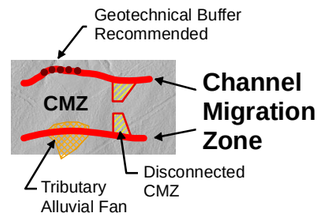




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
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Analyzed by: Andrew Nelson (GeoEngineers)
Reviewed by: Mary Ann Reinhart, LG, LEG (GeoEngineers)

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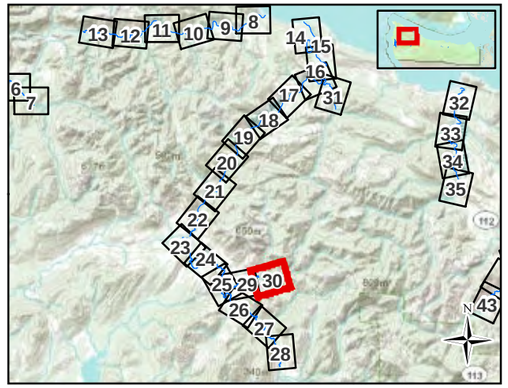
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Herman Creek **Map 29**

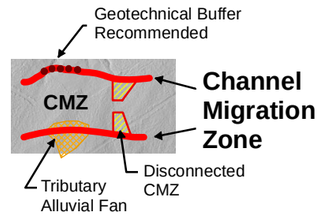
Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011



River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
River miles calculated from NHD stream alignment (USGS)
Roads from TIGER (US Census Bureau)
Coordinate System: State Plane Washington North

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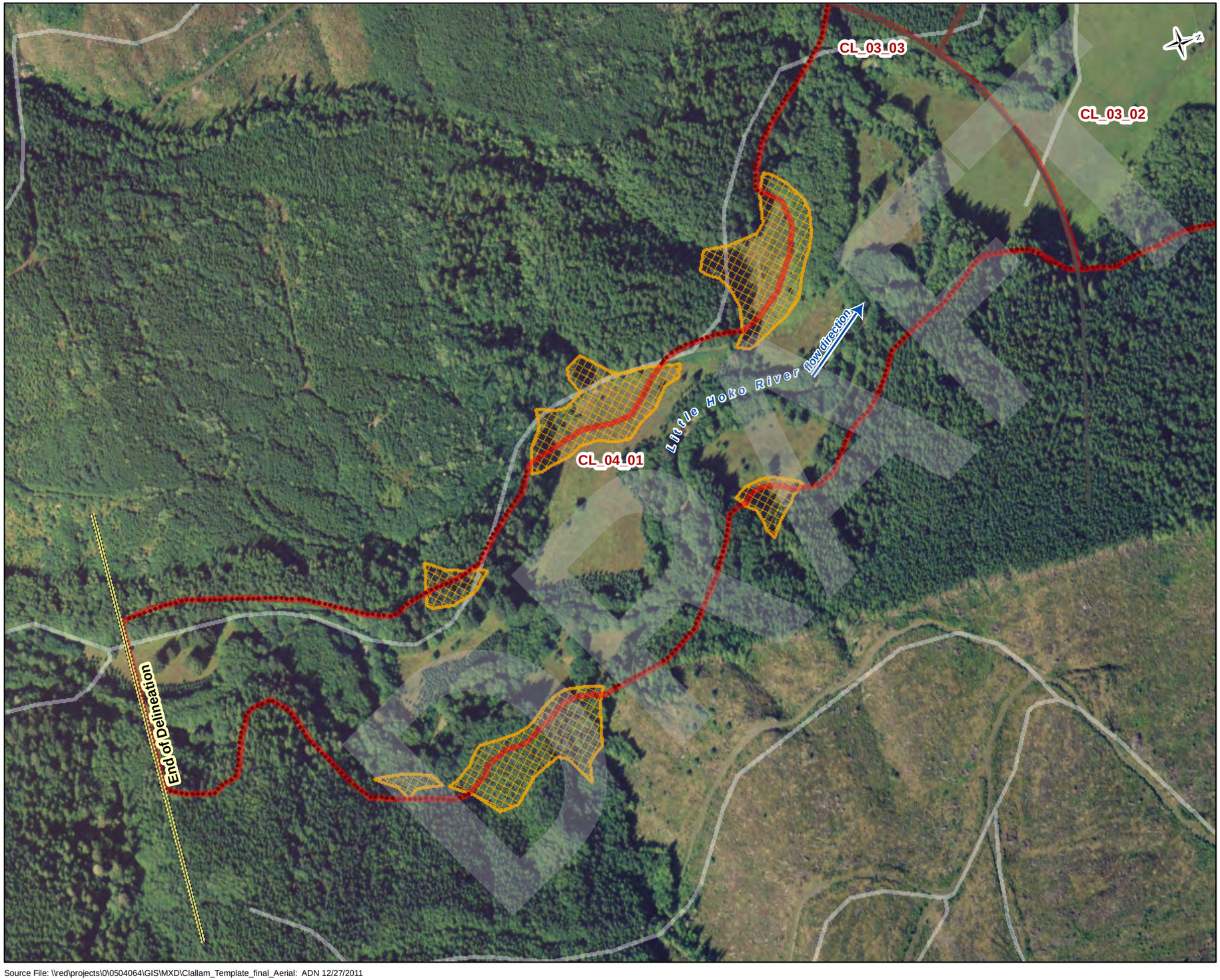
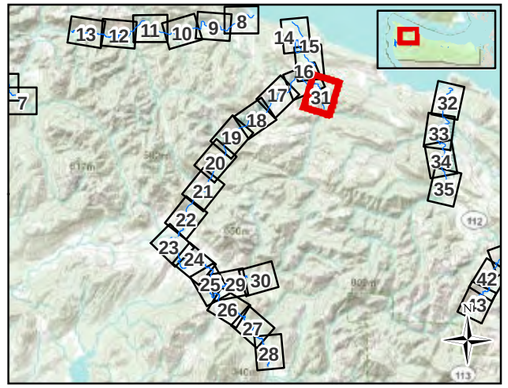
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Herman Creek **Map 30**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

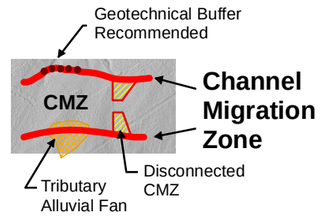




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
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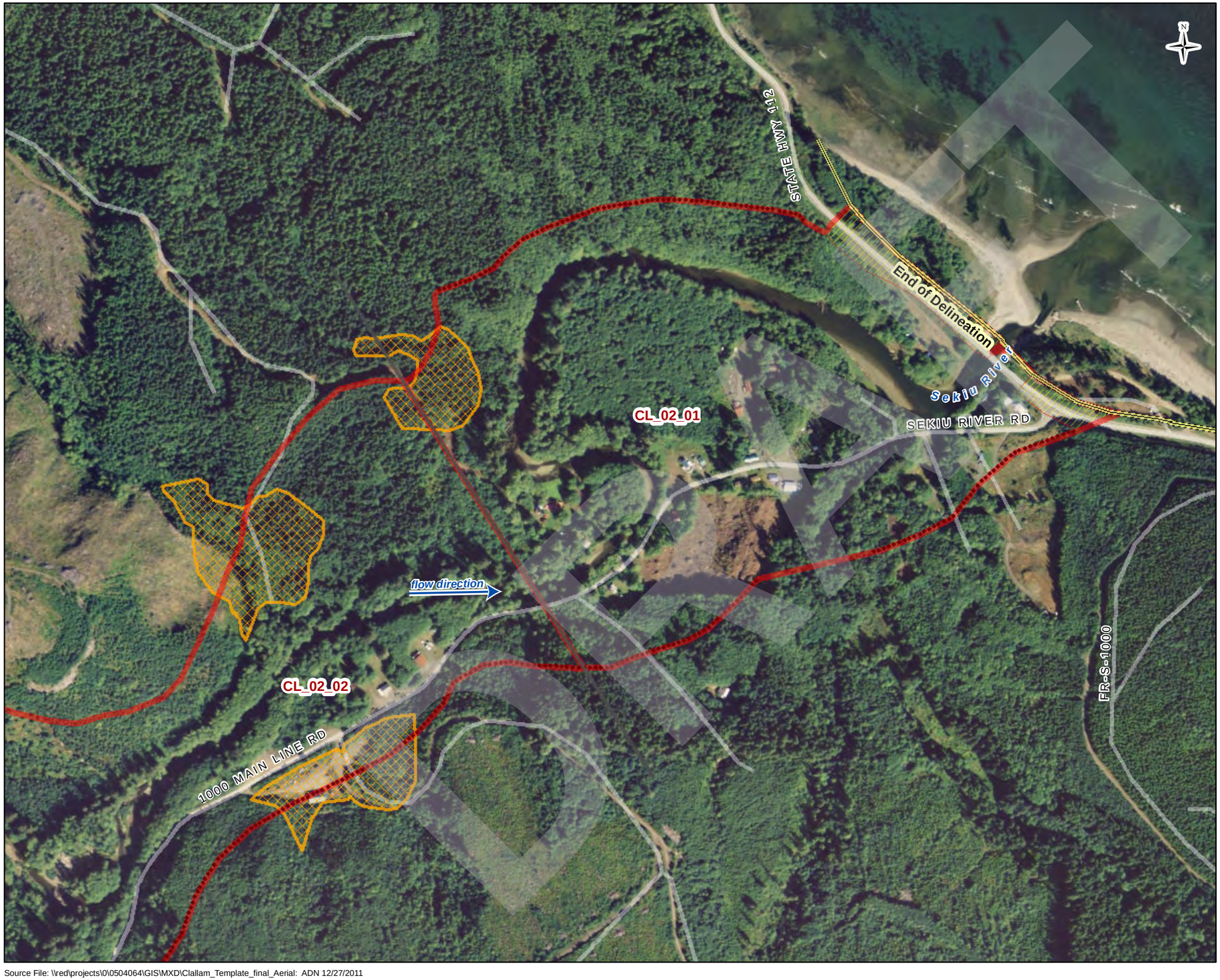
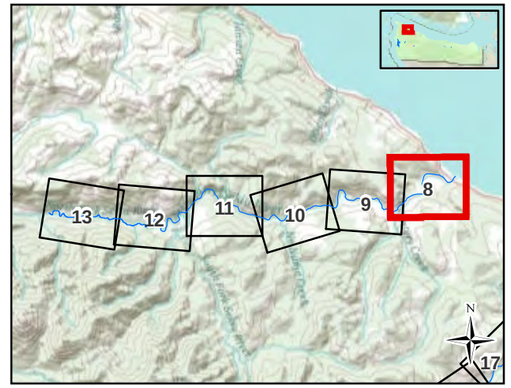
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Little Hoko River Map 31

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

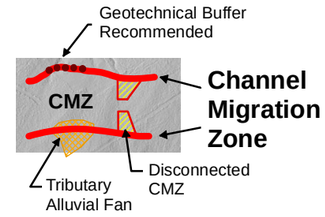




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
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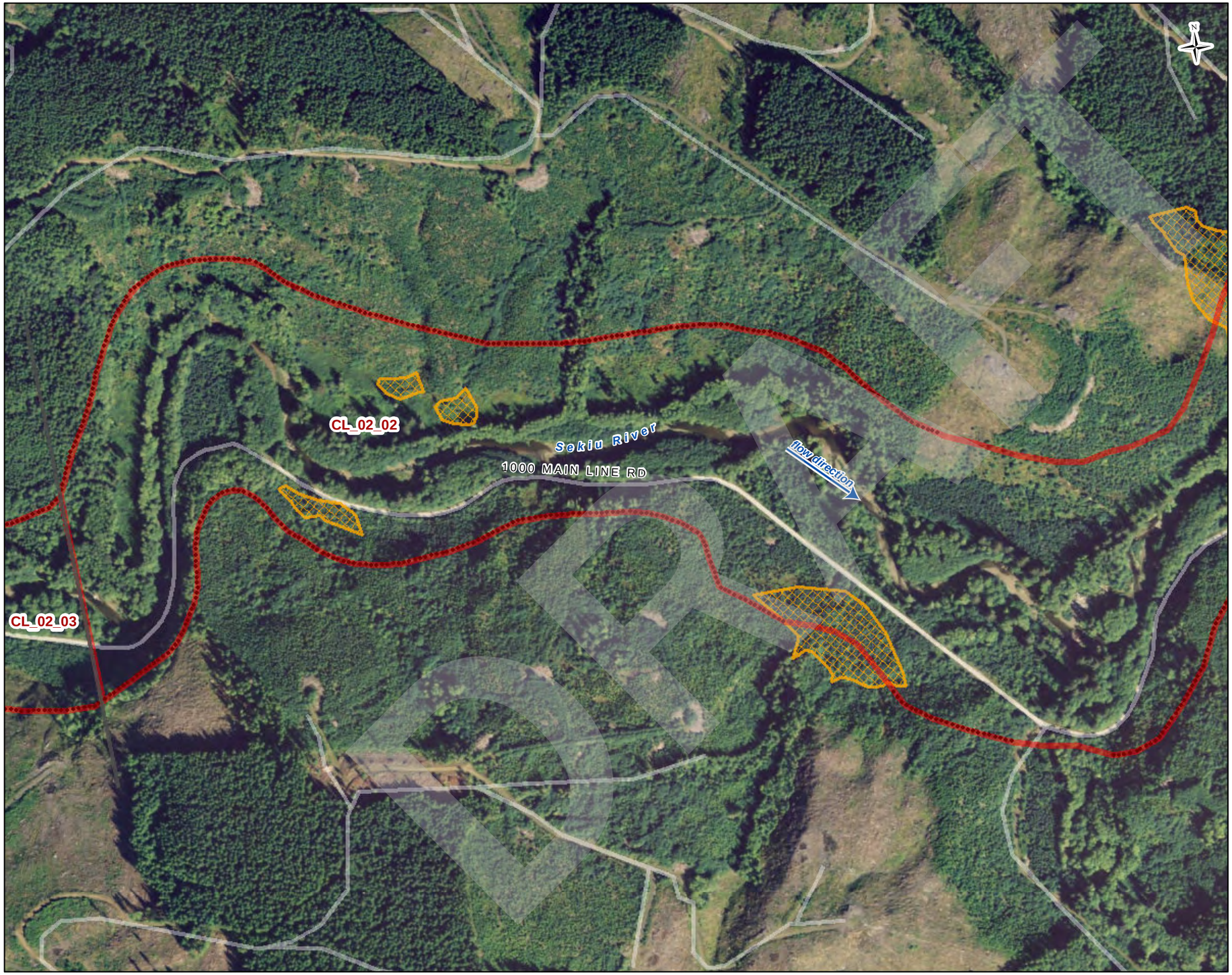
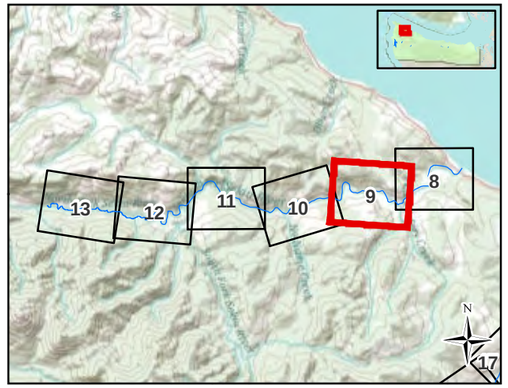
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Sekiu River **Map 8**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

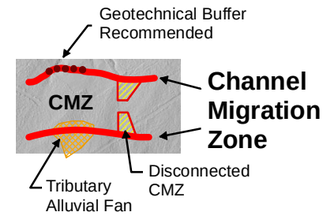




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
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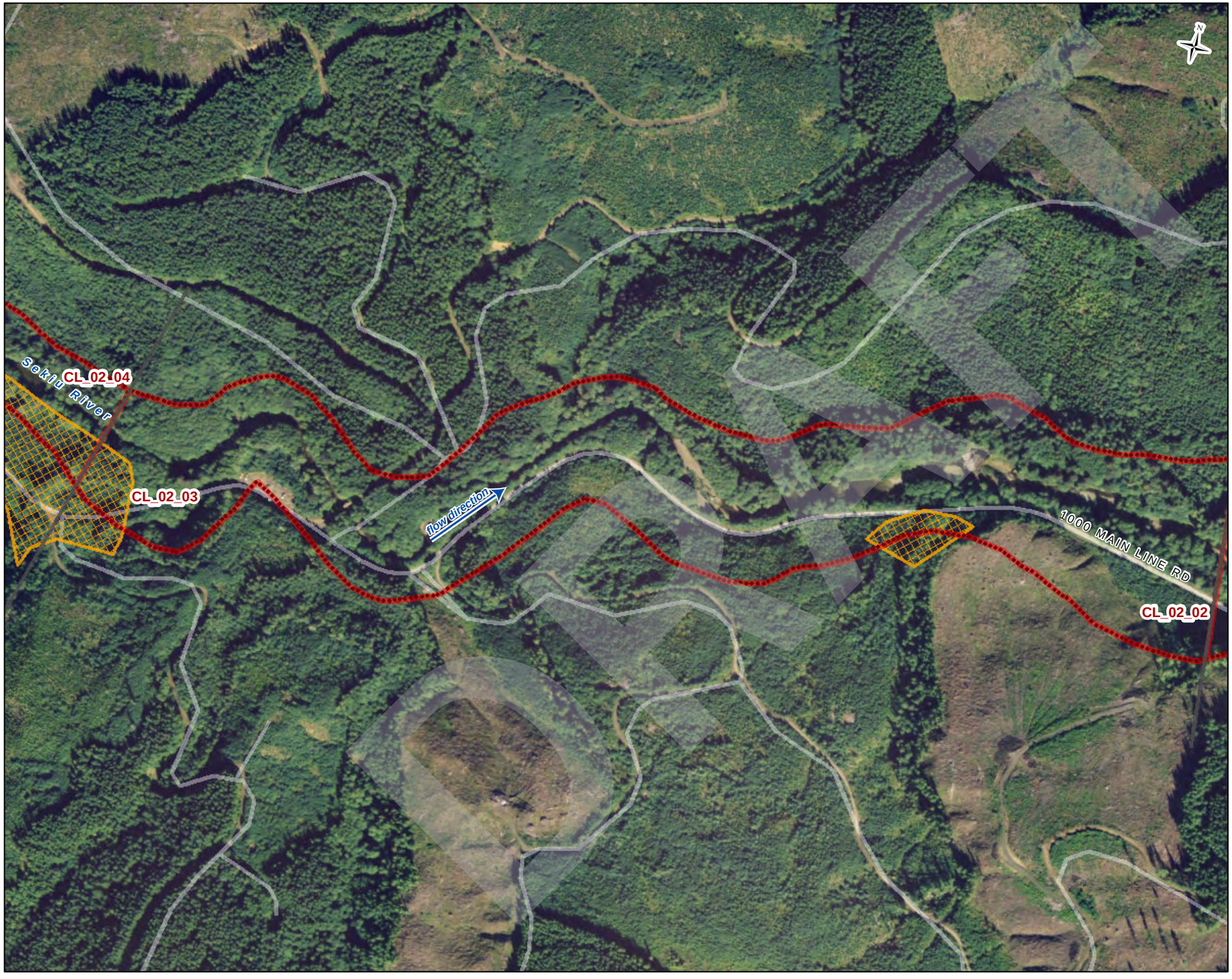
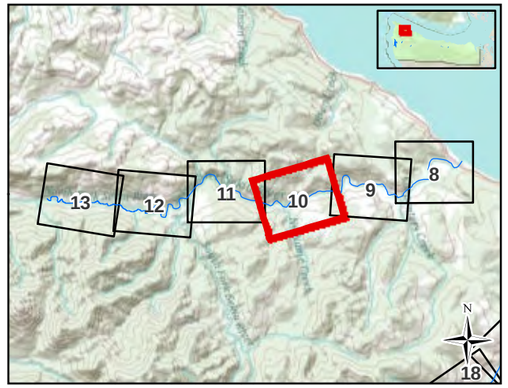
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Sekiu River **Map 9**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

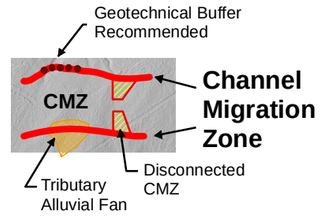




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
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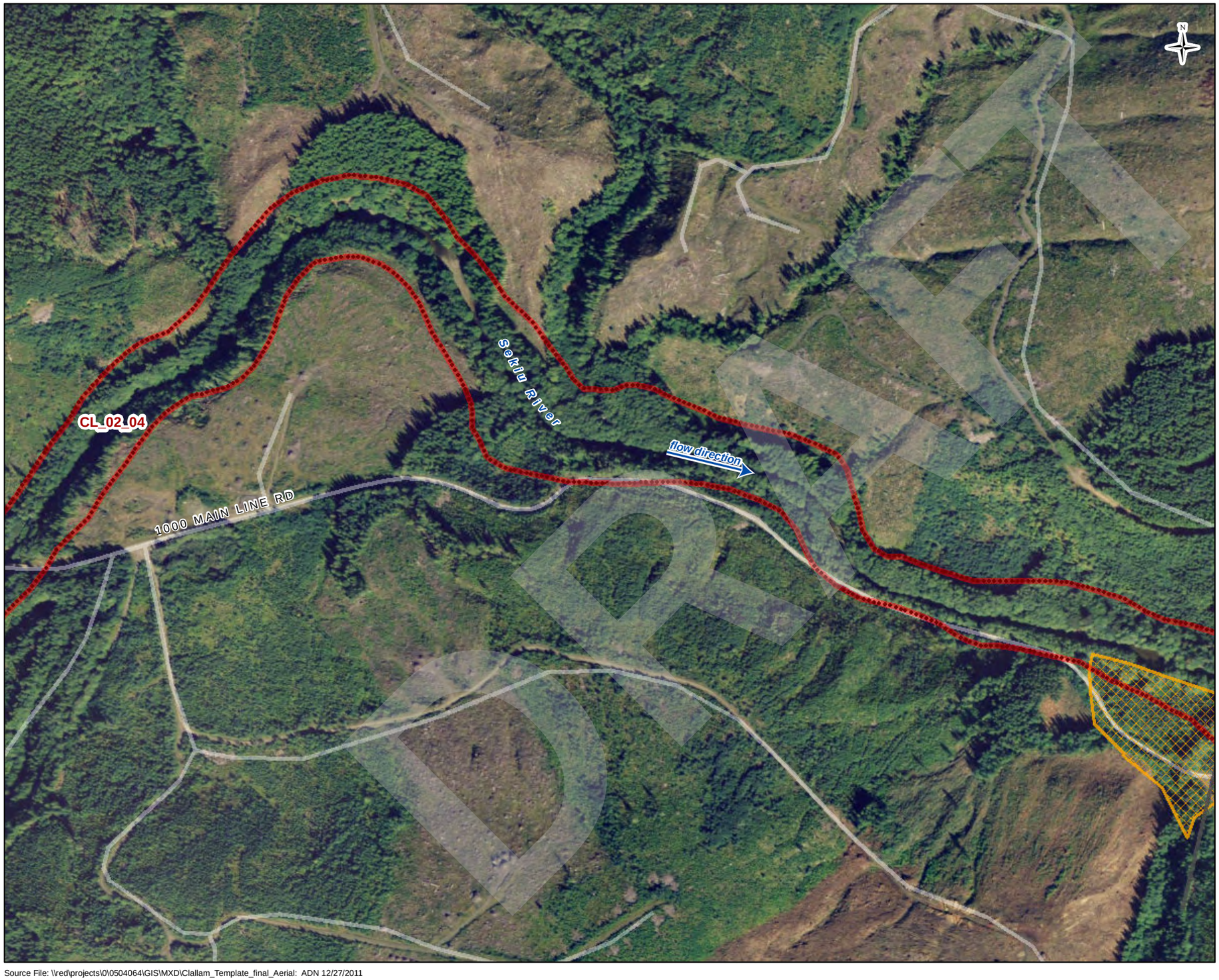
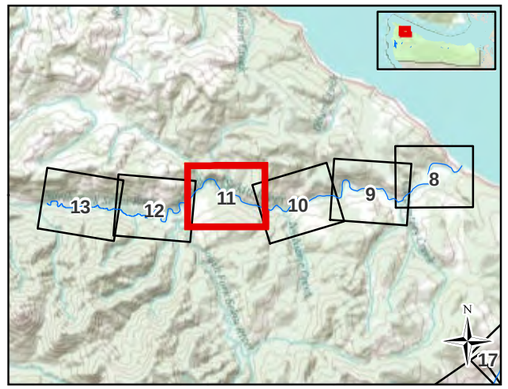
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Sekiu River **Map 10**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

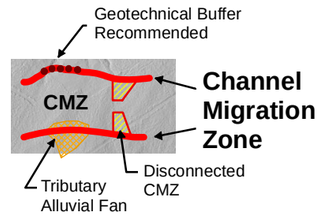




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
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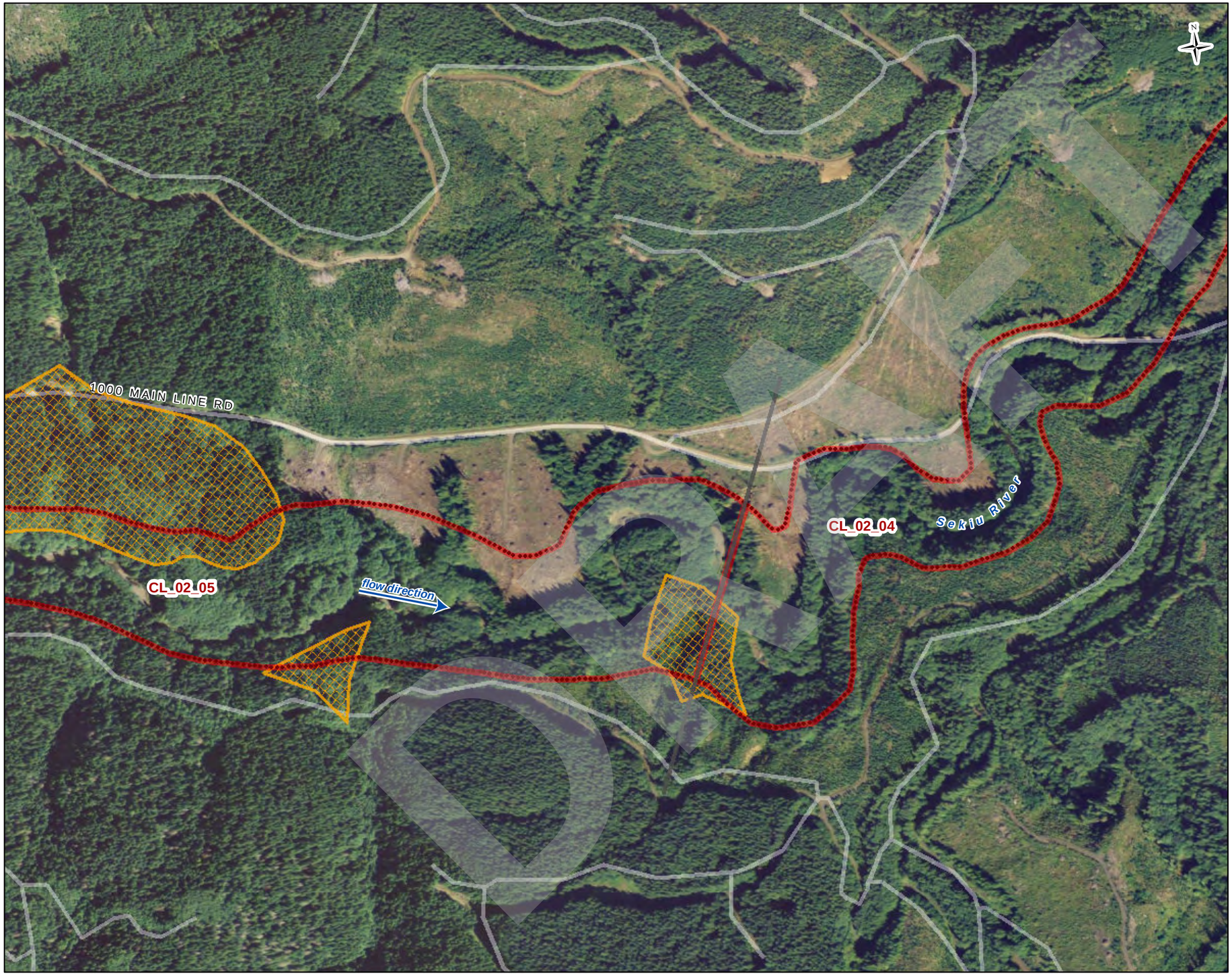
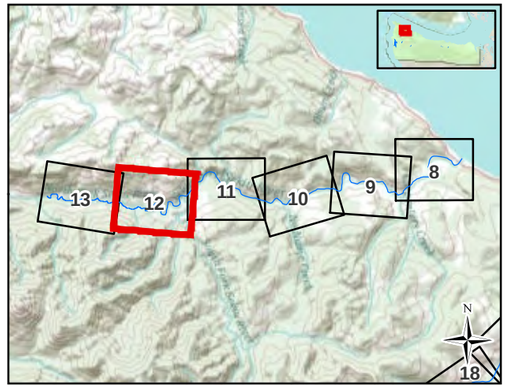
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Sekiu River **Map 11**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

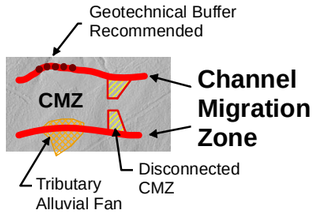




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
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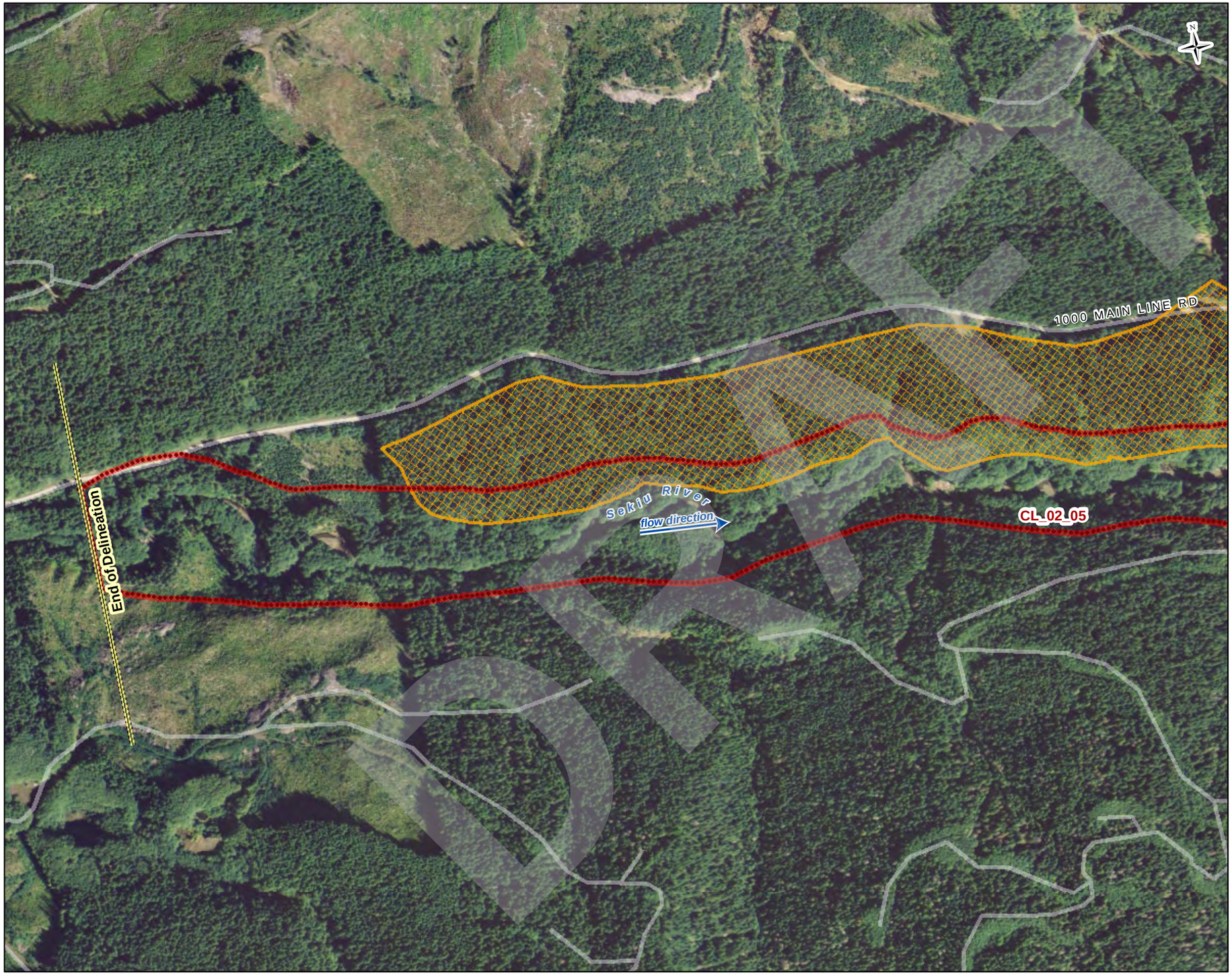
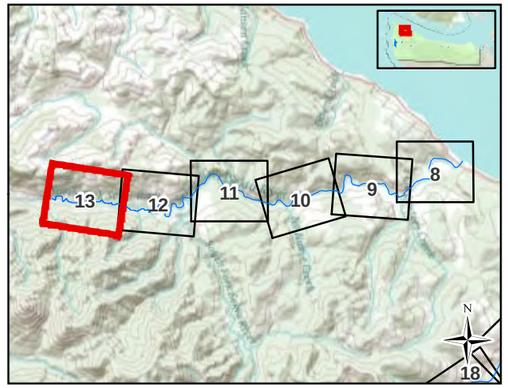
Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Sekiu River **Map 12**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011

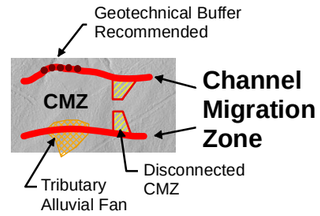




River Mile Marker

SK_##_## Reach_ID

Segment Boundary



0 50 100 150 Meters

0 250 500 Feet

2004 LIDAR topography (Puget Sound LIDAR Consortium).
10 m USGS Hillshade
2006 and 2009 aerials from ESRI World Imagery
WA State Dept of Nat. Resources 1:100,000 Geology
River miles calculated from NHD stream alignment (USGS)
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Channel Migration Assessment

Prepared for the Shoreline Master Program Update
Clallam County, Washington

Sekiu River **Map 13**

Source File: \\red\projects\0\0504064\GIS\MXD\Clallam_Template_final_Aerial: ADN 12/27/2011