

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.

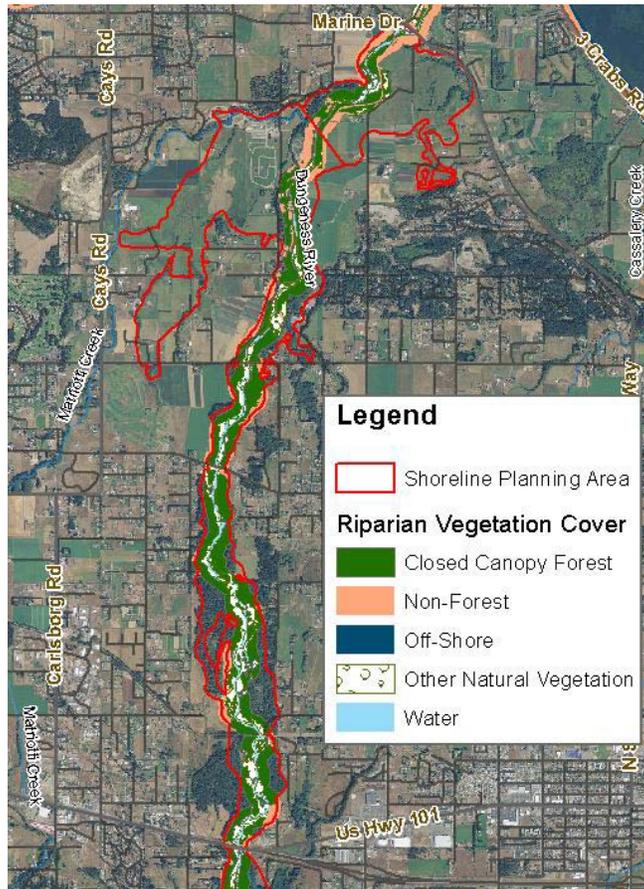


Figure 6-1. Riparian vegetation cover along the lower Dungeness River.

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 the gradient 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.

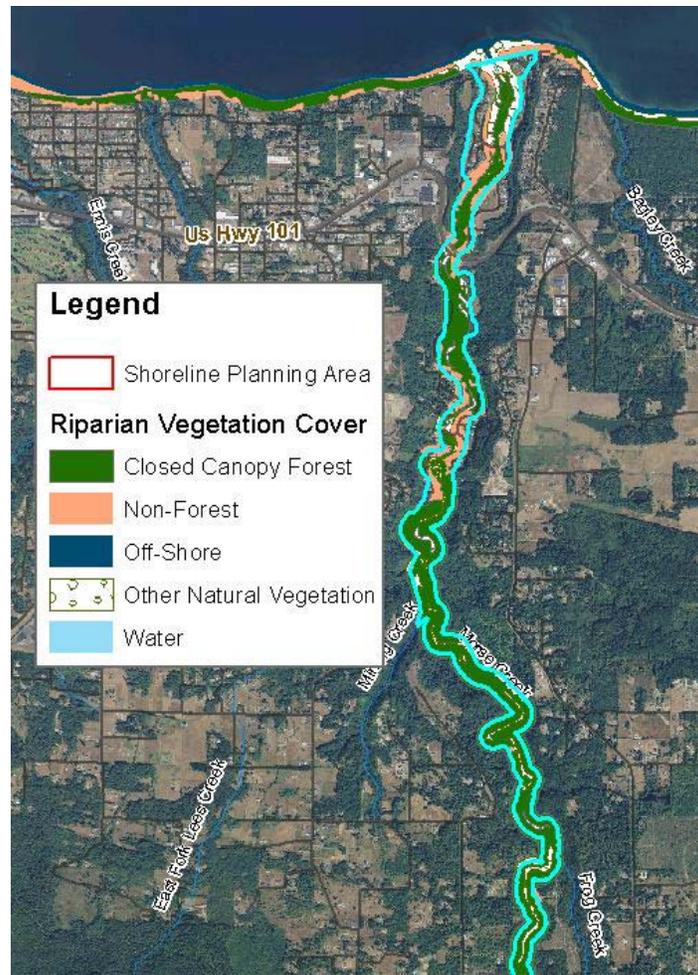


Figure 6-2. Riparian vegetation cover along the lower 4 miles of Morse Creek.

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).

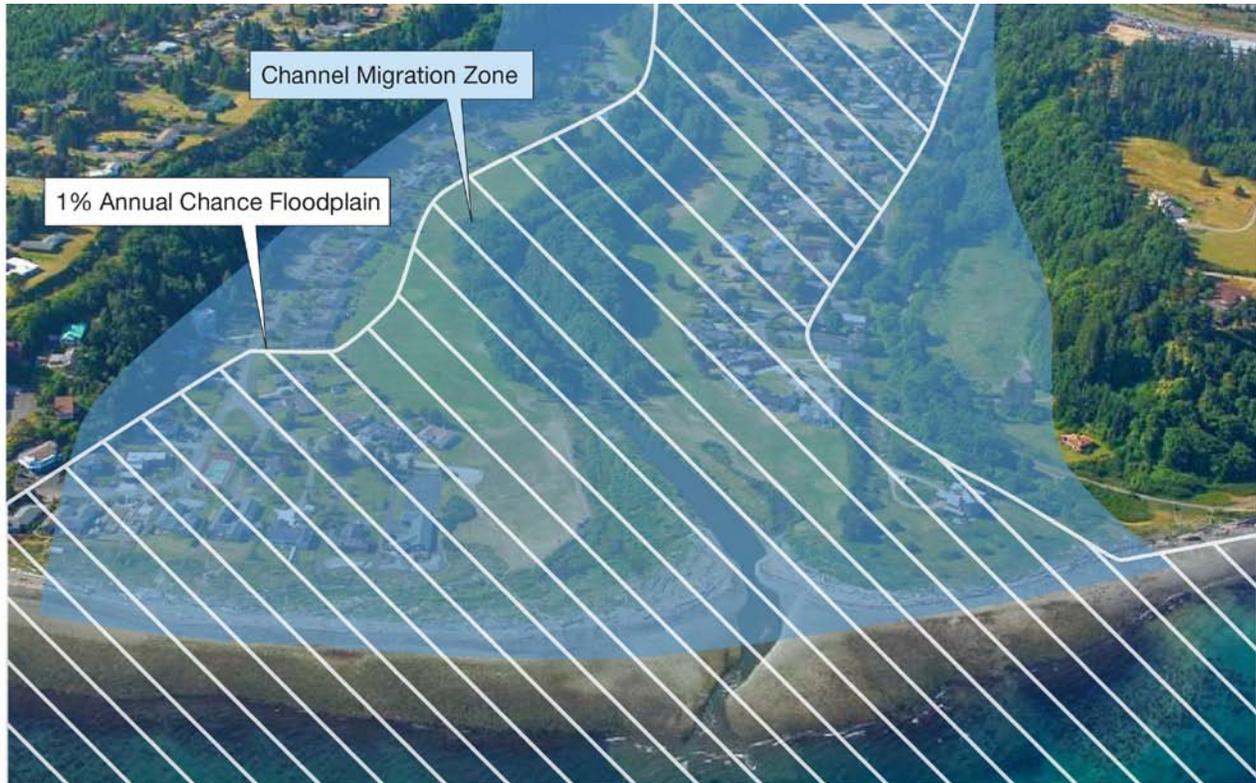


Figure 6-3. Channel migration zone and floodplain with existing development on Morse Creek

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 NOPL 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.

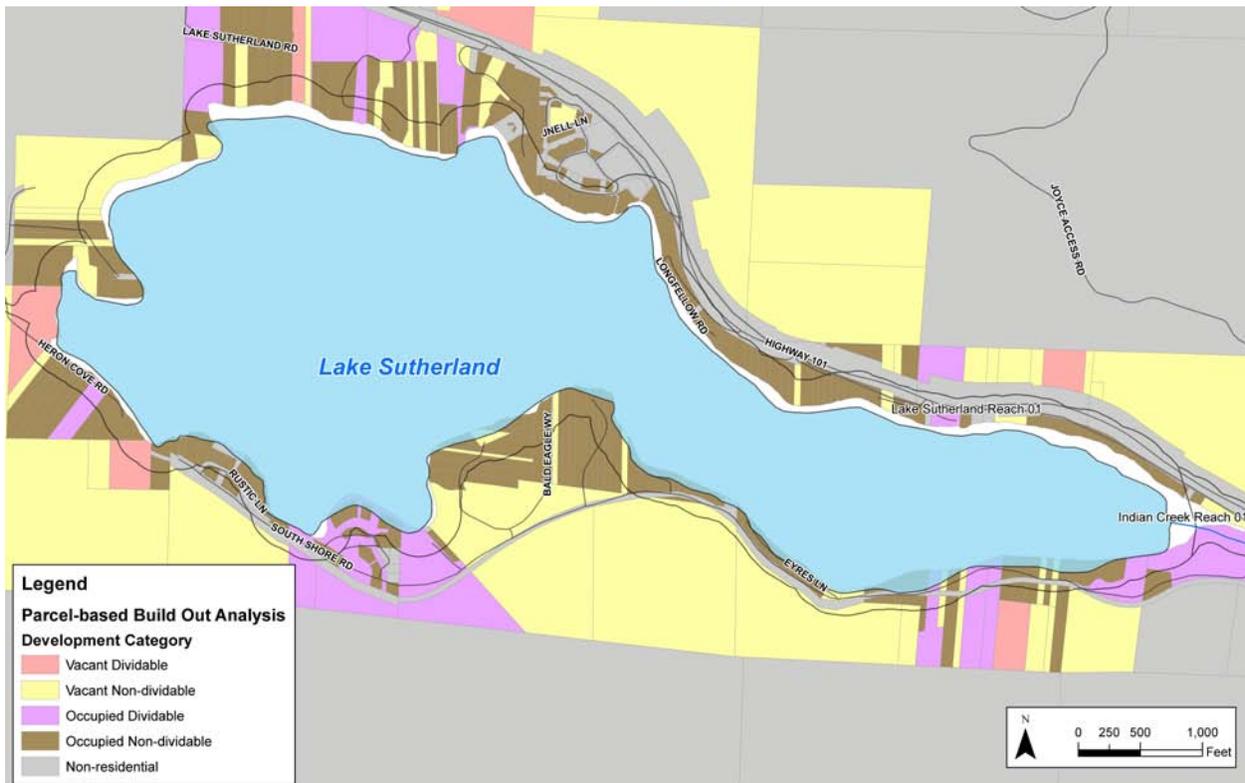


Figure 6-5. Existing and potential future development patters at Lake Sutherland. Brown and yellow parcels are not subdividable.

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; NOPL-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 (NOPL-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 (NOPL-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 (NOPL-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 (NOPL-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 (NOPL-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 Strait, 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 (NOPL-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 (NOPL-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 (NOPL-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 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 (NOPL-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 (NOPL-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 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 (NOPL-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 (NOPL-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 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 (NOPL-TRG 2011). The primary restoration goals of the watershed, as outlined by the WRIA 19 Salmon Recovery Plan (NOPL-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 (NOPL-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.

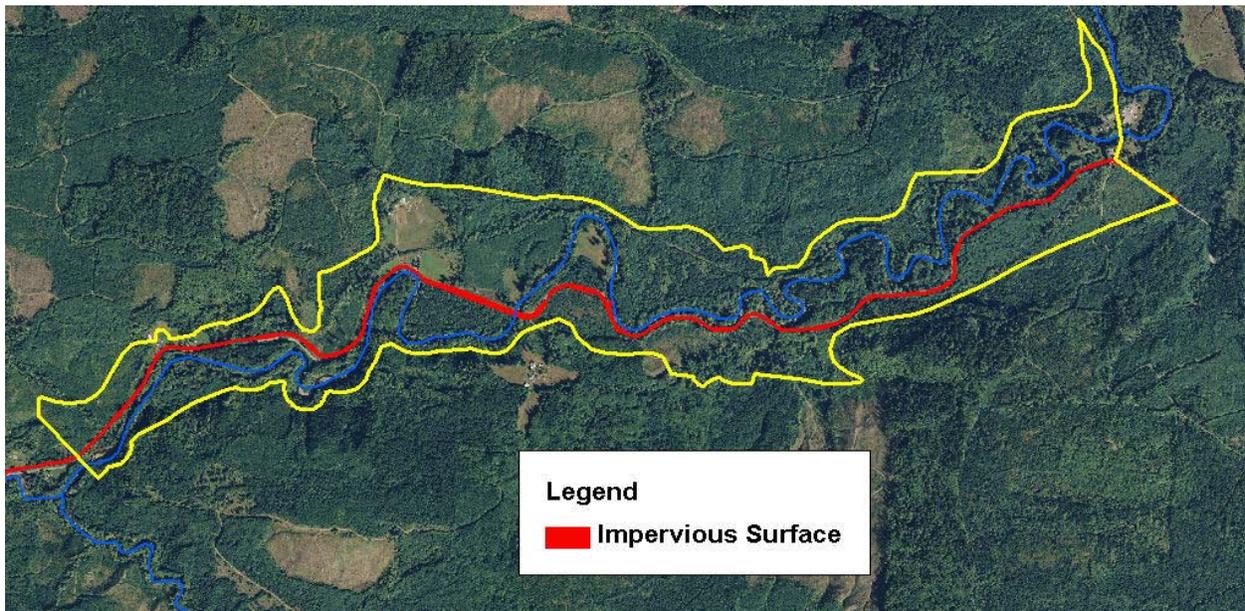


Figure 6-6. Impervious surface along the middle reach of the Pysht River

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. Conversion of forest areas to residential development would impact 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 (NOPL-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 bordered 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 (NOPL-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 (NOPL-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 Sekiu 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 (NOPL-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 WQL.

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 (NOPL-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.