LAND USE PLANNING
FOR SALMON, STEELHEAD AND TROUT:

A land use planner's guide to
salmonid habitat protection and recovery

Washington Department of FISH and WILDLIFE

External Review DRAFT June 2009

Acknowledgments
This guidance is a benchmark of 21st Century Salmon and Steelhead, a Washington Department of Fish and Wildlife Initiative to recover naturally-spawning salmon and steelhead populations.

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PREFACE

The Washington Department of Fish and Wildlife (WDFW) is providing this guidance on planning for salmon, steelhead and trout to assist the integration of local land use planning programs and state salmonid recovery efforts. This planner's guide to salmonid recovery is intended for local government planners and includes information on state salmonid recovery efforts, sources of scientific guidance and model policies and development regulations for implementing salmonid recovery.

In the last decade, over one hundred populations of salmon and steelhead have been federally listed as threatened or endangered in Washington State under the federal Endangered Species Act (ESA) (Good et al. 2005). Washington State has multiple efforts underway to recover salmonid populations including regional salmon recovery plans and lead entity strategies that guide on-the-ground restoration and acquisition projects. Yet regional salmon recovery plans are often disconnected from local land use planning initiatives.

Land use decisions implemented at the local level affect salmonid recovery efforts and protection strategies. Approximately fifty-four percent (23.4 million acres), of land in Washington State is privately owned (IAC 2001) and much of this land is in low-lying areas, such as floodplains and river deltas, where salmonid habitat is prevalent.

The timing of this guidance is significant as many jurisdictions are working on comprehensive updates of Growth Management Act (GMA) plans and regulations, including critical areas ordinances, and updates of Shoreline Master Programs mandated by the Shoreline Management Act (SMA). The GMA and SMA are the two most significant laws governing local planning and decision-making in Washington State. These planning programs are to be updated every seven years, and the adopted regulations have long-lasting influence on salmonid habitat protection and restoration. Both GMA and SMA require special consideration be given to conservation or protection measures necessary to preserve or enhance anadromous fish resources.

Salmonid habitat includes in-stream physical characteristics (e.g., temperature, water quantity, structure, substrate conditions, pool/riffle ratios, etc.), but habitat is strongly influenced by watershed processes beyond the waterline, including canopy cover, riparian condition, large woody debris recruitment, impervious surfaces and stormwater discharge, sediment delivery, water allocations (withdrawals), road location and maintenance, watershed hydrology, and nutrient dynamics. Therefore, planning for

salmon, steelhead and trout must address the condition and extent of water-related resources as well as upland processes that influence aquatic habitat.

There are many sources of scientific guidance to help local governments designate and protect salmonid habitat. (Appendix A includes a list of WDFW scientific guidance, as well as other relevant resources.) These publications are recognized as excellent sources of scientific information and provide local governments with useful resources for site-specific salmonid restoration applications. WDFW recognizes, however, that guidance effectively communicating the habitat needs of salmonids for local government planning purposes has been lacking. Therefore, this guidance document is intended to provide a sampling of model policies and regulations that can be incorporated into local ordinances to protect salmonids and prevent further loss or degradation of habitat. More specific technical assistance may be appropriate and provided by WDFW regional biologists.

Developing this guidance and having it become incorporated into local land use planning is an important step towards reaching the goal of recovering naturally-spawning salmonid populations. A handful of jurisdictions have begun to integrate the goals of regional salmon recovery plans in their land use planning projects, recognizing the clear nexus between local land use decision-making and salmonid recovery efforts. Model policies and regulations within this guidance document will highlight many of these proactive regional examples.

CHAPTER ONE
INTRODUCTION

1.1 Salmonid Populations in Washington State

The focus of this guidance document is on naturally spawning salmon, steelhead and trout, or salmonids. A greater emphasis is placed on migrating salmonids that rely on freshwater and saltwater environments[1] because these fish combine high value to people (food, recreation, cultural importance), high value to ecosystems of the state (they support a vast array of species in fresh and salt water from orca whales, sea lions, and seabirds to otters, eagles, herons, and insects), sensitivity to their environment (water quality, water quantity, food source, habitat structure and access), and their populations have declined.

It is Washington State's goal to:
"restore salmon, steelhead and trout populations to healthy harvestable levels and improve those habitats on which fish rely."

Currently, over one hundred populations of salmon and steelhead in Washington State have been added to the federal Endangered Species Act (ESA) as threatened or endangered and seven salmon stocks are already extinct in Puget Sound (Brennan and Culverwell 2004). The dramatic decline in wild salmonid populations is closely linked to loss of habitat as well as detrimental harvest, hatchery operations, and hydropower facilities.

To restore salmon, steelhead and trout populations to healthy harvestable levels, WDFW issues fewer commercial fishing licenses, marks hatchery fish, and has reduced fishing seasons and catch. To allow harvest on hatchery fish while protecting wild fish, WDFW manages its hatcheries to produce fish for harvest and to restore and support wild fish populations. WDFW has also been involved with watershed planning efforts in the Columbia River basin to protect, mitigate and enhance fish and wildlife affected by hydropower dams. Hydrosystem releases may impair the health of fish by influencing the temperature, time and volume of water, changing or drowning natural habitats and causing super saturation of dissolved oxygen downstream. Hydrosystem releases also impair fish passage by reliance on fish ladders.

[1] Although freshwater habitat functions can also be applied to resident salmonids.

1.2 Salmonid Recovery in Washington State

To improve the habitats upon which salmonids rely, Washington State has multiple efforts underway to recover and protect salmonid habitat including the development of regional recovery plans. Numerous entities and programs have been formed under the Salmon Recovery Act (RCW 77.85) resulting in regional recovery plans, associated work plans and on-the-ground restoration and acquisition projects. These voluntary projects forge partnerships between state, federal, local governments, tribes and private agencies that have resulted in valuable habitat improvements throughout the state.

Regional recovery plans are an important resource for local planners regarding listed salmonids and priority habitat recommendations in their region. The regional recovery plans are available at: *http://www.governor.wa.gov/gsro/regions/recovery.asp* (links are provided to each plan below).

Figure 2.1: Salmon Recovery Regions in Washington State

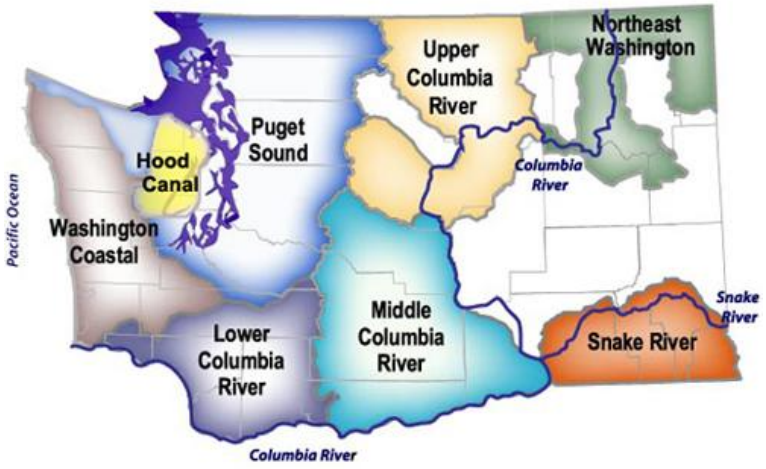

Figure 2.1: Governor's Salmon Recovery Office

Washington Coastal. The Washington Coastal Salmon Recovery Region includes all Washington river basins flowing directly into the Pacific Ocean and includes all or portions of Clallam, Jefferson, Grays Harbor, Mason, Thurston, Pacific, and

Lewis counties. There are no federally listed anadromous salmonids in this region however, two non-anadromous salmonids, Lake Ozette sockeye and bull trout, are listed as threatened. (The Washington Coast Sustainable Partnership web site is under development.)

Puget Sound. The Puget Sound Salmon Recovery Region is the largest in the state and comprises all or part of 12 counties including Whatcom, Skagit, Island, San Juan, Snohomish, King, Pierce, Thurston, Mason, Kitsap, Jefferson, and Clallam. The size of the Puget Sound Salmon Recovery Region is dictated by the Puget Sound Chinook Evolutionarily Significant Unit (ESU), identified by the NOAA Fisheries. Puget Sound Chinook and steelhead are listed as threatened as well as bull trout. More information available at: *http://www.psp.wa.gov/SR_status.php*.

Hood Canal. The Hood Canal area is located within the Puget Sound Salmon Recovery Region, although it may become a separate salmon recovery region in the near future. It includes portions of Jefferson, Mason, Clallam, and Kitsap Counties. Puget Sound Chinook and Hood Canal summer chum are listed as threatened as well as bull trout. More information available at: *http://hccc.wa.gov/*.

Lower Columbia River. The Lower Columbia River Salmon Recovery Region encompasses five counties in Southwest Washington. This Region includes Clark, Cowlitz, Lewis, Skamania, and Wahkiakum, and portions of Pacific and Klickitat counties. Chinook, coho, chum, steelhead, and bull trout are listed as threatened. More information available at: *http://www.lcfrb.gen.wa.us/default1.htm*.

Middle Columbia River. The Middle Columbia River Salmon Recovery Region includes salmon bearing streams in Benton, Kittitas, Yakima, and parts of Chelan and Klickitat counties. Steelhead and bull trout are listed as threatened in this region. More information available at: *http://www.ybfwrb.org/*.

Upper Columbia River. The Upper Columbia River Salmon Recovery Region includes salmon-bearing streams in Chelan, Douglas, and Okanogan counties. Spring Chinook, steelhead and bull trout are listed as threatened. More information available at: *http://www.ucsrb.com/*.

Northeast Washington. The Northeast Washington Region includes salmon bearing streams in Ferry, Lincoln, Pend Oreille, Spokane, and Stevens counties. There is no official recovery board in this region; recovery strategies are coordinated by the Pend Oreille LE. Bull trout are listed as threatened.

Snake River. Snake River Salmon Recovery Region includes salmon-bearing streams in Walla Walla, Columbia, Garfield, Asotin, and parts of Franklin and Whitman counties. Sockeye, Chinook, steelhead and bull trout are listed as threatened. More information available at: *http://www.snakeriverboard.org/*.

1.3 Salmonid Recovery and Land Use Planning

This guidance document is focused on protecting salmonid habitat to demonstrate how land use planning programs can support and encourage salmonid recovery. Managing development of urban and suburban areas, industrial, residential and business uses, as well as resource lands are assumed to be the primary activities of land use planners. The two most significant laws governing these activities in Washington State are the Growth Management Act (GMA) and the Shoreline Management Act (SMA). Both laws require that local governments provide special consideration for the protection of anadromous fish resources.

Areas of rapid urbanization tend to occur near water resources, such as Puget Sound or the Columbia River basin, where there is a low-gradient and the terrain is easier to develop. These lowland areas provide a majority of the freshwater and estuarine habitat available to salmonids. Therefore, development in these areas can result in a dramatic loss of habitat.

Agricultural and forest lands have the potential to preserve important habitat and watershed processes for salmonids, if carefully managed. But, agricultural production and forest practices can harm salmonid habitat if best management practices are not implemented. For example, agricultural production that allows animal access to waterways can result in bank erosion and nutrient loading thus harming water quality and salmonid habitat structure. Forest practices can also impact salmonid habitat in the higher elevations where freshwater tributaries can become clogged with sediment or fish are unable to access natal streams or important spawning areas due to poorly installed culverts at forest road crossings.

Voluntary restoration and protection programs, as identified in regional recovery plans, will not be able to keep pace with development impacts, particularly given the current rate of growth that Washington is experiencing. Washington State has grown by nearly one million people in the last decade, bringing the total population to over six and a half million.[2] A growing population has altered land cover resulting in increased urbanization and a greater demand on resource lands including existing agricultural and forest lands.

Restoration and acquisition projects demand extensive funding and coordination to purchase land and/or implement habitat improvements and thus it is less costly to protect sensitive areas than it is to repair them once damaged (May et al. 1996). Therefore, there is a key role for local land use planners to play through permitting programs such as the critical areas ordinance and Shoreline Master Program as well as incentive programs such as transfer of development rights. Protecting existing priority habitat areas and restoring lost habitat as guided by regional recovery plans is a proactive approach land use planners can take to protect at-risk salmonid populations.

Drafting adequate rules and policies to capture the diversity of salmonid habitat needs found in the scientific literature can be difficult for local planners. Therefore, this guidance was written to provide local planners with example policy and regulation language that gives special consideration for the protection of anadromous fish resources.

In order for salmonid recovery to become a reality, it is necessary that local governments adopt policies and rules specific to salmonid recovery and protection in their land use planning programs.

A handful of jurisdictions have begun to integrate the goals of regional salmon recovery plans in their land use planning programs, recognizing the clear nexus between local land use decision-making and salmonid recovery efforts. In addition to longer-term watershed planning, some local governments are making immediate changes to protect salmonid habitat. These early actions include improvements in road maintenance and other operations, changes in land-use permitting and enforcement, and other efforts to conserve salmonid habitat. For example, Skagit County is

[2] Washington State Office of Financial Management, 2008 Population Trends. http://www.ofm.wa.gov/forecasting/key2pop.asp.

engaged in a proactive program to restore salmon habitat and encourage recovery throughout the Skagit River watershed. County Commissioners adopted a salmon policy resolution directing County departments to consider the Puget Sound Salmon Recovery Plan in all their actions. Chapter Three highlights many of these regional examples.

1.4 Relationship to Other Guidance

WDFW has published numerous sources of scientific guidance to protect and recover salmonid habitat. These include the Pacific Salmon and Wildlife technical report, Statewide Steelhead Management Plan, and Nearshore and Riparian Management recommendations. These reports, as well as the best available science (BAS) for anadromous fish resources provided by the Washington State Department of Community Trade and Economic Development, provide local governments with numerous scientific resources related to salmonids.

Due to the breadth of scientific guidance available to help local governments provide special consideration for salmonids, this guidance document focuses on planning policies and regulations with only a general overview of the science. For additional information, Appendix A includes a list of WDFW scientific guidance, as well as other relevant resources, including contact information for WDFW staff.

CHAPTER TWO
PACIFIC SALMONIDS AND LAND USE

2.1 Salmon, Steelhead and Trout

Salmon, steelhead and trout are in the family *Salmonidae*, subfamily *Salmoninae* and referred to collectively as salmonids. Some salmonids exhibit anadromy, residing in both freshwater and saltwater (including lakes, rivers, streams, as well as wetlands) and saltwater (including estuary and open ocean) environments in a lifetime. However, within each subfamily there are particular species that exhibit a higher propensity to reside wholly in freshwater.

Salmonids indigenous to the State of Washington that are currently listed under ESA are provided in Table 2.1. Within each species there are Evolutionary Significant Units (ESU) or Distinct Population Segments (DPS)[3] that are defined by regional geographic extent and genetic differentiation, hence the listing of Puget Sound Chinook as Threatened, whereas Upper Columbia Spring-run Chinook are listed as Endangered and Upper Columbia summer/fall-run Chinook are not listed. In addition, there may be one or more independent salmonid populations, otherwise known as Major Population Groups (MPGs) within each ESU or DPS that are based on local geographic extent, genetic, and ecological similarities. For additional information on federally ESA listed fish species by ESU/DPS in Washington State visit:
http://wdfw.wa.gov/fish/management/esa/federally_listed_esa_fish.pdf.

The Fisheries Division of the National Oceanic and Atmospheric Administration (NOAA) has jurisdiction over anadromous fish listed under the ESA.[4] The ESA defines "Endangered" as any species which is in danger of extinction throughout all or a significant portion of its range; "Threatened" includes any species which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

[3] For a definition of Evolutionary Significant Unit or Distinct Population Segment, see Appendix B, Definitions.
[4] Trout and whitefish are under the jurisdiction of the United States Fish and Wildlife Service.

Table 2.1: Federally Listed Pacific Salmonids in Washington State

Common/*Scientific* Name	ESU/ DPS	Federal Listing
Chinook Salmon/	Puget Sound	Threatened
Oncorhynchus	Upper Columbia R. Spring Run	Endangered
tshawytscha	Snake R. Fall Run	Threatened
	Lower Columbia R.	Threatened
	Snake R. Spring and Summer Run	Threatened
Chum Salmon/	Hood Canal Summer Run	Threatened
Oncorhynchus keta	Columbia R.	Threatened
Coho Salmon/	Puget Sound/Strait of Georgia	Candidate
Oncorhynchus kisutch	Lower Columbia R.	Threatened
	Southwest Washington	Candidate
Sockeye Salmon/	Ozette Lake	Threatened
Oncorhynchus nerka	Snake River	Endangered
Steelhead (Rainbow	Middle Columbia	Threatened
Trout)/	Puget Sound	Threatened
Oncorhynchus mykiss	Snake R. Basin	Threatened
	Upper Columbia	Endangered
	Lower Columbia	Threatened
Bull Trout/Dolly Varden/	Coastal-Puget Sound	Threatened
Salvelinus confluentus	Upper Columbia R.	Threatened
	Middle Columbia R.	Threatened
	Snake R.	Threatened
	Touchet/Walla Walla[5]	Threatened
	Lower Columbia R.	Threatened
	Olympic Peninsula	Threatened
	Northeast Washington	Threatened
Coastal Cutthroat Trout/	Southwest Washington/	Candidate
Oncorrhynchus clarki clarki	Columbia R. Coastal	

For each population to achieve recovery and ultimately a delisting, the ESA requires the federal government to develop recovery plans for listed salmon. NOAA-Fisheries (NOAA-F) has determined that such recovery plans be developed on an ESU, or regional basis. Therefore, regional recovery boards prepare a recovery plan (described in Section 1.2) to gain regional consensus on measurable fish population results, integrates actions necessary in harvest, habitat, hydropower, and hatcheries, and gains commitments to achieve results. They coordinate a multitude of plans across watersheds into one regional plan

[5] Oregon Recovery Unit

and help connect local social, cultural, and economic needs and desires with science and ESA goals.

The ESA is concerned with the extinction risk faced by an entire ESU. To retain and recover a viable salmonid population that has a negligible risk of extinction, it is essential to 1) conserve the environment to which they are adapted, 2) allow natural process of regeneration and disturbance to occur, and 3) limit or remove human caused selection or straying that weakens the adaptive fit between a salmonid population and its environment or limits a population's ability to respond to natural selection (McElhany et al. 2000). The following sections on life cycle and habitat function describe the components necessary to retain and recover viable salmonid populations.

2.2 Ecosystem Interactions

The ecological impacts of salmonids are far-reaching. These organisms have variable life stages that connect them to the ecology of many aquatic and terrestrial consumers. They have an indirect relationship to the entire food web and play a crucial role in supporting overall ecosystem health (Cederholm et al. 2000). Over 137 species of birds, mammals, amphibians and reptiles use salmonids for one or more stages of their life, preying on eggs, juvenile and adult salmonids (Cederholm et al. 2000). Many species also feed on salmonid carcasses, including insects and aquatic invertebrates that then become food for young salmon; salmonid carcasses also become fertilizer for vegetation around streams and lakes (Fresh 2006).

Salmonid influence on watershed processes also includes biofeedback. Carcasses decomposing in a riparian system fertilize soils and promote faster growing trees. Increasing vegetative production provides more trees for large woody debris recruitment which in turn provides cover, spawning, and rearing habitat for salmon.

> *"Salmon are an icon of Northwest culture and the foundation of the health of our watersheds. If the salmon are not doing well, our watersheds are not doing well, and neither are we."*
> *–Washington Governor Chris Gregoire*

Because of their contribution to the productivity of the entire watershed, salmonids are considered a "keystone species" (Quinn 2005). A keystone species

is extremely important because it plays a critical role in ecosystem health, having a disproportionate influence on other species (Kauffman et al. 2001). It is unknown how far the impacts of losing salmonids in watersheds would go, but it is likely there would be far-reaching impacts on all natural resources.

2.3 Anadromous Fish Life Stages and Habitat

Salmonids are also considered an umbrella species because they require large blocks of relatively natural or unaltered habitat to maintain viable populations in freshwater and saltwater environments throughout their life. The life stages of anadromous salmonids are shown in Figure 2.1. The stages include spawning and egg incubation, freshwater rearing, seaward migration, open ocean rearing, return migration to freshwater to spawn and the deposition of marine derived nutrients into the freshwater ecosystem (Cederholm et al. 2000). Survival of anadromous salmonids depends upon their ability to occupy and move among freshwater, nearshore and open ocean habitats (Fresh 2006).

FIGURE 2.2 Anadromous Fish Life Stages

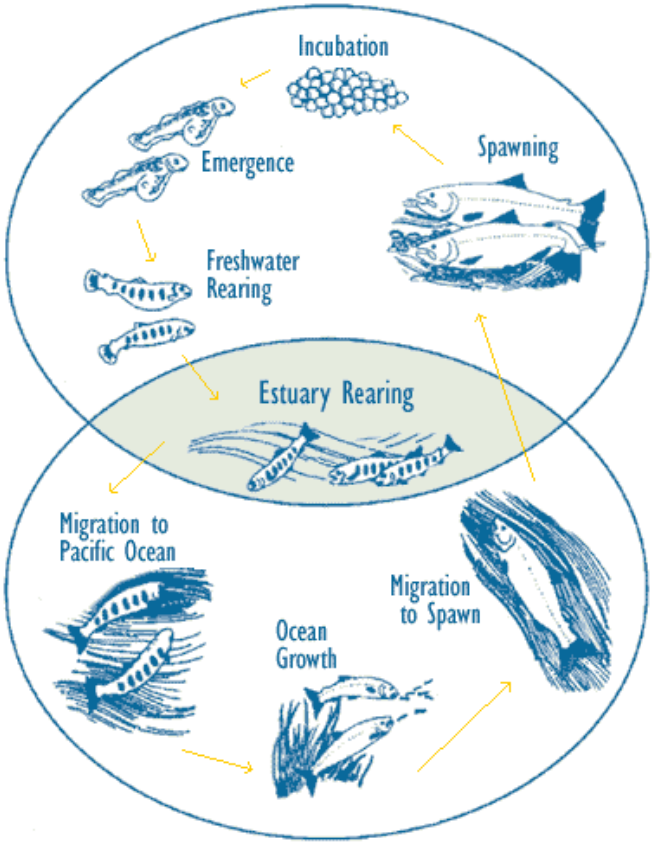

Figure 2.2: Washington Department of Fish and Wildlife.

Salmonids have evolved with diverse life history trajectories allowing them to exploit interannual variation in conditions. For example, within the same river system Chinook salmon juveniles may migrate directly to sea as fry, migrate to the delta and rear for months before moving to sea, migrate to the nearshore but move into subestuaries for rearing, or remain in the river system for months before migration to sea (Fresh 2006). Therefore, it is important to retain healthy habitat in a variety of habitats to allow exploitation of a variety of life history trajectories and spatial structure (McElhany et al. 2000).

Photo 2: Coho Salmon Spawning

2.3.1 Freshwater Spawning. Spawning and egg incubation occurs in freshwater where females construct a nest, or redd. Site selection often occurs in the transition zone between a pool and a riffle where water velocity increases to overcome the riffle crest (Bjornn and Reiser 1991). These are ideal locations for egg incubation because as water velocity increases, water is flushed through the redd, bringing cool, well-oxygenated water and carrying away metabolic waste (Quinn 2005; Merz et al. 2008).

Redd site selection is influenced by physical variables, such as stream depth, velocity, and substrate size (sand, gravel, etc.). The shallow downstream ends of pools leading to riffles contain loose gravels the product of size-dependent sediment transport and deposition following erosion upstream. Female salmonids use their tail to clean away sand and silt before depositing fertilized eggs into excavated pits, covering them with more gravel. Habitat structure such as large woody debris found in many streams increases the habitat complexity by creating areas with different depths, velocities, substrate types and amounts of cover. In general, salmonids avoid the slowest water with fine sand and silt; avoid the fastest water; and prefer water about 30-60 cm deep, flowing about 30-100 cm per second over coarse sand and small to medium gravel (2-10 cm in diameter). This allows a high flow of oxygenated water through the interstitial

spaces in the streambed, bringing cool, well-oxygenated water to the redd and carrying away metabolic waste (Quinn 2005).

To build a redd, the female moves substrate by creating a vacuum with her tail to clear away the fine sediment, leaving large spaces between gravel and cobble substrate (Cederholm et al. 2000; Merz et al. 2008). Survival of eggs in the gravel is closely tied to relatively stable substrate that is free of fine sediments. Fine sediment deposition reduces water flow resulting in less dissolved oxygen and a build-up of metabolic wastes in redds, in effect suffocating larval and egg-stage salmonids (Cederholm et al. 2000; May et al. 1996). Once the female deposits the eggs, they are immediately fertilized by one or more males. If temperature and flow conditions are suitable, the eggs will hatch as alevin in 19-150 days. Alevin initially stay inside the redd substrate and require the same habitat functions, cool temperatures and flow to provide well-oxygenated water and carry away metabolic waste.

2.3.2 Freshwater Rearing. Freshwater rearing continues as the fish develops from an alevin to a fry. At this stage they feed on a variety of aquatic and terrestrial insects[6] and often seek refuge in low-velocity areas such as side channels, oxbows, floodplain wetlands (NMFS 2008), in pools below riffles, behind large woody debris or boulders, undercut banks, or on the margins of streams. Large woody debris or boulders create local variations in flow because water speeds up adjacent to the obstacle and the water is slowed on the leeward side creating pools. These in-stream features allow juvenile cutthroat trout, steelhead and larger salmon to occupy low velocity locations in the channel to conserve energy while feeding from the relatively higher velocity areas carrying food. Likewise, off-channel areas provide cost-effective territories for rearing salmonids, especially coho, with good winter

Photo 3: Coho Freshwater Rearing

[6] Larger juvenile salmonid (parr) may supplement their macroinvertebrate diet with occasional salmonid eggs or fry (Cederholm et al. 2000).

feeding conditions and a place to avoid high flows and turbidity of main rivers (Cederholm et al. 2000).

The mix of in-channel and hydraulic features that shape freshwater rearing habitat extends beyond the waterway. Upland areas provide key habitat in the freshwater environment as natural terrestrial vegetation provides food source (insects), cover and input of large woody debris. Upland native vegetation also contributes to erosion control and temperature control and filters pollutants and sediment that runoff impervious surfaces.

2.3.3 Nearshore Habitat. The physical, chemical, and biological processes that create nearshore habitats must be maintained for salmonids (Fresh 2006). The nearshore includes the photic zone, the maximum depth offshore where sunlight is sufficient to support plant growth, as well as the shoreline and upland and backshore areas that directly influence shoreline conditions (Envirovision et al. 2007). Nearshore areas that are not significantly affected by freshwater inputs are considered nearshore "marine" habitats (Buchanan et al. 2001) and the nearshore also extends upstream to estuaries and bays where freshwater and marine waters converge (Envirovision et al. 2007).

Figure 2.3 Nearshore Zone

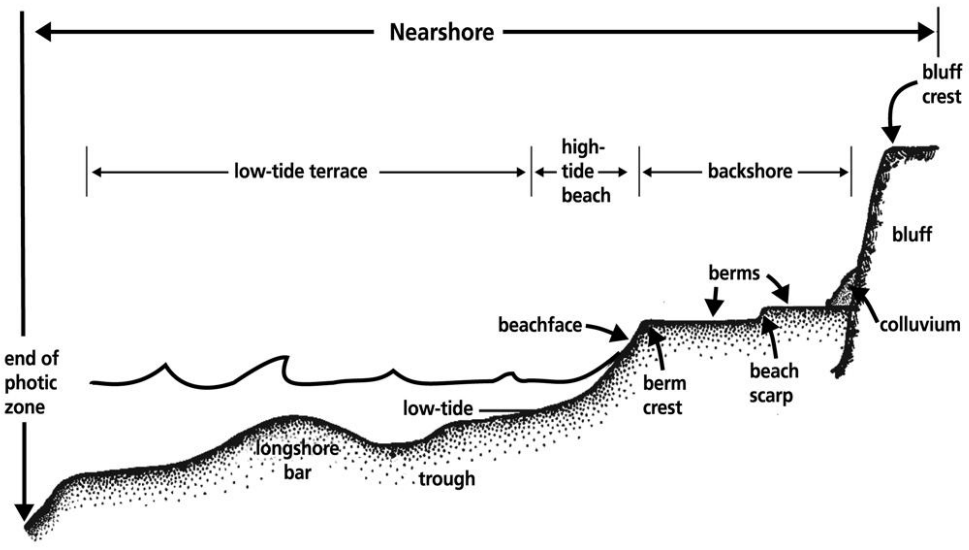

Figure 2.3: Cross-section of a beach with terminology used in the Puget Sound area (Johannessen and MacLennan 2007 modified from Komar 1976).

Photo 4: Natural Estuary Habitat

Commonly, within a year or two, all anadromous salmonids migrate downstream to estuaries. The amount of time spent in the transition zone of estuaries varies. Some salmonid use this area only for transition to the open ocean, while others may reside in the estuary and feed and head back up the stream for another season. Species such as Chinook, pink and chum rely heavily on the estuary for foraging, growth, and physiological transition that require good estuary habitats (Cederholm et al. 2000).

Estuaries provide a transition zone for young salmonids preparing to enter the open ocean, allowing stressful physiological changes to occur which allow salmonids to adapt from freshwater to saline conditions. Estuaries also provide important feeding areas (due to food abundance and diversity), refuge from predators, and a place for growth before entering the ocean (Simenstad et al. 1982; Cederholm et al. 2000).

Photo 5: Natural Nearshore Habitat

Juvenile salmonids migrate through their natal estuaries and deltas to nearshore marine habitats where they forage for food on their way to the open ocean. Within the Puget Sound, exposed, cobble, or gravel beaches appear to be preferred nearshore marine habitats for salmonids (Simenstad et al. 1982); all marine and estuarine nearshore habitats are occupied by forage fish, a critical prey species for salmonids (Pentilla 2007).

Nearshore food webs support abundant prey types especially important to juvenile salmonids including a wide variety of aquatic and terrestrial invertebrates, forage fish including herring, sandlance, surf smelt, and anchovy. Juvenile salmonids seek refuge from predation in eelgrass and macroalgae (kelp

and marine alga) (Williams and Thom 2001; EnviroVision et al. 2007). Other nearshore features that may reduce predation on juvenile salmonids include high levels of turbidity, presence of shallow water habitat, and abundant and diverse prey resources that sustain high growth rates and allow juvenile salmonids to rapidly outgrow many of their predators (Fresh 2006).

Upland vegetation provides similar habitat functions in the nearshore environment as in freshwater riparian areas (Brennan and Culverwell 2004). Shoreline terrestrial vegetation provides food source (insects), cover and input of large woody debris and filters pollutants and sedimentation from impervious surface runoff. All these habitat components of the nearshore support gradual transitions between estuarine and marine waters which is an energy intensive process for salmonids.

2.3.4 Ocean Residence. Salmonids may spend six months or up to five years and travel great distances in the Pacific Ocean before returning to their natal streams to spawn as adults. The amount of time spent in the ocean and the migration patterns vary among and within species. For example, anadromous salmonids will always migrate to the ocean and return to spawn before dying, whereas the resident phenotype of *Oncorhynchus mykiss* (rainbow trout) does not migrate to the ocean. In addition, both steelhead and rainbow trout can spawn multiple times in a lifetime (Merz et al. 2008; Cederholm et al. 2000).

Chum and pink migrate seaward shortly following emergence from the gravel, going directly to the estuaries and the ocean, spending very little time in freshwater, whereas some races of Chinook and almost all coho may remain in freshwater for at least one or two years before smolting and migrating seaward (Simenstad et al. 1982). Sockeye may remain for one or two years before smolting and steelhead often remain for at least two years and sometimes as many as five to seven years before migrating seaward.

Once salmonids reach the open ocean they forage opportunistically on a diverse assemblage of marine organisms (Cederholm et al. 2000). However, ocean habitat components are beyond the scope of this guidance document.

2.3.5 Return Migration. After one to seven years, salmonids are prompted to return to freshwater environments to spawn by internal physiological changes, temperature changes, length of day, and barometric pressure,[7] among other environmental triggers (Quinn 2005; Merz et al. 2008). Adult salmonids find their way back to their natal streams for spawning using olfactory cues imparted by chemical odors emanating from individual watersheds and tributaries (Bjornn and Reiser 1991; Quinn 2005). The return migration requires a reverse transition from saline to freshwater environments which again occurs in estuarine and nearshore environments. If natal stream habitat has been degraded in the time these fish have been away in the open ocean, spawning success may be impaired or eliminated.

Photo 6: Chum Return Migration

2.4 Habitat Functions

Although the habitat requirements of each species of anadromous salmonid differ somewhat, all share some common habitat needs to support life stage development (Spence et al. 1996). Common habitat functions include:

- a stable incubation environment (flow regime/water quantity),
- cool, well-oxygenated water (water quality),
- cover (habitat structure),
- sufficient sources of prey (food source), and
- unimpeded access to off-channel areas and saline waters (access).

2.4.1 Flow Regime (Water Quantity). Flow patterns affect salmonid survival due to the close inter-relationship between the fish and its stream (May et al. 1996; Spence et al. 1996). The amount, location and timing of water flow is a product of (1) climate (how much water falls when and whether it is frozen or liquid), (2) gravity acting on water, and (3) resistance from rock, soil, vegetation, and surfaces modified by humans. Not all water flows in channels as streams or rivers. Some water seeps into the soil and becomes groundwater, some of which

[7] Barometric pressure indicates rain and therefore freshwater inputs influencing stream flow.

may later intersect a channel and feed stream flow as base flow; in dry seasons this may be the vast majority of flow.

The amount of flow determines the depth and velocity distribution in a channel and velocity will vary from place to place in a channel even with a constant flow. Varied depth and velocities are favorable for salmonid habitat, but very high and very low flows can pose a risk to developing eggs, depending on the magnitude relative to the flows at the time of spawning (May et al. 1996; Spence et al. 1996). In a healthy riparian system, natural flood and drought events establish habitat processes such as erosion or sediment input which provide new sediments for spawning and incubation, but does not overwhelm the system. Whereas unnatural flow patterns that bring pollutants and added mud or silt from increased peak flows can scour spawning gravels, change substrate size, redistribute large woody debris within the channel, facilitate channel incision or widening, accelerate bank erosion and result in summer low flows leading to stranding of fish in off-channel areas (Spence et al. 1996).

Land use strongly interacts with water use to affect how much water and velocity is needed to yield good habitat in streams. Stormwater runoff and water allocations are examples of how land use practices influence flow. Excessive flow scours fish habitat (especially spawning habitat), delivers pollutants and pathogens, and brings excess nutrients to surface waters during wet weather (May et al. 1996). Increased flows can also fill up spaces between rocks with fine sediment, resulting in decreased oxygen and concentrated waste. Water allocations for hydropower, irrigation, or municipal/industrial diversion alterations can harm salmonids by changing the amount and type of in-stream flow. For example, peaks in electricity demand influence the timing and volume of hydrosystem releases which can lead to the stranding of adults, juveniles and redds (Spence et al. 1996).

2.4.2 Water Quality (Temperature and Chemistry). Water quality includes temperature, dissolved oxygen, and other dissolved and suspended substances. The most common water quality concerns for salmonid-associated aquatic communities are adequate dissolved oxygen concentration, temperature, pH, and avoidance of contaminants.

Photo 7: Bull Trout in Clean Freshwater

Freshwater temperatures influence egg incubation, growth, movement timing, and survival. Although salmonids are variable in their temperature requirements, most species are at risk when temperatures exceed 23-25°Celsius (~73-77°Fahrenheit) (Bjornn and Reiser 1991). However, the Washington Department of Ecology gathered continuous temperature data from a variety of sources and found that in general, during non-spawning and non-incubating times, the temperature should be less than 16-17.5°C (~60-63.5°F) and spawning temperatures should be less than 12.5-14°C (~54.5-57°F) (Hicks 2000). In freshwater temperatures at or above these temperature ranges, salmonids become more lethargic, prone to diseases, lose competitive interactions to other fishes, and become more susceptible to predation.

Water temperature is affected by air temperature, flow regime, substrate composition, riparian vegetation, turbidity, groundwater-surface water interactions, channel complexity, water diversion, the presence of headwater wetlands and lakes, and reservoir releases (May 2003; Merz et al. 2008). Many of these impacts are associated with land use development practices.

Freshwater temperatures also influence water chemistry. Cool, well-oxygenated water is essential for salmonid survival. Natural streams generally contain an abundant supply of dissolved oxygen (DO) (May 2003). Warmer temperatures increase the metabolic demand for oxygen while the capacity of freshwater to hold oxygen decreases (Quinn 2005). The concentration of DO must be above a critical level for salmonids to exist in freshwater streams (Bjornn and Reiser 1991). Embryo dependence on DO peaks just before hatching, alevins prefer high concentrations of DO, and reduced concentrations of DO can adversely affect the swimming performance of salmonids during return migration. Also important to consider is relative water volume; a small polluted stream entering a large river is quickly diluted, perhaps to a level of minimal (although potentially cumulative) impact. The same stream entering a small stream may be devastating to fish and human use.

Photo 8: In-stream Habitat Structure

2.4.3 Habitat Structure. In-stream salmonid habitat includes structures such as pools, riffles, boulders and large woody debris that provide critical functions for salmonids in freshwater and nearshore environments. Deep areas of pools provide living, holding and hiding space for adult and juvenile fish. Habitat structures, such as large woody debris (LWD) and boulders, dissipate the flow of energy, protect streambanks, stabilize streambeds, store sediments, and provide natural in-stream cover from predators and habitat diversity for salmonids (May et al. 1996). It also provides surface area on which primary and secondary production occur, providing food for salmonids. Maintaining sufficiently broad riparian zones that allow natural channel migration, flooding and habitat forming processes will ensure trees are available for recruitment to the stream to support salmonid rearing as well as providing resting areas for salmonids as they migrate upstream to spawn (Spence et al. 1996).

2.4.4 Food (Energy) Source. To support life stage development, salmonids require sufficient energy to meet their basic metabolic needs (Spence et al. 1996). In freshwater environments, juvenile salmonids feed on macroinvertebrate stream drift from both in-stream and terrestrial sources. In freshwater and marine systems, as much as 50% of the food resources for salmonids are derived from terrestrial insects falling into the stream or nearshore environment. Other sources of food for growing juvenile salmonids include salmonid eggs.

As salmonids mature and enter marine environments, they begin to feed on smaller fish as well as invertebrates. In the nearshore larger salmonids feed on forage fish, such as sand lance, surf smelt and herring (Envirovision et al. 2007).

Photo 9: Cutthroat Migrating Upstream

2.4.5 Access. Access refers to the return migration of adult salmonids returning to spawn in their native channels. Interference with migration can lead to reproductive failure and population decline. Migrating upstream demands a great deal of energy and fish need unimpeded access to suitable spawning and rearing habitats. Fish passage barriers such as culverts, can result in complete barriers blocking all fish migration, temporal barriers delaying access which can result in mortality before spawning, and partial barriers that block juvenile or weaker salmonids within a species and reduce genetic diversity (Wofford et al. 2005).

2.5 Land Use and Potential Habitat Impacts

Land use such as urban and rural growth, agricultural production and forest practices can have detrimental impacts on salmonid habitat functions and therefore salmonid survival. However, land use planning can avoid many of these impacts when policies and regulations include management practices designed to protect and restore salmonid habitat. Management and protection of salmonid habitat includes a special emphasis on stormwater, riparian areas, wetlands, in-stream habitat including large woody debris, floodplains, channel migration, landslide hazardous areas, and water quality, to name a few.

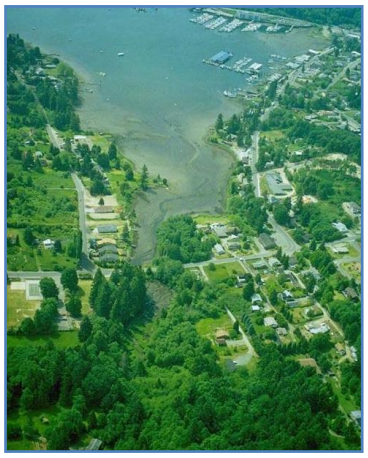

Photo 10: Shoreline Development

2.5.1 Urban and Rural Growth. Development in rural and urban areas is often located in low-gradient areas within a watershed where riparian systems converge. Urbanization in these riparian environments can alter land surface, soil, vegetation and hydrology by increasing the area of impervious surface. Impervious surface area is strongly correlated with adverse impacts on stream conditions including extensive changes in basin hydrology, channel morphology, and physio-chemical water quality (May et al. 1996; Booth 2000; R2 Resource Consultants et al. 2000).

Implementing land use planning for salmon, steelhead and trout can avoid many impacts associated with urban and rural growth by maintaining estuarine, wetland and riparian habitats, and adjacent upland habitats, among others. For example, limiting impervious surface in the watershed and locating development away from riparian systems (using native vegetation buffers) would improve salmonid habitat function and hence survival (May 2003).

2.5.2 Agricultural Production. The cultivation of land for agricultural production is also commonly located in low-gradient areas, such as floodplains or coastal estuaries (Kauffman et al. 2001; Merz et al. 2008). Some of the potential impacts of agricultural production on salmonid habitat functions include the removal of streamside vegetation resulting in elevated water temperatures. Riparian functions may be further impacted by chemical and nutrient fertilizers, pesticides, and fine sediments from farm runoff (Spence et al. 1996). In some cases, dike construction, stream relocation, and tide gate installation have restricted access to historically important in-stream and off-channel habitats.

Photo 11: Stream Adjacent to Agricultural Development

Aquaculture is a form of agriculture and the impacts on juvenile salmonids vary. Aquaculture includes the farming of food fish, shellfish, and other aquatic plants and animals in fresh water, brackish water or salt water areas.[8] Aquaculture activities such as planting and harvesting can impact salmonids in marine intertidal waters where the growth of eelgrass beds may be disrupted (a critical habitat for juvenile salmonids) (Mumford 2007).

Land use planning for salmon, steelhead and trout can avoid many of the impacts associated with agricultural production. For example, retaining vegetated buffers along waterways improves water quality by increasing shade, filtering solutes and suspended particles and decreasing bank erosion. Vegetated buffers also contribute to salmonid food source by providing leaf litter and insect recruitment as well as habitat structure through large wood recruitment.

[8] For more information visit the Washington Department of Natural Resources Aquatic Resources Division, http://www.dnr.wa.gov/AboutDNR/Divisions/ARD/Pages/home.aspx.

2.5.3 Forest Practices. Upland development, such as forest practices, also impacts salmonid habitat functions. Forest activities such as road building can impede fish passage and extensive clearing associated with timber harvest removes vegetation and compact soils. This influences water flows and can result in erosion and sedimentation, introducing fines into stream systems which can clog spawning substrates, inhibiting the interchange of oxygenated water causing egg suffocation and juvenile entombment (Everest et al. 1987; NRC 1996).

The removal of timber in upland areas can also influence salmonid habitat even in areas with non-fish bearing streams. Removing vegetation exposes upland riparian areas to direct sunlight thereby increasing water temperatures (Chamberlin et al. 1991). Water flowing over the surface of warmer land and unbuffered tributaries eventually reaches fish-bearing streams at lower elevations. The removal of downed woody debris also impacts habitat, removing natural damming debris from the forest floor (Knutson and Naef, 1997).

Photo 12: Logged Wetland

The Forest and Fish Law (RCW 76.09) was created to address habitat impacts associated with commercial timber harvest, however, non-commercial timber removal and conversion of forest lands to developed lands are regulated by local governments. Land use planning for salmon, steelhead and trout includes protection and management of riparian and wetland areas that could be impacted by forest practices, related activities (such as road building) and land conversions.

2.5.4 Habitat Impacts Associated with Land Use. Table 2.2 includes a list of potential development actions related to urban and rural growth, agricultural production and non-commercial forest practices or forest land conversions (R2 Resource Consultants et al. 2000), the habitat function potentially impacted (May et al. 1996) and the potential planning tool that, if implemented, would promote the protection of existing salmonid habitat functions. Chapter Three contains further discussion of planning tools to maintain habitat functions.

Table 2.2: Planning tools to manage development impacts on salmonid habitat

Development Action	Potential Impact on Salmonid Habitat Function	Potential Planning Tool to Manage Development Impacts
River channel clearing and channelization (stream bank alterations)	Water quality, flow regime, habitat structure, access	Channel Migration Zone protection, riparian buffers,[9] floodplain protection, riparian vegetation retention, large woody debris recruitment, in-stream work standards, clearing and grading standards
Loss of riparian vegetation	Water quality, flow regime, habitat structure, food source	Riparian buffers, riparian vegetation retention, clearing and grading standards, LWD recruitment standards, habitat restoration projects, incentives to protect habitat
Loss of forested areas	Water quality, flow regime, access, habitat structure	Forest land conversion regulations, riparian buffers and riparian vegetation retention on all streams, LWD recruitment standards, habitat restoration projects, incentives to protect habitat
Loss of wetlands	Water quality, flow regime, habitat structure, food source	Wetland buffers, no-filling permitted, clearing and grading standards, habitat restoration activities, incentives to protect habitat
Development of impervious surfaces	Water quality, flow regime, habitat structure	Stormwater management, water quality standards, riparian vegetation retention, impervious surface limits within a watershed

[9] Restoration projects that provide a net benefit to habitat functions are allowed in buffers. Buffers are intended to prohibit development and vegetation clearing in the riparian buffer.

Loss of estuarine and nearshore areas	Water quality, habitat structure, food source, access	Shoreline development standards, riparian buffers, vegetation retention, floodplain protection, habitat restoration projects, incentives to protect habitat
Bulkhead and overwater structures	Water quality, flow regime, habitat structure, food source	Shoreline development standards, riparian buffers, vegetation retention, floodplain protection
Upland clearing and grading	Water quality, flow regime, habitat structure, food source, access	Channel Migration Zone protection, Landslide Hazardous Area protection, riparian buffers, floodplain protection, riparian vegetation retention, clearing and grading standards, vegetation restoration
Fish Passage Barriers	Access	Road standards, non-commercial forest practices
Water allocations/ urban stormwater outfall	Water quality, flow regime	Stormwater management, in-stream (stream flow) standards
Industrial effluent	Water quality	Zoning, Industrial Discharge Regulations, Sewer and septic system standards

CHAPTER THREE
PLANNING FOR SALMON, STEELHEAD AND TROUT

3.1 GMA/SMA and Salmonid Recovery

With approximately fifty-four percent of the land in Washington State in private ownership (IAC 2001) and mostly under the planning authority of local governments, the land use decisions of landowners and local governments influence salmonid survival. Two laws that are most influential to governing salmonid habitat at the local level are the Shoreline Management Act (SMA) and Growth Management Act (GMA). Under both of these statutes, local governments are required to develop planning policies and regulations that address environmentally sensitive areas and apply special consideration for anadromous fish resources.

3.1.1 Shoreline Management Act. The Shoreline Management Act (RCW 90.58), or SMA, requires all local governments in Washington State to adopt Shoreline Master Programs (SMPs) that contain policies and regulations that will ensure no net loss of shoreline ecological functions. Shoreline areas affected include those extending 200 feet landward of the Ordinary High Water Mark adjacent to marine waters, streams with a mean annual flow greater than 20 cubic feet per second, water areas of the state greater than 20 acres and associated wetlands, river deltas and some or all of the 100-year floodplain.

"Protection and restoration of the ecological functions of shoreline natural resources" is a policy goal of the SMA. SMPs are, at a minimum, to achieve no net loss of ecological functions necessary to sustain shoreline natural resources and to plan for restoration of ecological functions where they have been impaired (WAC 173-26-201(2)(c)). The SMP guidelines (WAC 173-26) point to ecosystem connections among freshwater, marine and terrestrial shoreline environments that support anadromous fish life cycles.

The SMA establishes a balance of authority between local and state government. Cities and counties are the primary regulators, but the state (through the Department of Ecology) has approval authority of local programs and permit decisions. Every SMP is somewhat unique, but typically include the following elements (per SMP Guidelines): an inventory and characterization of shoreline

areas, environment designations, a shoreline restoration plan, and shoreline policies and regulations.

When preparing and amending an SMP, special consideration should be given to protect salmonid habitat functions. In the *Inventory and Characterization of Shoreline Areas,* each jurisdiction is required to prepare an analysis of shoreline issues of concern including anadromous fish habitat. *Environment Designations* are based on the existing pattern of use, the biological and physical character of the shoreline, and the goals and aspirations of the community as expressed through comprehensive plans as well as SMP criteria. There are several designations highlighted in the SMP Guidelines. Areas containing anadromous fish habitat are consistent with the most protective designation which is "Natural." As expressed in the SMP Guidelines [WAC173-26-211(5)(a)(iii)]:

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

(A) *The shoreline is ecologically intact and therefore currently performing an important, irreplaceable function or ecosystem-wide process that would be damaged by human activity;*

(B) *The shoreline is considered to represent ecosystems and geologic types that are of particular scientific and educational interest; or*

(C) *The shoreline is unable to support new development or uses without significant adverse impacts to ecological functions or risk to human safety.*

Because environment designations inform development regulations, assigning a "Natural" environment designation to anadromous fish habitat is an important step in protection and restoration of salmonids.

SMPs also include a *Restoration Plan* to achieve overall improvements in shoreline ecological functions over time. Restoration plans influence salmonid recovery because each considers and addresses existing restoration projects, identifies degraded areas, prioritizes future restoration projects and provides monitoring strategies to ensure restoration projects and programs will be implemented consistent with the plan. SMP Restoration Plans should be closely linked with existing salmonid recovery efforts, including habitat limiting factors

analysis, salmon recovery plans and watershed management plans.[10] More information on coordination with salmonid recovery programs is provided in Appendix A.

Finally, SMPs are to establish *Shoreline Policies and Regulations* that apply to shoreline modifications and uses. Shoreline rules are to be at least as protective as the jurisdictions critical areas ordinance (discussed further in the GMA section) and assure that development does not result in a net loss of ecological functions. Because shoreline regulations are to be based on scientific and technical information and a comprehensive analysis of drift cells for marine waters or reach conditions for river and stream systems (WAC 173-26-201), permitted development can be assessed at an ecosystem scale rather than site-specific scale. If implemented, this will result in better protection of salmonid habitat by considering ecosystem-wide processes in land use decisions.

The SMP establishes a framework for protecting critical shoreline areas in the State of Washington. To further protect salmonids, the environment designation informs policies and provisions for regulating development, the inventory and characterization can be referenced to assess cumulative impacts to ecological functions, and the restoration plan can be referenced to determine consistency with recovery priorities and inform habitat mitigation.

3.1.2 Growth Management Act. In 1990 the Legislature found that "uncoordinated and unplanned growth, together with a lack of common goals… pose a threat to the environment, sustainable economic development, and the health, safety, and high quality of life enjoyed by residents of this state. It is in the public interest that citizens, communities, local governments, and the private sector cooperate and coordinate with one another in comprehensive land use planning." This is the foundation for the Washington State Growth Management Act (RCW 36.70A), or GMA.

[10] The Watershed Planning Act was enacted by the Washington State Legislature in 1998. The act encourages local governments to develop watershed plans using collaborative processes. The plans are based on water resource inventory areas (WRIAs). The Department of Ecology provides funding for and reviews watershed management plans. Watershed management plans address four main items, water availability, water quality, fish habitat, and in-stream flows. These plans include specific recommended actions linked to land use planning and coordination with salmon recovery plans.

Several planning goals (RCW 36.70A.020) adopted in the Act influence salmonid recovery and protection:

> *Goal 8: Natural resource industries. Maintain and enhance natural resource-based industries, including productive timber, agricultural, and fisheries industries. Encourage the conservation of productive forest lands and productive agricultural lands, and discourage incompatible uses.*
>
> *Goal 9: Open space and recreation. Retain open space, enhance recreational opportunities, conserve fish and wildlife habitat, increase access to natural resource lands and water, and develop parks and recreational facilities.*
>
> *Goal 10: Environment. Protect the environment and enhance the state's high quality of life, including air and water quality, and the availability of water.*

Most counties and cities in Washington are required to implement specific aspects of the GMA. They must agree on county-wide **planning policies** to guide regional issues such as urban growth areas, public facilities, economic development, and affordable housing. They must adopt **comprehensive plans** to provide the framework and policy direction for land use decisions made within the local jurisdiction. Finally, they must adopt **development regulations** that carry out their comprehensive plans.

Although not all jurisdictions must plan under GMA, all jurisdictions are required to designate and protect natural resource lands and critical areas. Critical areas include the following areas and ecosystems: (a) wetlands; (b) areas with a critical recharging effect on aquifers used for potable water; (c) fish and wildlife habitat conservation areas (including rivers, streams, lakes, and salt water shorelines); (d) frequently flooded areas; and (e) geologically hazardous areas. (RCW 36.70A.030(5)). These areas are to be designated and protected using the best available science to protect the functions and values of environmentally sensitive areas (RCW 36.70A.172).

In addition to developing policies and regulations based on best available science, the Act goes further and requires that "**special consideration**" be given to

> *(1) In designating and protecting critical areas under this chapter, counties and cities shall include the best available science in developing policies and development regulations to protect the functions and values of critical areas. In addition, counties and cities shall give special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries. RCW 36.70A.172(1).*

conservation or protection measures necessary to preserve or enhance anadromous fisheries (WAC 365-195-900). Special consideration means that measures supported by current science relating to protection or enhancement for anadromous fish resources should be given more weight. If protective measures are identified as necessary for the protection or enhancement of anadromous fish resources they should be carefully evaluated; those that are applicable to local conditions should be used.

Special consideration of anadromous salmonid habitat includes protecting the aquatic and terrestrial environments that influence salmonid habitat functions, including water quality, flow regime, food source, access, and habitat structure. In order to be effective for salmonid habitat protection, critical area regulations should address the condition and extent of water-related resources as well as upland processes that affect aquatic habitat including watershed processes of canopy cover, extent of impervious surface, stormwater, water quality, water allocations, watershed hydrology, nutrient flow, and species interactions.

3.2 Special Consideration for Anadromous Fish Resources

To address other impacts, rules and standards have been developed to protect salmonids and other natural resources and values under the Salmon Recovery Act (RCW 77.85, also parts of 77.95), federal Coastal Zone Management Act implemented by Ecology, as well as the Hydraulics Code (RCW 77.55). Although these laws are beyond the scope of local planning programs, they should be reviewed and integrated with local planning and regulatory programs.

This section highlights policy and regulatory considerations to protect freshwater, marine and terrestrial environments that influence salmonid habitat functions. Policies are included because these establish the vision for protecting anadromous fish resources. Regulations have been included because rules are necessary to implement the vision.

Recommendations are organized by common land use planning tools to protect salmonid habitat function from development impacts. For example, a riparian buffer is a land use planning tool that protects naturally vegetated riparian habitat by preventing development in the riparian buffer. A naturally vegetated riparian buffer reduces impervious surface, filters sediment, contributes to terrestrial food sources, and enables recruitment of large woody debris. Prohibiting development in riparian buffers therefore maintains salmonid habitat functions such as water quality, food source, habitat structure and flow regime.

In addition to these salmonid specific policies and regulations, a local jurisdiction needs to have adequate performance and review procedures in place to make salmonid protection and recovery a reality. The Washington State Department of Community Trade and Economic Development has developed model language in the Critical Areas Assistance Handbook (WDCTED 2003) that addresses general provisions necessary to ensure enforcement of salmonid specific provisions.

To protect anadromous fish habitat, special emphasis should be placed on management of the following:

1. Stormwater Runoff
2. Riparian Areas
3. Nearshore Areas
4. Wetlands
5. Large Woody Debris Recruitment
6. In-Stream Habitat
7. Floodplain Areas
8. Channel Migration Zone
9. Landslide Hazardous Areas
10. Water Quality
11. Salmonid Recovery Planning

3.2.1. Stormwater Runoff. Traditional urban and rural development practices remove forests, vegetation and topsoil, and diminish the land's ability to hold and infiltrate rainwater. The remaining water becomes stormwater runoff, rushing off impervious surfaces such as roofs, roads and compacted soils instead of infiltrating the soil column (Booth 2000). Stormwater runoff damages essential habitat for salmonids and other aquatic life because it erodes streams, causes flooding, and carries pollution and sediment to aquatic resources. When it erodes streams, it creates larger channels which need more flow during low flow season (usually late summer) to provide good habitat. Due to the lack of infiltration during rainy months, less stream flow is available to juvenile salmonids during important summer months.

Habitat functions impacted by stormwater runoff include water quality, flow regime, habitat structure and food source.

Stormwater results in a loss of salmonid habitat because runoff reduces oxygen levels, increases water temperatures, and alters channel complexity and substrate conditions. When runoff erodes streams, it creates larger channels which require more flow during the low flow season (typically later summer) to provide good habitat. Fine sediments entering a stream, may reduce spawning gravel quality and harm food sources such as aquatic invertebrates.

Runoff is of particular concern in regions of intense rainfall, such as glacial outwash regions surrounding Puget Sound, or limited vegetation and landscapes with thin soils, such as the arid and semiarid interior east of the Cascade Range (Booth 2000). In the Puget Sound, stormwater outfalls concentrate runoff onto discrete locations on the beach, inhibiting the sheetflow that might normally exist. This may impact habitats and species particularly sensitive to desiccation, including forage fish eggs.

The Puget Sound Partnership has determined that stormwater runoff is the leading contributor to water quality pollution of urban waterways in the State of Washington. Therefore, it is imperative that local governments adopt policies and regulations to reduce and treat stormwater runoff.

Table 3.2.1 Stormwater Runoff Management Recommendations

Policy Considerations	• Adopt a stormwater design manual equivalent to the Washington State Department of Ecology's "Stormwater Management Manual for Western Washington" or "Stormwater Management Manual for Eastern Washington." It should outline standards for construction and post-construction development activities, including management of stormwater runoff and maintenance of stormwater facilities. • Use low-impact development (LID) techniques to manage stormwater, such as limiting impervious surfaces, using permeable pavement, retaining or replacing topsoil, amending soils, creating graded swales and planting trees in amended soils to help provide stormwater retention and restore the evapotranspiration, retaining native vegetation, dispersing stormwater runoff, and using roof water runoff for watering.
Policy Example (Management Manual): *Stormwater should be managed in a manner consistent with the goals of the Puget Sound Water Quality Management Plan to protect natural drainages, habitats and wetlands; control and treat pollution at its source and to control erosion and sedimentation. A surface water management manual that reflects best management practices should be adopted. San Juan County Comprehensive Plan Section B, Element Four, Water Resources, Policy 4.2.F.5.* ***Policy Example (Management Methods)****: Stormwater runoff shall be managed through a variety of methods, with the goal of limiting impacts to aquatic resources, reducing the risk of flooding, protecting and enhancing the viability of agricultural lands and promoting groundwater recharge. Methods of stormwater management shall include temporary erosion and sediment control, flow control facilities, water quality facilities as required by the Surface Water Design Manual, and best management practices as described in the Stormwater Pollution Control Manual. Runoff caused by development shall be managed to prevent adverse impacts to water resources, forests, and farmable lands. Regulations shall be developed for lands outside of the Urban Areas that favor nonstructural stormwater control measures when feasible including: vegetation retention and management; clearing limits; limits on actual and effective impervious surface; low-impact development methods that minimize direct overland runoff to receiving streams; and limits on soil disturbance. King County Comprehensive Plan Chapter Four, Environment, Policy 419.*	

Regulatory Considerations	• Stormwater regulations incorporate adaptive management provisions to address cumulative increases to total impervious area and forest cover thresholds at the sub-basin scale. Thresholds are based on best available science. To protect aquatic resources, WDFW recommends limiting impervious surfaces to no more than 10% of an urban watershed. More than 10% impervious surfaces will have corresponding effects on channel morphology, water quality, and fish and wildlife habitat functions regardless of the width of the riparian area (Knutson and Naef 1997). • Low Impact Development standards are incorporated to encourage limited impervious surfaces, vegetation retention, and retention of natural soils and topography in site design. • New discharge facilities are prohibited from contributing pollutants and excessive artificial nutrients to riparian areas. • Temporary or permanent erosion and sedimentation controls are required to prevent the introduction of sediments or pollutants to water bodies or water courses within salmonid habitat.
Regulatory Example (Management Manual): *The proposed activity must be designed and constructed in accordance with the Stormwater Management Manual for Eastern Washington, as amended (Ecology 2004) for those geographic areas covered under the Eastern Washington Phase II Municipal Stormwater Permit (Ecology 2007) or activities covered under the Ecology General Construction Permit (Ecology 2005) , and/or the locally adopted program, as applicable. Walla Walla County Critical Areas Ordinance, 18.08.240.*	
Planning Resources	**Stormwater Management and Design Manual:** Washington State Department of Ecology, *http://www.ecy.wa.gov/programs/wq/stormwater/index.html* **Low Impact Development Technical Guidance Manual for Puget Sound:** Puget Sound Action Team (January 2005), *http://www.psparchives.com/publications/our_work/stormwater/lid/LID_manual2005.pdf* **Stormwater Resources:** Puget Sound Partnership, *http://www.psparchives.com/our_work/stormwater/stormwater_resources.htm*

3.2.2. Riparian Areas. Salmonids are particularly sensitive to their freshwater environments which includes aquatic environments such as off-channel wetlands and floodplain areas and adjacent terrestrial habitat which is the riparian area (or zone). Riparian areas influence multiple habitat functions: food source, habitat cover, habitat structure, oxygen, water quality, spawning grounds, migration routes to ocean systems and filters water runoff and substrate inputs to the riparian area (Kauffman et al. 2001). Protecting the riparian area to maintain these functions is essential to survival of salmonids and many other species.[11]

Photo 13: Fish Passage Barrier

Functional riparian areas have adequate riparian vegetation that moderates the movement of materials between the terrestrial environment and the stream, provides shade which can have a significant effect on moderating water temperature and climate within riparian zones, provides streambank stabilization with erosion resistant roots that bind soils and builds banks during high flows, provides large woody debris and favor, filters fine sediment from upstream urban development, and favors percolation into groundwater, where soil filters many contaminants, keeping them out of water bodies (Knutson and Naef 1997; Cederholm 2000; Kauffman et al. 2001). Riparian vegetation also provides a home for terrestrial insects and aquatic insects which feed upon organic matter (litterfall) derived from adjacent riparian vegetation that fall into the stream (Kauffman et al. 2001). This underscores the importance of maintaining healthy, diverse, and mature riparian vegetation to provide a steady food source to the stream and nearshore ecosystems. The functions of riparian areas are fundamentally altered when upland and riparian vegetation is removed (May 2003).

Maintaining connectivity of small freshwater tributaries to larger riparian systems is also an important consideration. Salmonids migrate or use different areas of a watershed at different times during their life histories. Artificial barriers to migration disrupt connectivity. Fish passage barriers include poorly designed culverts and dams as well as areas made too shallow for fish to swim past because of water diversion or groundwater pumping.

[11] Knutson and Naef (1997) estimate 85% of Washington's terrestrial vertebrate species use riparian habitat for essential life activities.

Small streams, both non-fish bearing and fish bearing, are particularly important for determining the amounts and timing of stream flow and therefore salmonid habitat downstream. In mountain headwaters, much of the flow, as well as the timing and quality of flow, is determined by headwater processes (snowfall, freezing, melt, glacial melt, rainfall). Disturbance (such as timber cutting and road building) will impact the hydrologic flow regime and water quality. Small freshwater tributaries at any elevation that are tightlined or filled as part of land development also diminish the function of hydrologic regimes, reducing infiltration, as well as nutrient and substrate contribution to marine waters or larger river systems (Cederholm et al. 2000). The reduction of terrestrial vegetation can cause elevated maximum stream temperatures, greater flow fluctuations and reduced winter temperatures (where ice formation is a concern, like some eastside streams) in downstream waters (R2 Resource Consultants et al. 2000). Small fish-bearing tributaries also provide important refuge areas for small fish trying to survive winter floods.

Aquatic ecosystems are not only influenced by terrestrial vegetation, but also in-water projects. Hydraulic projects such as shoreline armoring and overwater structures can impact salmonid habitat functions by decreasing aquatic food supply, changing prey diversity, disrupting migration and feeding areas, increasing wave energy, increasing scour, and increasing predation due to shading from overwater structures. Further discussion on projects in nearshore areas is provided in subsection 3.2.3 and in freshwater riparian areas in subsection 3.2.6.

Habitat functions maintained by riparian areas include water quality, flow regime, habitat structure, food source and access.

Wide terrestrial buffers, a near continuous corridor, mature, native vegetation, and limits on in-water projects are all necessary to protect salmonid habitat functions in riparian areas. Riparian buffers should be established based on best available science for the resource, the quality of existing riparian vegetation and the ability of the site to grow mature native trees (May et al. 1996). In areas with existing development (where natural buffers are unrealistic), explicit provisions for retaining native vegetation for a variety of land uses can be stated and enforced to compensate for inadequate buffers and flexible standards.

Table 3.2.2 Riparian Areas Management Recommendations

Policy Considerations	• Protect and restore natural streambank conditions and functions, including vegetative cover, natural input of large woody debris and gravels by adopting riparian buffers and avoiding bank hardening. • Designate natural buffers of a width based on best available science around all riparian systems that support anadromous fish resources. This includes fish-bearing as well as feeder tributaries. • Designate riparian buffers that maintain native riparian vegetation and encourage the restoration of riparian vegetation. When removal cannot be avoided, require mitigation that addresses cumulative impacts and requires replanting. • Use the "Washington State Integrated Streambank Protection Guidelines" and the "Stream Habitat Restoration Guidelines" when considering protection and restoration of stream habitat. • Restrict livestock access to streams and rivers to prevent streambank and vegetation degradation, channel widening and heating, and direct salmonid impacts, such as redd (nest) trampling.
Policy Example (Riparian Buffers): *Maintain buffers between land-disturbing activities and surface water resources to meet the standards of the best available fisheries science for protecting water resources and related habitat functions. Jefferson County Comprehensive Plan Chapter Eight, Environment Element, Policy 2.5.* ***Policy Example (Vegetated Buffers):*** *Vegetation removal adjacent to riparian areas, resulting from development or other activities, should be strictly controlled with adequate buffers maintained to support the healthy functioning of the hyporheic zone. Pierce County Comprehensive Plan, Water quality 19A.60.050.*	
Regulatory Considerations	• Adopt a setback of at least 15 feet from habitat buffers to protect habitat from impacts associated with construction and buildings. • Natural vegetation buffers are based on best available science and therefore are sufficient to maintain functions and processes necessary for salmonids. • If modifications or buffer averaging must be allowed to prevent an unreasonable hardship on a landowner, habitat enhancement is required to protect the integrity, functions, and values of existing

	anadromous fish habitat (see below for habitat management plan recommendations). Buffer averaging requires review by a qualified habitat biologist. • Buffers are measured landward from the Ordinary High Water Mark (OHWM). • Buffers are extended to include adjacent critical areas (such as wetlands, floodplains, and channel migration zones). • Clearing of native vegetation is only permitted if no net loss to fish and wildlife habitat conservation areas can be shown or clearing of native vegetation is necessary to mitigate hazardous trees. A qualified professional must prepare the report (i.e. arborist). • A vegetation conservation plan is required to ensure native vegetation retention and restoration to ensure no net loss of marine and freshwater riparian functions. The plan is reviewed by a qualified professional. • Bank hardening is prohibited.

Regulatory Example (Vegetated Buffers): *Establishment of Buffers. The Director shall require the establishment of buffer areas for activities adjacent to habitat conservation areas when needed to protect habitat conservation areas. Buffers shall consist of an undisturbed area of native vegetation or areas identified for restoration established to protect the integrity, functions, and values of the affected habitat. Required buffer widths shall reflect the sensitivity of the habitat and the type and intensity of human activity proposed to be conducted nearby and shall be consistent with the management recommendations issued by the Washington Department of Fish and Wildlife. Walla Walla County Critical Areas Protection, Chapter 18.08.640.*

Regulatory Example (Hazardous Trees): *(1) In a critical area or critical area buffer, removal of hazardous, diseased or dead trees and vegetation by the landowner may be permitted when necessary to: (a) Control fire; or (b) Halt the spread of disease or damaging insects consistent with the State Forest Practices Act, RCW 76.09; or (c) Avoid a hazard such as landslides; or (d) Avoid a threat to existing structures or above-ground utility lines. (2) Before hazardous, diseased or dead trees and vegetation may be removed by the landowner pursuant to subsection (1): (a) Unless there is an emergency pursuant to SCC 14.24.070(1), the landowner shall obtain written approval from Planning and Development Services. This*

consent shall be processed promptly and may not be unreasonably withheld. If the Administrative Official fails to respond to a hazard tree removal request within 10 business days, the landowner's request shall be conclusively allowed; and (b) The removed tree or vegetation should be left within the critical areas or buffer unless the Administrative Official, or a qualified professional, warrants its removal to avoid spreading the disease or pests; and (c) Any removed tree or vegetation shall be replaced with an appropriate native species in appropriate size. Replacement shall be performed consistent with accepted restoration standard for critical areas within one (1) calendar year. (d) For 14.24.130 only, a qualified professional shall mean a certified arborist, certified forester or landscape architect. Skagit County Critical Areas Ordinance, 14.24.130 Hazard Tree Removal.

Regulatory Example (Vegetation Retention): *Standards for allowed uses and activities. Vegetation Removal. 1. Removal of native vegetation. Removal of native vegetation within priority habitat, marine riparian habitat areas, and riparian habitat areas along streams, within wetlands and buffers of both shall be prohibited except as provided for in this chapter.3. Noxious weeds and invasive plants. a. Removal of noxious weeds, as defined by Chapter 16-750 WAC, under the direction of the Thurston County Noxious Weed Control Agency, is permitted in important habitat areas consistent with a county approved integrated pest management plan, applicable county and state regulations, and Subsections W(3)(d) and (e) below. b. Removal of invasive plants is permitted subject to Subsections W(3) (c-e). c. Plant removal shall be performed such that it will not increase the likelihood of stream bank erosion, marine bluff erosion (see Section 17.15.600), significantly damage untargeted vegetation, or impair any habitat functions. These areas may be maintained to promote native vegetation; The method of removal shall be approved in writing by Thurston County Development Services Department, consistent with applicable county, state, and federal regulations. d. Hand tools shall be used for plant removal unless the approval authority determines that the scale of the project warrants use of small scale equipment (e.g., riding mowers or light mechanical cultivating equipment) or other method (i.e., application of herbicide with a state and federally approved formulation by a licensed applicator in accordance with the safe application practices on the label) and use of the equipment/method does not pose a significant risk to untargeted areas, habitat functions, or water quality. e. Erosion shall be effectively controlled and exposed areas shall be stabilized immediately following plant removal consistent with Chapter 15.05 TCC. If the area of exposed soil exceeds 100 square feet, it shall be planted with appropriate native plant species present in the area at a density that will provide complete ground cover at maturity, unless the approval authority determines that the area will revegetate naturally without jeopardizing water quality or the important habitat area. Thurston County Critical Areas Ordinance (In Draft), 17.15.870, http://www.co.thurston.wa.us/permitting/.*

Planning Resources	**Riparian Management Recommendations:** Washington Department of Fish and Wildlife Priority Habitats and Species Management Recommendations (December 1997), *http://wdfw.wa.gov/hab/phspage.htm* **Integrated Streambank Protection Guidelines:** Washington Department of Fish and Wildlife Aquatic Habitat Guidelines (April 2003), *http://wdfw.wa.gov/hab/ahg* **Stream Habitat Restoration Guidelines:** Washington Department of Fish and Wildlife Aquatic Habitat Guidelines (2004), *http://wdfw.wa.gov/hab/ahg* **Restoring the Watershed, A Citizen's Guide to Riparian Restoration in Western Washington.** Washington Department of Fish and Wildlife, *http://wdfw.wa.gov/recovery.htm* **Managing Vegetation on Coastal Slopes:** Washington Department of Ecology, *http://www.ecy.wa.gov/programs/sea/pubs/93-31/intro.html* **Mapping Resources (listed in Appendix A):** • *SalmonScape* • *WDFW Priority Habitats and Species Data*

3.2.3 Nearshore Areas. On the westside of the state, local governments have both freshwater and nearshore areas. Nearshore riparian areas include the saltwater subtidal zone (marine), intertidal zone (estuaries and bays) and terrestrial riparian zone (Buchanan et al. 2001). Nearshore riparian areas offer refuge and foraging habitat for juvenile salmonids as they transition to the open ocean. Estuaries are a particularly important nearshore habitat as estuaries provide distinctive environmental conditions for the physiological changes necessary to move from freshwater to saltwater as juveniles, and back to freshwater as mature adults.

Habitat functions maintained by nearshore areas include water quality, flow regime, habitat structure, food source and access.

Nearshore riparian areas support many of the same habitat functions as freshwater riparian areas (food, access, habitat structure) and therefore management recommendations, such as native vegetation in riparian buffers listed above in subsection 3.2.2, are essential.

Photo 14: Nearshore Feeder Bluff

In addition to protecting riparian vegetation, nearshore riparian areas are vulnerable to impacts such as shoreline armoring and overwater structures. Overwater structures, such as floats, impact salmonid prey sources and refugia when shading and grounding occurs. Shoreline armoring impacts nearshore environmental functions by blocking, delaying, or eliminating natural erosion that provides smelt and sand lance spawning habitat (Pentilla 2007). Salmonid nearshore habitat will become increasingly vulnerable to disturbance as sea levels rise and beach habitats are squeezed between rising waters and shoreline armoring (Washington State Climate Advisory Team 2007). Additional management recommendations specific to the nearshore are provided here.

Table 3.2.3 Nearshore Areas Management Recommendations

Policy Considerations	• Designate natural shoreline buffers of a width based on best available science to protect salmonid habitat processes and functions. • Designate natural shoreline buffers that maintain native riparian vegetation and encourage the restoration of riparian vegetation. When removal cannot be avoided, require mitigation that addresses cumulative impacts and requires replanting. • Maintain the connectivity and nursery habitat at the mouths of tributaries, estuaries, and wetlands and other nearshore habitats through the establishment of habitat buffers. • Identify and protect potential and known forage fish (herring, smelt, and sand lance) spawning areas. • Allow new bank stabilization of shorelines only after a geotechnical or hydrologic analysis, reviewed by a qualified third party, and demonstrates an imminent threat to existing residential or business structures or critical public facilities. Innovative, bioengineering alternatives to hard armoring should always be considered first. • Require proposed bulkhead rebuild projects to evaluate the effectiveness of alternative designs (e.g., soft-shore approaches) as opposed to in-kind replacement • Identify feeder bluffs and protect them (and their functions) through appropriate shoreline designation and SMP regulations • Identify intact beaches and protect them through appropriate shoreline designation and SMP regulations • New or enlarged piers, floating docks, mooring buoys, navigational aids and swimming floats are located away from (and not in) marine aquatic vegetation beds and are sufficiently restricted to protect salmonid rearing areas and migration corridors. • Encourage community use projects for piers, boat ramps, and access sites

<table>
<tr><td colspan="2">Policy Example (Nearshore Habitat Designation and Protection): The county should identify and protect, consistent with best available science, important, sensitive marine habitats, such as juvenile salmon migration corridors, kelp and eelgrass beds, shellfish beds, and herring and smelt spawning areas. Thurston County Comprehensive Plan Chapter Nine, Environment, Policy C.3.2.</td></tr>
<tr><td>Regulatory Considerations</td><td>An established marine riparian habitat area and management zone extending 200 feet on a horizontal plane, landward from the ordinary high water mark. The marine riparian habitat area retains existing conditions, including native vegetation at least 100 feet landward from the OHWM. When conditions are degraded, replanting of native vegetation may be a condition for upland development. Development permitted in the marine riparian management zone is restricted as necessary to minimize adverse impacts to existing native vegetation that have a beneficial impact on marine critical areas, such as forage fish-spawning beaches. Development in the marine riparian management area requires a vegetation conservation plan or habitat management plan with measures to promote and sustain native vegetation and facilitate dispersion and filtering of runoff.
Provisions for overwater structures include, no grounding of floats, use of inert materials that do not pose a risk to water or sediment quality, full compliance with Corps of Engineer Regional General Permit Number 6, timing restrictions to protect critical forage fish spawning and incubation time, no fill or armoring of the shoreline, grating/materials that allow sunlight to penetrate docks, piers, and floats, and loss of existing native vegetation requires mitigation.
Overwater structures should be constructed of materials that will not adversely affect water quality or aquatic plants and animals in the long term.
Prohibit bulkheads that result in water falling rather than flowing onto the shore.</td></tr>
<tr><td colspan="2">Regulatory Example (Nearshore Habitat Protection): Marinas or launch ramps shall not be permitted within the following marine shoreline habitats because of their scarcity, biological productivity and sensitivity unless no alternative location is feasible, the project would result in a net enhancement of shoreline ecological functions, and the proposal is otherwise consistent with this Program: (1) Marshes, estuaries and other wetlands; (2) Tidal pools on rock shores; (3) Kelp beds,</td></tr>
</table>

eelgrass beds, spawning and holding areas for forage fish (such as herring, surf smelt and sandlance); Whatcom County Shoreline Master Program, Boating Facilities: Marinas and Launch Ramps, 23.100.04.	
Planning Resources	**Protecting Nearshore Habitat and Functions in Puget Sound:** Washington Department of Fish and Wildlife Aquatic Habitat Guidelines (October 2007), *http://wdfw.wa.gov/hab/nearshore_guidelines/* **Marine and Estuarine Shoreline Modification Issues and Overwater Structures:** Washington Department of Fish and Wildlife Aquatic Habitat Guidelines White Papers, *http://wdfw.wa.gov/hab/ahg/ahgwhite.htm* **Mapping Resources (listed in Appendix A):** • *Salmonscape* • *WDFW Priority Habitats and Species* • *DNR Shorezone Inventory* • *Ecology Coastal Zone Atlas*

Photo 15: Natural Wetland Habitat

3.2.4 Wetlands. Wetlands are low areas in the landscape that are inundated or saturated by surface or ground water, hydrologically connected to riparian areas and support a prevalence of native vegetation (Kauffman et al. 2001). Wetlands promote more movement of water into groundwater, settle erosion products (instead of transporting them to a stream), and contribute to less extreme hydrology (May 2003). Stream-adjacent wetland habitat contributes to salmonid survival by providing off-channel habitat, food source and moderating stream flows. Wetlands and associated vegetation provide essential off-channel habitat to sustain young salmonid growth and protect them from predators (Spence et al. 1996). Wetland habitat also hosts amphibious species and insects that are potential food sources for salmonids. Wetlands moderate stream flows by preserving adequate water recharge to streams during low flow periods and protect rearing salmonids from the effects of high flows.

Habitat functions maintained by wetland protection include water quality, flow regime, habitat structure, food source and access.

Table 3.2.4 Wetlands Management Recommendations

Policy Considerations	• Adhere to Washington Department of Ecology guidance when identifying, classifying, and protecting wetlands (e.g., "Washington State Wetland Identification and Delineation Manual," "Washington State Wetland Rating System for Western Washington," "Wetlands in Washington State, Volume 2: Guidance for Protecting and Managing Wetlands.") • Protect the connectivity of wetlands to streams and nearshore habitats through the establishment of habitat buffers
Policy Example (Wetland Protection): *King County's overall goal for the protection of wetlands is no net loss of wetland functions and values within each drainage basin. Acquisition, enhancement, regulations, and incentive programs shall be used independently or in combination with one another to protect and enhance wetlands functions and values. Watershed management plans, including ((Water Resource Inventory Area)) WRIA plans, should be used to coordinate and inform priorities for acquisition, enhancement, regulations, and incentive programs within unincorporated King County to achieve the goal of no net loss of wetland functions and values within each drainage basin. King County Comprehensive Plan Chapter Four, Environment, Policy 446.*	
Regulatory Considerations	• Wetlands have been rated, designated and mapped according to the Department of Ecology Wetland Rating System. Activities allowed in wetlands do not alter the structure or functions of the existing wetland. Development in or near wetlands requires a critical areas report prepared by a qualified wetland scientist. • Wetland buffers are tailored to protect specific anadromous fish habitat and functions, as supported by best available science. • If modifications or buffer averaging must be allowed to prevent an unreasonable hardship on a landowner, habitat enhancement shall be required to protect the integrity, functions, and values of existing anadromous fish habitat (see below for habitat management plan recommendations). Buffer averaging requires review by a qualified habitat biologist.

	• Buffers are extended to include adjacent critical areas (such as riparian areas).
Regulatory Example (Wetland Classification and Designation): *(1) Classification. Wetlands shall be classified using the 2004 Washington State Department of Ecology's Wetland Rating System for Western Washington (Ecology Publication #04-06-025), or as amended. Wetland rating categories shall not be determined based upon illegal modification to the land. Wetland delineations shall be determined by using the Washington State Wetlands Identification and Delineation Manual, March 1997, or as amended hereafter.* *(2) Designation. As determined using the 1997 Washington State Department of Ecology's Washington State Wetlands Identification and Delineation Manual (Ecology Publication #96-94 or as amended), wetlands shall be designated as critical areas and regulated under this article regardless of size; PROVIDED that Category IV wetlands less than one-tenth (0.1) acre (4,356 square feet) shall be exempt from the requirements of this article when all of the following criteria are met: Jefferson County Critical Areas Ordinance 18.22.300.*	
Planning Resources	**Wetland Identification and Delineation Manuals**: Washington State Department of Ecology, *http://www.ecy.wa.gov/programs/sea/wetlands/index.html*

3.2.5 Large Woody Debris Recruitment. Large woody debris may be the most important structural component of salmonid habitat (May et al. 1996). If a large tree falls within a riparian buffer, it has the potential to recruit to the channel and influence channel morphology catching smaller trees and branches that would otherwise float away. Benefits include dissipation of energy associated with water flow, streambank protection and stabilization, sediment storage, and in-stream cover and habitat diversity (May et al. 1996). Habitat diversity includes the creation of pools that provide suitable rearing habitat for salmonids where food is plentiful with minimal energy expenditure. These pools also assist in the retention of salmonid carcasses by adding habitat complexity where these carcasses may settle out and add nutrients for stream productivity (Cederholm et al. 2000). Deep pools may also provide cover from predators (Kauffman et al.).

Habitat functions maintained when large woody debris naturally recruits to the stream include habitat structure, flow regime and access.

In some cases, large woody debris is removed when it poses a safety concern to property owners or in areas of high recreational use such as boat launches. However, threats posed by LWD can often be alleviated by simply repositioning the wood; removal should be a last resort and appropriately mitigated by replacing wood in another spot to offset habitat impacts. Signage at river or stream boat launches can educate the public about the habitat benefits and safety risks associated with LWD.

Table 3.2.5 Large Woody Debris Recruitment Management Recommendations

Policy Considerations	• Retain large woody debris in streams and maintain long-term recruitment of large woody debris from riparian zones. • Do not remove, relocate, or modify large woody debris in aquatic habitats and adjacent banks except when posing an immediate threat to public safety or critical facilities. Assessments of safety threat posed by LWD should be determined in consultation with a qualified professional. • Large woody debris complexes clearly posing a threat to infrastructure and critical facilities should be moved or removed as necessary and mitigation required. Mitigation may include placing the wood back into the system at a location where it will not pose an immediate hazard and where the lack of large woody debris has been identified as a problem. If wood is not returned to the system, it should be reserved for use in habitat restoration projects. Mitigation also includes replanting native trees at the site of removal. • Planning for new or reconstructed infrastructure should consider the inherent nature of wood to accumulate and move in streams. • Prohibit salvage logging (including firewood cutting) from aquatic areas.
Policy Example (Vegetation Retention): *King County should adopt development regulations for vegetated areas along streams, which once supported or could in the future support mature trees, that include buffers of sufficient width to facilitate the growth of mature trees and periodic recruitment of woody vegetation into the water body to support vegetation-related shoreline functions. King County October 2008 Draft Shoreline Master Program, Policy 640.*	
Regulation Considerations	• Hazard tree removal within a stream requires a Hydraulic Project Approval permit under RCW 77.55 from the Washington Department of Fish and Wildlife. • Hazard tree removal requires department review and professional assessment to determine if a tree poses a “direct threat to property and life.” A habitat management report prepared by a qualified arborist must be submitted that includes a description of existing habitat conditions, explores

	alternatives to outright removal (such as limbing or crown thinning), assesses tree health for recruiting to the channel, and on-site replanting provisions to mitigate removal impacts. • New structures at dams or weirs that inhibit the passage of wood are prohibited. • A qualified professional (habitat biologist or arborist) is to determine the appropriate management recommendations when LWD poses an immediate threat to public safety or critical facilities. Threats can often be alleviated by repositioning the debris; removal is a last resort.
Regulatory Example (Hazardous Trees): *To the maximum extent practical…Hazard trees should be retained in aquatic area buffers and either topped or pushed over toward the aquatic area. King County Critical Areas Ordinance, 21A.24.365.* ***Regulatory Example (Hazardous Trees):*** *The county may authorize the limbing, thinning or removal of hazard trees in important habitat areas and associated buffers provided that: c. Snags shall be left in place to provide habitat unless they have a disease that would jeopardize other trees. All trees and branches cut in the important habitat area and buffer shall remain there unless the tree is diseased. Thurston County Critical Areas Ordinance (In Draft), 17.15.870, http://www.co.thurston.wa.us/permitting/.*	
Planning Resources	**Stream Habitat Restoration Guidelines**, WDFW Aquatic Habitat Guidelines, *http://wdfw.wa.gov/hab/ahg*

3.2.6 In-stream Habitat. In addition to large woody debris, other structural components influence salmonid habitat. Certain substrate (e.g. gravel, cobble) in the stream bed provide critical habitat for egg incubation and embryo development. Human influences on water flows can result in excessive scour and aggradations to substrate, diminishing streambed habitat (May et al. 1996).

In-stream habitat is also altered when hydraulic projects change the bed and flow of waters. Stream crossings that require bridges or culverts may disrupt habitat connectivity and impede fish access to natal spawning streams.[12] Bridges that span the entire high water channel of a stream are far less impacting than culverts, causeways, or bridges with multiple piers. RCW 77.55 grants the authority to the Washington Department of Fish and Wildlife to permit construction projects in state waters. Any person, organization, or government agency proposing to conduct any construction activity that will use, divert, obstruct or change the bed or flow of waters of the state must do so under the terms of a Hydraulic Project Approval (HPA), issued by WDFW. Waters of the state include all marine waters and freshwaters of the state. Although WDFW permits hydraulic projects, local governments are in a unique position to adopt complimentary in-stream protection standards to ensure adequate protection of in-stream salmonid habitat functions.

Habitat functions maintained by in-stream habitat protection include flow regime and access.

Photo 16: In-Stream Habitat

[12] Additional recommendations for road crossings are located in section 3.3.7 Road Standards.

Table 3.2.6 In-stream Habitat Management Recommendations

Policy Considerations	• Retain streambed gravel. • Remove human-made barriers to salmonid migration, such as blocking culverts and tide gates; maintain fish passage throughout the range of anadromous and resident fish species. • Discourage in-stream structures that are not improving habitat functions such as flood control works. • New road construction avoids stream and wetland crossings. Measures to prevent new crossings include: investigation of alternative access locations across neighboring properties, and use of joint access roads for multiple lots whether developed together or individually. When avoidance cannot be achieved, bridges should be considered before culverts. • Identify and prioritize the repair/replacement of stream crossings that impede salmon passage as part of a local jurisdiction's periodic Transportation Improvement Program. Identify funding and develop a work schedule to remedy problem stream crossings, working cooperatively with responsible parties, whether public or private.
Policy Example (Substrate Retention): *Mining, dredging, or the removal of gravel, fill or similar materials from streams, ground water recharge areas, or other surface water areas shall be strictly controlled to prevent adverse alterations to flow characteristics, siltation and the pollution or disruption of fish passage, spawning beds, or juvenile rearing areas. Pierce County Comprehensive Plan, Water quality 19A.60.050.* ***Policy Example (Flood Control):*** *New or expanding development or uses in the shoreline, including subdivision of land, that would likely require structural flood control works within a stream, channel migration zone, or floodway should not be allowed. Whatcom County Shoreline Master Program, Flood Control Works and In-stream Structures, 23.100.06.* ***Policy Example (Flood Control):*** *Non-structural and non-regulatory methods to protect, enhance, and restore shoreline ecological functions and processes and other shoreline resources should be encouraged as an alternative to structural flood control works and in-stream structures. Nonregulatory and non-structural methods may include public facility and resource planning, land or easement acquisition, education, voluntary protection and enhancement projects, or incentive programs.*	

<table>
<tr><td colspan="2"><u>Whatcom County Shoreline Master Program, Flood Control Works and In-stream Structures, 23.100.06.</u></td></tr>
<tr><td>Regulatory Considerations</td><td>

Prohibit removal of gravel from the streambed.
Activities including mining, dredging or the removal of gravel, fill or similar materials from freshwater streams and nearshore habitats should be avoided. When activities cannot be avoided, a habitat management plan, prepared by a qualified professional, is required to minimize impacts to salmonid habitat.
Road crossing culverts are avoided in critical salmonid habitat areas, particularly spawning areas. When avoidance is not an option, road-crossing culverts are designed to facilitate upstream fish migration (see planning resources).
Require that any existing crossings which impede fish passage be repaired or replaced during road upgrade or improvement projects, subdivision approvals, building, or site development permit approvals.
Adopt standards for culvert placement and design as listed in WDFW’s Design Manual for Culverts. Culverts and bridges should pass the 100-year flood event plus associated debris. In addition to effects on salmonids, under-sized culverts frequently result in failure and replacing such a crossing twice is more expensive than installing an appropriately sized structure the first time.
Existing fish passage barriers are inventoried at time of land use application and if mitigation is necessary, correction or removal of fish passage barriers is required.

</td></tr>
<tr><td colspan="2">Regulatory Example (Stream Crossings): Any private or public road expansion or construction which is proposed and must cross streams classified within this article, shall comply with the following minimum development standards:
(a) The design of stream crossings shall meet the requirements of the Washington Department of Fish and Wildlife. Fish passage shall be provided if necessary to address manmade obstructions on-site. Other alternatives may be allowed upon a showing that, for the site under review, the alternatives would be less disruptive to the habitat or that the necessary building foundations were not feasible. Submittal of a habitat management plan which demonstrates that the alternatives would not result in significant impacts to the fish and wildlife habitat area (FWHCA) may be required;</td></tr>
</table>

(b) Crossings shall not occur in salmonid spawning areas unless no other reasonable crossing site exists. For new development proposals, if existing crossings are determined to adversely impact salmon spawning or passage areas, new or upgraded crossings shall be located as determined necessary through coordination with the Washington State Department of Fish and Wildlife; *(c) Bridge piers or abutments shall not be placed either within the floodway or between the ordinary, high water marks unless no other reasonable alternative placement exists;* *(d) All stream crossings shall be designed based on the 100-year projected flood flows, even in non-fish bearing Type Np and Ns streams. In addition, crossings for Type S and F streams should allow for downstream transport of large woody debris;* *(e) Crossings shall serve multiple properties whenever possible; and* *(f) Where there is no reasonable alternative to providing a culvert, the culvert shall be the minimum length necessary to accommodate the permitted activity. Jefferson County Critical Areas Ordinance,18.22.250.* ***Regulatory Example (Stream Restoration):*** *Allowed Uses. Restoration of streams previously piped or channeled into a new or relocation streambed when part of a restoration plan that will result in equal or better habitat and water quality and quantity, and that will not diminish the flow capacity of the stream or other natural stream processes; provided, that the relocation has a state hydraulic project approval and all other applicable permits. Walla Walla County Critical Areas Ordinance, 18.08.620.*	
Planning Resources	**Design of Road Culverts for Fish Passage:** Washington Department of Fish and Wildlife Aquatic Habitat Guidelines, *http://wdfw.wa.gov/hab/ahg/* **Protecting Nearshore Habitat and Functions in Puget Sound:** Washington Department of Fish and Wildlife Aquatic Habitat Guidelines, *http://wdfw.wa.gov/hab/nearshore_guidelines/* **In-stream Flow**: Washington State Department of Ecology, *http://www.ecy.wa.gov/programs/wr/instream-flows/isfrul.html*

3.2.7 Floodplain Areas. Flooding is a natural event that can have positive influences on salmonid habitat (e.g., recruitment and redistribution of large woody debris and gravels), but flooding exacerbated by impervious surfaces and man-made flood control structures can negatively affect salmonid habitat by increasing sediment loads, increasing point and non-point source pollutants, and removing in-stream habitat structures such as large woody debris. Floods have their greatest impact to salmonid populations during incubation where they can scour redds (NMFS 2008).

Habitat functions maintained by floodplain protection include water quality, flow regime, habitat structure, food source, and access.

Floodplain areas are the relatively flat, low-lying areas adjacent to the main channel of a river or stream (May 2003) subject to inundation by the base flood (WDCTED 2003). Protecting floodplain areas is becoming more important than ever as natural flooding events are increasing due to climate change. Climate change evidence includes increases in average air and ocean temperatures, widespread melting of snow and glaciers, and rising sea level (NMFS 2008). In the short-term climate change is affecting the frequency and magnitude of storm events, resulting in unpredictable flooding events. In the long-term, sea level is expected to rise, inundating and regularly flooding the lowest lying areas during the daily tide cycle. Low-lying river deltas, port areas, and ocean beach communities on the Long Beach peninsula of Willapa Bay and the Ocean Shores community near Grays Harbor are known to be at risk (Washington State Climate Advisory Team 2007).

Table 3.2.7 Floodplain Areas Management Recommendations

Policy Considerations	• Prohibit new development in the 100-year floodplain. • Prohibit new dikes, levees, tide-gates, floodgates, pump stations, culverts, dams, water diversions, and other alterations to the floodplain, excepting habitat improvements such as a wider culvert for fish passage. • Develop flood hazard reduction plans and ordinances. • Identify opportunities for and encourage restoration of side channel habitat for salmonids as mitigation for floodplain alterations where feasible. • Adhere to the National Marine Fisheries Service Biological Opinion (September 22, 2008) list of reasonable and prudent alternatives to prevent and/or minimize the degradation of channel and floodplain habitat. Although, the 2008 biological opinion was issued for the Puget Sound region, the recommendations can be applied statewide to protect salmonid habitat.
Policy Example (Flood Hazard Protection): *Protect flood hazard areas from development and uses that compromise the flow, storage and buffering of flood waters, normal channel functions, and fish and wildlife habitat and to minimize flood and river process risk to life and property. Jefferson County Comprehensive Plan Chapter Eight, Environment Element, Goal 11.* ***Policy Example (Flood Hazard Management Plans):*** *In cooperation with other applicable agencies and persons, the County should continue to develop long term, comprehensive flood hazard management plans, such as the Lower Nooksack River Comprehensive Flood Hazard Management Plan, to prevent needless flood damage, maintain the natural hydraulic capacity of floodways, and conserve valuable, limited resources such as fish, water, soil, and recreation and scenic areas. Whatcom County Shoreline Master Program, Flood Control Works and Instream Structures, 23.100.06.*	
Regulatory Considerations	• Prohibit development in the floodway and 100-year floodplain. • Frequently flooded areas are designated. A critical area report using best available science is required to avoid floodplain alteration.

	• If development within the 100-year floodplain is permitted, subject any loss of floodplain habitat to mitigation sequencing provisions. Additionally, indirect adverse effects of development in the floodplain (effects to stormwater, riparian vegetation, bank stability, channel migration, hyporheic zones, wetlands, etc.) must also be mitigated such that equivalent or better salmonid habitat protection is provided. For permitted development within the 100 year floodplain, construction in the floodplain shall use Low Impact Development (LID) methods (generally requiring infiltration of all on-site stormwater), such as those described in the Low Impact Development Technical Guidance Manual for Puget Sound.
Regulatory Example (Flood Storage): *Development proposals and alterations shall not reduce the effective base flood storage volume of the floodplain. A development proposal shall provide compensatory storage if grading or other activity displaces any effective flood storage volume. King County Critical Areas Ordinance, 21A.24.240.* ***Regulatory Example (Flood Control):*** *Flood control works to protect existing development should be permitted only when the primary use being protected is consistent with this Program, and the works can be developed in a manner that is compatible with multiple use of streams and associated resources for the long term, including shoreline ecological functions, fish and wildlife management, and recreation. Whatcom County Shoreline Master Program, Flood Control Works and Instream Structures, 23.100.06.* ***Regulatory Example (Flood Control):*** *New flood control works are prohibited on estuarine shores, on point and channel bars, and in salmon and trout spawning areas, except for the purpose of fish or wildlife habitat enhancement or restoration. Whatcom County Shoreline Master Program, Flood Control Works and Instream Structures, 23.100.06.*	
Planning Resources	**Biological Opinion on Puget Sound National Flood Insurance Program:** National Marine Fisheries Service (September 22, 2008), *http://www.nwr.noaa.gov/* **Low Impact Development Technical Guidance Manual for Puget Sound**: Puget Sound Action Team (January 2005), *http://www.psparchives.com/our_work/stormwater/stormwater_resources.htm#tech*

3.2.8 Channel Migration Zone. Natural flooding conditions are supported when river channels are able to migrate across the floodplain, gradually eroding one bank while depositing sediment along the other. This natural process of a river or stream channel moving laterally across or within its floodplain creates side channels and off-channel areas that shelter juvenile salmon. This area, where a stream or river is susceptible to channel erosion and therefore reforming is termed a channel migration zone (CMZ) and extends beyond floodways and floodplains as mapped on Flood Insurance Rate Maps. Floodplains and floodways are focused on inundation, whereas CMZs characterize areas susceptible to channel erosion either within or outside areas prone to flooding (Rappe and Abbe 2003).

Habitat functions maintained by channel migration protection include water quality, flow regime, habitat structure, food source and access.

The CMZ provides important natural functions for salmonids as the water meanders and braids creating side channels and off-channel areas that provide forage, natural cover, rearing and refuge for juvenile salmonids (NMFS 2008). Channel migration also alters habitat structure as water courses erode shoreline vegetation and recruit LWD to the channel.

Stream channels are believed to be in a dynamic equilibrium over time scales measured in decades and centuries unless disturbed by volcanoes or landslides. Dynamic equilibrium means that channel dimensions, including pool:riffle ratios, gradient, and sinuosity, remain constant even though locations of individual channel units change. Consequently, native fish have adapted to the balance of flow conditions and timing of flows and the habitats in the channels (cascades, riffles, runs, pools) and their life histories are tied to such geomorphic and hydrological features.

Table 3.2.8 Channel Migration Zone Management Recommendations

Policy Considerations	• Delineate channel migrations zones. • Designate channel migration zones as critical areas because they are important fish and wildlife conservation areas. • Minimize adverse impacts in existing channel migration zones by adopting CMZ protection standards. • Discourage new dwelling units or expansion of existing structures within the CMZ. • Allow no new or expanded channel stabilization projects or other river control structures in the channel migration zone, unless protecting existing essential facilities or increasing habitat through bioengineered restoration. • Encourage the removal or relocation of structures within the channel migration zone to facilitate the natural recovery of channel migration processes that create and maintain salmonid habitat.
Policy Example (CMZ Protection): *The county should minimize disruption of long-term stream channel migration processes that allow formation of essential habitat features by prohibiting construction of new structures in channel migration zones and minimizing streambank stabilization. Thurston County Comprehensive Plan Chapter Nine, Environment, Policy D.4.*	
Regulatory Considerations	• Allow no development in CMZ plus 50 feet. Exceptions must be mitigated and not adversely affect water quality, water quantity, flood volumes, flood velocities, spawning substrate, and/or floodplain refugia for listed salmonids.
Regulatory Example (Riparian Buffers): *The Director shall have the authority to increase the width of a stream buffer on a case-by-case basis when such increase is necessary to achieve any of the following…Maintain areas for channel migration. Walla Walla County Critical Areas Ordinance, 18.08.674.*	

Regulatory Example (CMZ Protection): *Areas adjacent to critical areas shall be considered to be within the jurisdiction of these requirements and regulations to support the intent of this Chapter and ensure protection of the functions and values of critical areas. Adjacent shall mean any activity located…Within the floodway, floodplain, or channel migration zone; Walla Walla County Critical Areas Ordinance, 18.08.030.*	
Planning Resources	**A Framework for Delineating Channel Migration Zones:** Washington State Department of Ecology, *http://www.ecy.wa.gov/pubs/0306027.pdf*

3.2.9 Landslide Hazardous Areas. Steep slopes such as marine bluffs replenish beach substrate which influences the habitat functions salmonids use in nearshore riparian areas. Natural erosion rates of shoreline bluffs provide essential functions by providing beach material ("beach nourishment") and therefore shoreline bluffs should be maintained.

Land use activities, such as timber harvest, road building and clearing and grading, that destabilize marine bluffs can have negative impacts in the nearshore environment by increasing erosion, causing landslides, and elevating levels of suspended sediments and turbidity. Therefore, designating and protecting landslide hazardous areas, such as marine bluffs, is important to maintain salmonid habitat functions in the nearshore environment.

Designating and protecting steep slopes in freshwater habitat areas is also important for salmonid survival. Landslides infrequently occur adjacent to freshwater systems where the landscape is natural. When they do occur in natural systems, they contribute large wood which sorts sediment into suitable spawning gravel and unsuitable fine sediment. In systems that have been managed for timber, agriculture or urban development, landslides deliver sediment to the streams without wood, which smothers spawning gravel.

Habitat functions maintained by landslide hazardous areas protection include water quality, flow regime, habitat structure, food source and access.

Many freshwater riparian hillslope failures that enter stream channels may move considerable distances downstream, removing streamline vegetation and soil. Landslides that reach stream channels can transform into catastrophic debris torrents that can scour headwater channels down to bedrock and create a mass export of sediment and large wood to larger, downstream fish-bearing channels. Although gravel and large woody debris can benefit habitat structure, highly altered rates of their disturbance and delivery can have negative impacts on whole stream reaches, leading to channel widening, riparian forest degradation, reducing food resources and warming stream temperatures (Cederholm et al. 2000). Human activities that can influence landslides include vegetation removal near and on unstable slopes, cutting into the toe of a slope, altering natural drainage patterns and contributing to surface erosion, and developing within channel migration zones.

Table 3.2.9 Landslide Hazardous Areas Management Recommendations

Policy Considerations	• Give special protection to landslide hazardous areas that can damage rivers and streams during mass wasting events. • Maintain vegetation and control drainage on steep slopes. • Protect marine bluffs to allow natural functions of beach nourishment and avoid elevated levels of suspended sediments and turbidity.
Policy Example (LHA Protection): *The protection of lands where development would pose hazards to health, property, important ecological functions or environmental quality shall be achieved through acquisition, enhancement, incentive programs and appropriate regulations. The following ((natural landscape features)) critical areas are particularly susceptible and should be protected…..Slopes with a grade of 40 percent or more or landslide hazards that cannot be mitigated; King County Comprehensive Plan Chapter Four, Environment, Policy 503.*	
Regulatory Considerations	• Marine feeder bluffs are designated and protected as a geologically hazardous area. • Buffers on streams with ravines are measured from the edge of the bankfull channel (May 2003). • Vegetation removal is forbidden in landslide/geologically hazardous areas, including viewshed clearing. If viewshed pruning is permitted, limbing or crown thinning is in compliance with National Arborist Association pruning standards, • Maintain the top slope of bluffs with native vegetation. • The placement of structures on feeder bluffs is prohibited. Shoreline armoring of feeder bluffs requires geotechnical assessments, reviewed by a third party, to evaluate problems and analyze potential solutions, including the use of alternative designs (Envirovision et al. 2007). • Development that alters natural drainage and cuts into the slope, especially the toe, is prohibited. • If modifications must be allowed to prevent an unreasonable hardship on a landowner, require habitat enhancement to protect the integrity, functions, and values of existing anadromous fish

	habitat (see below for habitat management plan recommendations). Management plans should be prepared by a qualified geologist in consultation with a qualified biologist. • Stormwater runoff shall not contribute to the erosion of the shoreline.
Regulatory Example (Marine Bluff Protection): *Increased marine buffer. The width of the marine buffer shall be increased where there are steep slopes, landslide hazard areas, or inadequate vegetation to protect water quality... Thurston County Critical Areas Ordinance (In Draft), 17.15.830, http://www.co.thurston.wa.us/permitting/.* ***Regulatory Example (Vegetation Retention):*** *Unless otherwise provided in K.C.C. 21A.24.045 or as a necessary part of an allowed alteration, removal of any vegetation from a landslide hazard area or buffer is prohibited; King County Code 21A.24.280.* ***Regulatory Example (LHA Buffers):*** *All buffers shall be measured perpendicularly from the top, toe or edge of the landslide hazard area boundary. A standard buffer of 30 feet shall be established from the top, toe and all edges of landslide hazard areas. A building setback line is required to be five (5) feet from the edge of any buffer area for a landslide hazard area OR to outside the full extent of the high risk channel migration zone (CMZ), whichever is greater. Jefferson County Critical Areas Ordinance 18.22.170.*	
Planning Resources	**Managing Drainage on Coastal Bluffs**: Washington State Department of Ecology, *http://www.ecy.wa.gov/programs/sea/pubs/95-107/intro.html* **Integrated Streambank Protection Guidelines**: Washington Department of Fish and Wildlife Aquatic Habitat Guidelines, *http://wdfw.wa.gov/hab/ahg/* **Protecting Nearshore Habitat and Functions in Puget Sound**: Washington Department of Fish and Wildlife Aquatic Habitat Guidelines, *http://wdfw.wa.gov/hab/nearshore_guidelines/*

3.2.10 Water Quality

Clean, well-oxygenated water is necessary at all stages of life for salmonids to thrive. While climate change may influence water quality over the long-term, most water quality degradation can be attributed to land use development practices. Development compromises water quality by causing excessive runoff and stormwater discharge which washes nutrients, contaminants, and toxic materials from impervious surfaces into waterways, (R2 Resource Consultants et al. 2000) increasing water temperatures and creating conditions of low dissolved oxygen. This is a more influential factor in streams draining highly urbanized watersheds (May et al. 1996).

Water quality protection also benefits flow regime, food source and habitat structure.

Other sources of water quality degradation include sewage and septic discharges, direct application of chemicals to tidelands, marine dumping, and airborne contaminants, all of which introduce toxic substances that may threaten salmonid survival. Aquatic invertebrates (a primary food source for juvenile salmonids) are also strongly affected by water quality.

In addition to chemical properties of water, salmonids also require cool temperatures and thrive at temperatures below 17.5°C (~61°F) (Hicks 2000). Potential conditions leading to elevated water temperatures include loss of shading vegetation, reduced groundwater recharge, and increased nutrient inputs.

Table 3.2.10 Water Quality Management Recommendations

Policy Considerations	• Identify water quality and hydrologic processes within jurisdictions, including water quality problems, stream flow issues, important groundwater recharge areas and natural storage areas, and existing pollutant sources. • Maintain or restore the natural sources, storage, delivery, and routing of surface water, groundwater, sediments, and nutrients. • Healthy riparian areas, groundwater recharge areas, and natural storage areas are protected and promoted. • Classify and map critical aquifer recharge areas. • Develop short and long-term strategies where water quality problems are known to exist. • Develop local ordinances to protect water quality. • Make efficient use of recycled water. • Consider new technologies and planning techniques for wastewater and stormwater treatment that may also benefit salmon. • Promote water conservation practices on individual development sites, including water-wise landscaping practices, on-site water reclamation and reuse, as well as rainwater catchment. • Encourage water reclamation and reuse at public wastewater treatment plants to enhance stream flows in water quantity-limited watersheds. • Participate in regional water quality monitoring efforts. • Prohibit pesticide/herbicide use in riparian and wetland buffers. (Include exemptions for noxious weed control Washington State Department of Ecology-approved activities and pesticides approved by the EPA for use near aquatic systems). • Adopt land use and development standards consistent with recommendations in the Watershed

	Management Plan as administered by the Department of Ecology pursuant to the Watershed Management Act (Chapter 90.82 RCW). • Adopt a ground water management program designed to protect ground water quality, to ensure ground water quantity, and to provide for efficient management of water resources within a designated ground water management area or subarea and developed pursuant to Chapter 173-100 WAC. • Plan for and implement public sewer and water line extensions in synchrony to prevent alteration of water system balances, particularly in small watersheds where surface waters are fed by shallow groundwater aquifers. Extension of sewer lines into areas on private wells, can lead to the net export of water from a subbasin, reducing downstream surface water flows. • Consider water reclamation and reuse plans that return clean effluent to streams higher in a watershed for the benefit in-stream aquatic resources consistent with local multi-stakeholder watershed plans. • Encourage the adoption of water metering to aid watershed residents with understanding the quantifying water use and conservation measures.
Policy Example (Water Quality Protection): *Shoreline uses and modifications should be designed and managed to prevent degradation of water quality and alteration of natural conditions. Whatcom County Shoreline Master Program, Aquatic Shoreline Area, 23.30.11.* ***Policy Example (Water Quality Protection):*** *The location, construction, operation, and maintenance of all shoreline uses and developments should maintain or enhance the quantity and quality of surface and ground water over the long term. Whatcom County Shoreline Master Program, Water Quality and Quantity, 23.90.04.* ***Policy Example (Pollution Prevention):*** *Shoreline use and development should minimize the need for chemical fertilizers, pesticides or other similar chemical treatments to prevent contamination of surface and ground water and/or soils, and adverse effects on shoreline ecological functions and values. Whatcom County Shoreline Master Program, Water Quality and Quantity, 23.90.04.*	

Policy Example (Stream Flow Assessment): *The county should determine, based on watershed plans, if there are areas where low summer stream flows or elevated instream water temperature may, now or in the future, imperil anadromous or native resident fish. If such areas are identified, the county should devise and implement development restrictions and management practices as necessary to sustain the fish. Thurston County Comprehensive Plan Chapter Nine, Environment, Policy B.3.*	
Regulatory Considerations	• Water quality monitoring is required when development projects unavoidably occur in wetland or riparian vegetation. • Critical area reports prepared by a qualified professional are required for any activity determined to have an adverse impact on surface or ground water quality or quantity. Unavoidable impacts are mitigated to achieve no net loss to habitat function and processes. • Best Management Practices are required in areas supporting critical salmonid habitat including shorelines and riparian zones, to protect water quality. BMPs include: — Control soil loss and reduce water quality degradation caused by high concentrations of nutrients, animal waste, toxics, and sediment; — Minimize adverse impacts to surface water and ground water flow, circulation patterns, and to the chemical, physical, and biological characteristics of wetlands; — Protect trees and vegetation designated to be retained during and following site construction; and — Provide, monitor and enforce appropriate standards for proper use of chemical herbicides within critical areas. • Adequate provisions are in place to protect the hyporheic zone that contains some portion of surface waters, serves as a filter for nutrients, and maintains water quality (see riparian zone recommendations above). • Riparian and wetland buffer widths are determined by water quality functions as indicated by the Best Available Science, including WDFW riparian management recommendations and Department of Ecology Watershed Management Plans.

	• Shoreline modifications are required to be constructed of materials that will not adversely affect water quality or aquatic plants and animals.
Regulatory Example (Hydrogeologic Assessment): *For all proposed activities to be located in a critical aquifer recharge area, a critical area report shall contain a level one hydrogeological assessment. A level two hydrogeologic assessment shall be required for any of the following proposed activities: Any other activity determined by the Director likely to have an adverse impact on ground water quality or quantity or on the recharge of the aquifer. Walla Walla County Critical Areas Ordinance, 18.08.230.* ***Regulatory Example (Pollution Prevention):*** *All materials that may come in contact with water shall be constructed of materials, such as untreated wood, concrete, approved plastic composites or steel, that will not adversely affect water quality or aquatic plants or animals. Materials used for decking or other structural components shall be approved by applicable state agencies for contact with water to avoid discharge of pollutants from wave splash, rain, or runoff. Wood treated with creosote, copper chromium arsenic or pentachlorophenol is prohibited in or above shoreline water bodies. Whatcom County Shoreline Master Program, Water Quality and Quantity, 23.90.04.*	
Planning Resources	**Water Quality:** Washington State Department of Ecology Temperature Standards and Criteria, *http://www.ecy.wa.gov/programs/wq/swqs/temperature.html* and Frequently Asked Questions about Protecting High Quality Waters in Washington, *http://www.ecy.wa.gov/biblio/0810001.html* **Watershed Management Plans:** Washington State Department of Ecology *http://www.ecy.wa.gov/biblio/watershed.html* **Protecting Nearshore Habitat and Functions in Puget Sound**: Washington Department of Fish and Wildlife Aquatic Habitat Guidelines, *http://wdfw.wa.gov/hab/nearshore_guidelines/* **Marine and Estuarine Shoreline Modification Issues and Overwater Structures**: Washington Department of Fish and Wildlife Aquatic Habitat Guidelines White Papers, *http://wdfw.wa.gov/hab/ahg/ahgwhite.htm* **Septic System Resources:** Puget Sound Partnership, *http://www.psparchives.com/our_work/waste/septics.htm*

3.2.11 Salmonid Recovery Planning. In order for salmonid recovery to succeed, it is critical that salmon protection, recovery and enhancement efforts be tracked and coordinated with other mitigation, recovery and protection efforts. There are watershed planning processes and salmonid recovery activities (i.e. site specific restoration projects) underway throughout the state, often more than one in the same watershed.

Photo 17: Riparian Vegetation Restoration

Local government staff involved in salmon recovery planning may not be the same staff as those developing land use policies and regulations. Therefore, coordination amongst departments is imperative. Coordination includes partnership and collaboration with outside agencies and groups as well as agencies within the local government. Depending on how a local government is organized, administrative services, health departments, parks, planning, building and public works departments may all influence land use decisions that affect salmonid habitat.

Table 3.2.11 Salmonid Recovery Planning Management Recommendations

Policy Considerations	• Continue to work with other local, State, federal, and tribal agencies to jointly develop and implement comprehensive integrated watershed and salmon recovery plans. • Coordinate planning programs with regional salmonid recovery organizations to ensure development standards are consistent with salmonid protection and restoration. • Adopt regional and watershed salmon recovery plans by reference and consider these as sources of best available science. • Develop and adopt salmonid recovery plans including an inventory of watersheds and local restoration and protection priorities based on best available science (see City of Seattle example). • Coordinate Shoreline Master Program restoration plans with salmonid recovery and watershed management plans. For example, implement a process to align projects in salmon recovery plans with areas identified in the SMP as needing restoration. • Adopt a resolution that directs all county departments to establish salmonid recovery priorities and programs consistent with lead entity strategies and regional salmon recovery plans.
Policy Example (Prioritizing Salmon Recovery and Protection: *In December 2003, the city of Seattle finalized the Urban Blueprint for Habitat Protection and Restoration. The Urban Blueprint analyzes what chinook salmon do as they move through Seattle, and helps identify the actions needed to protect them. The Urban Blueprint draws on recent and groundbreaking research by independent scientists and guides the city in making wise investments in salmon recovery.* *http://www.seattle.gov/util/About_SPU/Management/SPU_&_the_Environment/SalmonFriendlySeattle/SPU01_002751.asp* ***Policy Example (Salmon Recovery Planning):*** *King County shall continue to participate in the Water Resource Inventory Area based salmonid recovery plan implementation efforts and in other regional efforts to recover salmon and the ecosystems they depend on, such as the Puget Sound Partnership. King County's participation in planning and implementation efforts shall be guided by the following principles: a. Focus on early federally listed salmonid species first, take an ecosystem*	

approach to habitat management and seek to address management needs for other species over time; b. Concurrently work on early actions, long-term projects and programs that will lead to improvements to, and information on, habitat conditions in King County that can enable the recovery of endangered or threatened salmonids, while maintaining the economic vitality and strength of the region; c. Address both King County's growth management needs and habitat conservation needs; d. Use best available science as defined in WAC 365-195-905 through 365-195-925; e. Improve water quality, water quantity and channel characteristics; f. Coordinate with key decision-makers and stakeholders; and g. Develop, implement and evaluate actions within a watershed-based program of data collection and analysis that documents the level of effectiveness of specific actions and provides information for adaptation of salmon conservation and recovery strategies. King County Comprehensive Plan Chapter Four, Environment, Policy 601.

Policy Example (Internal Consistency): *Planning and design of flood control works and instream structures should be consistent with and incorporate elements from applicable watershed management plans, restoration plans and/or surface water management plans. Whatcom County Shoreline Master Program, Flood Control Works and Instream Structures, 23.100.06.*

Regulatory Considerations	• Allowed uses requiring mitigation are matched to appropriate restoration and enhancement activities as identified in salmonid recovery, watershed management, and shoreline restoration plans. • Shoreline environment designations and associated uses are consistent with areas identified as protection or restoration priorities in salmonid recovery, watershed management, and shoreline restoration plans. • Local governments conduct "planned actions" through decision-making that integrates the work of planning, stormwater management, parks, and other local departments.

Regulatory Example (Habitat Area Enhancement/Restoration): *The approval authority may, in consultation with WDFW and other experts (such as tribal biologists or DNR botanists), approve restoration of important habitat areas and associated buffers subject to an approved critical area report and restoration plan (see Section 17.15.880) and applicable provisions of this chapter. Stream enhancement/restoration shall only be performed under a plan for the design, implementation, maintenance and monitoring of the project approved by a qualified fisheries biologist and, if needed, by a civil engineer with*

experience in stream hydrology. The project shall be carried out under the direct supervision of a qualified fisheries biologist, hydrologist, or engineer with demonstrated experience, as appropriate. Thurston County Critical Areas Ordinance (In Draft), 17.15.860, http://www.co.thurston.wa.us/permitting/.	
Planning Resources	See **Appendix A** for a list of salmonid recovery planning resources including regional recovery plans, watershed management plans, habitat limiting factors reports and mapping resources.

3.3 Additional Regulatory and Programmatic Management Recommendations

3.3.1 Incentive Programs

Policies can also be adopted that direct county departments to use incentives and flexible approaches to encourage wetland and riparian protection (e.g., proper use of buffer averaging, long-term stewardship incentives). Incentives and innovative approaches to salmonid protection and recovery include tax reductions, transfer and purchase of development rights, fee reduction programs, streamlined permitting for stewardship activities, and financial assistance for stewardship activities, to name a few. Example incentive policies are listed here:

- Use transfer of development rights or other easement programs or incentives to encourage retention of appropriate agriculture, forestry, and open space uses of the floodplain and infill of urban lands.

> ***Incentive Program Example (TDR Program):*** *King County Transfer of Development Rights protects habitat for federal listed endangered or threatened species (King County Code 21A.37).*

- Direct mitigation, including off-site and compensatory mitigation, towards critical habitat areas and recovery needs for salmon.
- Where shorelines have been modified, provide incentives to encourage redevelopment activities to include salmonid habitat restoration.
- Support removal and control of noxious weeds in shoreline areas.
- Where available and appropriate, participate in in-lieu fee mitigation programs for unavoidable development activities.
- Adopt a Public Benefit Rating System (PBRS) Open Space Tax Program (RCW 84.34.055) to allow property owners a tax incentive to protect critical salmonid habitat on their property.

> ***Incentive Program Example (PBRS):*** *Thurston County Public Benefit Rating System offers a tax reduction (50-90%) for 5 acres or more of open space in critical areas (http://www.co.thurston.wa.us/permitting/Open_Space/Open_Space.htm).*

- Adopt incentives (such as lower or no impact fees, fast track permitting) for green building, redevelopment, brownfields development and infill.
- Adopt a Conservation Futures (RCW 84.34.230) tax levy to secure funds for critical salmonid habitat.

3.3.2 Outreach Programs

Outreach programs educate the public about the importance of salmonid protection and recovery. They can also be used to educate landowners about ways they may assist through low impact development practices at home. Example outreach policies are listed here:

- Build awareness, capacity, and support for stewardship of healthy watersheds and salmonid populations through outreach, partnerships, training, education, community events, and recognition awards; provide technical assistance and encourage stewardship involving landowners, citizens, associations, community groups, and others.
- Conduct public outreach and education: develop and distribute educational materials, promote active school participation in salmon-related activities, host classes and workshops for citizens and community groups, coordinate volunteer activities, maintain a website containing watershed information.

3.3.3 Zoning

The zoning ordinance is a set of regulations that prescribes or prohibits what landowners can do with their property. Zoning establishes use districts and densities that set the foundation for all future land use decisions (subdivision, clearing and grading, working lands, urban areas, building design, etc.). Therefore, zoning districts have a significant influence on protecting salmonid habitat. Below are several considerations for establishing zoning districts.

- Set densities that are appropriate to salmonid habitat needs within the district.

- Require overlay districts to reflect channel migration zones and other biodiversity areas protecting salmonid habitat.
- Limit conditional and special uses in salmonid habitat conservation areas.
- Allow flexible density and lot configuration to protect habitat areas.
- Rezones give proper consideration to the capacity of the land to support human densities and public infrastructure, while maintaining the productive capacity of salmonid as well as other fish and wildlife habitat. Rezones in priority salmonid recovery watersheds receive greater scrutiny.

3.3.4 Subdivision Code

Regulations over the division of land often can influence salmonid habitat protection. Breaking land up divides the impacts to a critical salmonid habitat because it creates multiple owners, each with a different idea about how to use their land. For example, adjacent landowners may share the same wetland. One landowner may have retained the natural vegetative buffer and has avoided using any pollutants such as lawn fertilizers. Another neighbor sharing the same wetland system, may have cleared a lawn up to the water's edge and treats their landscaping with heavy chemicals that runoff into the water, therefore diminishing the habitat benefits provided by their neighbor. Examples of provisions to improve management of salmonid habitat conservation areas when subdividing parcels are listed her:

- Prohibit subdivision of land that is wholly located within a salmonid habitat area (e.g. riparian or wetland buffers).
- Allow for flexible subdivision design, such as cluster development, planned unit development, or conservation subdivisions that set-aside habitat conservation areas into reserve tracts with one set of management recommendations. Require management plans for open space tracts to provide for long term stewardship.

> ***Subdivision Example (Cluster Development):*** *Skagit County Conservation and Reserve Developments (CaRDs) encourage open space retention of critical areas by providing a density bonus when homes are grouped on smaller lots and large areas of open space are set-aside (Skagit County Code 14.18.300).*

- Allow flexibility in lot size and configuration, including on-site density transfers to protect habitat patches and corridors.
- Encourage developers to locate open space tracts adjacent to other open space and/or contiguous with other protected fish and wildlife habitat corridors.
- Provide agency and public review for all rural subdivisions (e.g. does not exempt large lot segregations from review).

3.3.5 Clearing and Grading Ordinance

Clearing and grading occurs early in the development process and planning and site management choices at this stage can have a major impact on salmonid habitat conservation areas. Impacts to avoid or mitigate include increasing erosion and sedimentation, reducing slope stability, increasing soil compaction, damaging sensitive and critical areas, and disrupting flow regime. Examples planning provisions for clearing and grading are listed below. For more information see the Washington State Department of Community, Trade and Economic Development Technical Guidance Document for Clearing and Grading in Western Washington, June 2005 at: *http://www.cted.wa.gov/site/420/default.aspx*.

- Require clearing and grading permits to assess how to manage important habitat patches and connectivity and minimize vegetation disturbance.
- Adopt a clearing and grading ordinance or site alterations ordinance to limit the impacts of sediment-laden runoff to local streams and wetlands. When clearing is essential, encourage the practice of uprooting and retaining non-merchantable whole trees for later use as large woody debris in habitat projects.
- Avoid clearing and development in riparian zones.
- Limit clearing and grading to that necessary for establishment of the use or development and shall be conducted so as to avoid significant adverse impacts and to minimize the alteration of the volume, rate or temperature of freshwater flows to or within the habitat area and any buffer.
- Require clearing and grading permits to be identified with future actions (as opposed to isolated actions).

3.3.6 Agricultural Activities

Agricultural activities have the potential to preserve important habitat and watershed processes for salmonids, if carefully managed. Some of the potential impacts of agricultural production to avoid include the removal of streamside vegetation, livestock access to waterways, and farm runoff such as chemical and nutrient fertilizers, pesticides, and fine sediments.

- Encourage new agricultural activities follow Best Management Practices to conserve important habitat areas for salmonids while maintaining working lands
- Work with the local Conservation District to discuss Farm Bill and other incentive programs for habitat enhancements on agricultural lands.
- Encourage the development of farm management plans to limit animal access to waterways, fence off and concentrate agricultural activities away from streams, wetlands, and riparian areas, and prevent water runoff of farm or animal waste to streams.
- Encourage vegetation retention and restoration in riparian areas (see Conservation Reserve Enhancement Program (CREP) cited in regional example below).

> ***Agricultural Activity Example (CREP):*** *The Washington State Conservation Reserve Enhancement Program (CREP) provides incentives to property owners to restore and improve salmon and steelhead habitat on private land by planting native trees, shrubs, and grasses along streams that support salmon or steelhead. The program is jointly managed by the Farm Service Agency and the Washington State Conservation Commission. Contact your local Conservation District for more information.*
> *http://www.scc.wa.gov/index.php/Conservation-Reserve-Enhancement-Program/*

3.3.7 Forest Practices

RCW 76.09 grants the authority to the Washington Department of Natural Resources to permit timber harvest on non-federal public and private forest lands in Washington State (*http://www.dnr.wa.gov/forestpractices/*). In some counties a transfer of jurisdiction to the local government has occurred for non-

commercial forest practices due to the number of forest land conversions (Class IV special permits). These governments include Clark, King, Spokane, Mason, Pierce, and Thurston Counties; and the cities of Port Townsend and Bonney Lake. Other jurisdictions will be taking over this authority in the coming years.

The Forest and Fish Report of 1999 recommends adaptive management techniques to improve forest practices affecting water quality and salmonid habitat (*http://www.dnr.wa.gov/Publications/fp_fpi_introduction.pdf*). To address cumulative impacts to the watershed resulting from forest practices, watershed administrative units were established and a watershed analysis is to be performed based on a physical and biological inventory. Cumulative effects have been defined as "the changes to the environment caused by the interaction of natural ecosystem processes with the effects of two or more forest practices." These changes may be taken to include effects on water quality, wildlife, fish habitat, and other public resources. More information available at: *http://www.dnr.wa.gov/Publications/fp_wsa_manual_toc.pdf*.

Local governments administering non-commercial forest practices can influence salmonid habitat protection as follows:

- Follow management recommendations outlined in Forest and Fish Report and Watershed Analysis Manual.
- Adopt forested riparian buffers to reduce the delivery of eroded suspended material to streams. See WDFW Riparian Management Recommendations for more information (Knutson and Naef 1997).
- Follow the same example policy and provisions outlined above under "Special Considerations for Anadromous Fish Resources" (maintaining riparian protection zones, protecting water quality, reducing sediment input, leaving large woody debris, prohibiting in-stream alterations such as roads and bridges and coordinating mitigation with salmon recovery plans).
- Encourage salmonid habitat protection when forest land is converted to non-forestry use. A county, city, town, or regional government must place a six-year development moratorium on lands converted to non-forestry use. This moratorium may be lifted if mitigation measures, approved by the jurisdiction, are followed. These mitigation measures could include riparian restoration on potential or known salmonid bearing streams as identified in salmon recovery plans.

3.3.8 Exemptions (including variances and reasonable use exceptions)

Most codes include exceptions that allow a landowner to do something they could not otherwise do. Exemptions should be used sparingly and considered an exception rather than the rule. Below is a list of recommendations for managing land use exemptions.

- Exemptions (variances, reasonable use exceptions, etc.) require a public hearing and public review process.
- Exemptions to salmonid habitat protection rules are limited in accordance with Washington State Department of Community, Trade, and Economic Development Critical Areas Handbook recommendations (WDCTED 2003).
- All exempted activities use reasonable methods to avoid potential impacts to salmonid habitat conservation areas.
- In situations where a reasonable use or variance cannot be avoided, cumulative impacts are determined and mitigated using a habitat management plan prepared by a qualified professional. Variances are not allowed in high priority restoration or protection areas identified in salmonid recovery or watershed management plans. Mitigation is used to further restoration and protection objectives.

3.3.9 Road Standards

Capital projects such as road building and maintenance are often managed by separate departments than planning departments covering critical area ordinance or shoreline master program amendments. Therefore, road design standards can be disconnected from habitat protection priorities. Below is an example of road standard considerations to protect salmonid habitat protection. Additional recommendations regarding in-stream crossings are listed in Table 3.2.6, In-stream Habitat Management Recommendations.

- Encourage use of pervious paving materials in basins with porous soils and high aquatic species diversity or salmon-bearing streams.
- Avoid construction in, or clearing of, riparian areas.
- Enhance riparian habitat when it is reasonable to do so while working on adjacent county roads.
- Control drainage by directing road runoff onto forest floor before reaching a stream.

- Ensure road maintenance practices avoid direct or indirect entry of herbicides or pesticides into aquatic waters. Allow flexible road design in rural areas.

3.3.10 Building Code

Building materials and associated construction impacts can also impact salmonid habitat conservation areas. Example provisions to include in the building code are listed here:

- Include "green building" requirements for areas of high fish and wildlife diversity (can reduce water use and release of toxins from building materials).
- Include a building setback of at least 15 feet from habitat buffers.

3.3.11 Related Plans

Comprehensive Plans often include several related plans or sections (e.g. Subarea Plan, Wastewater Facilities Plan, Water System Plan, Special Purpose District Plans, etc.) that may be adopted by reference, incorporated within the plan or otherwise guide project management (e.g. Transportation Improvement Programs). Because related plans are developed by a variety of departments, they may not be developed with salmonid habitat protection in mind. To remedy this potential inconsistency, a policy should be established that related plans adopted by reference to the Comprehensive Plan address salmonid habitat protection and restoration priorities as outlined in the Comprehensive Plan.

3.4 Implementation and Monitoring

Once a jurisdiction has adopted policies and provisions to protect and restore salmonid habitat, successful implementation occurs during project review. Experienced, well-trained permit writers and planners will enable the implementation of special considerations to protect anadromous fish resources and all salmonids. These planners will ensure that exemption, reasonable use exception and variance language is implemented consistently and tied to mitigation to ensure no net loss to salmonid habitat functions. There are numerous opportunities for advanced training in environmental science (such as

salmonid ecology, shoreline ecology) and land use (GMA/SMA) for planners. Example training programs include:

- CTED short course on local planning: *http://www.cted.wa.gov/site/395/default.aspx*;
- Department of Ecology Coastal Training Program: *http://www.coastaltraining-wa.com/Course-Catalog/4.aspx*;
- Northwest Environmental Training Center: *http://nwetc.org/*; and
- Planning Association of Washington and American Planning Association Conferences.

Monitoring land use activities (especially mitigation projects), is an important action local governments can take to ensure regulations are succeeding at protecting salmonid habitat. One way to measure the success of salmonid protection programs is to conduct an annual audit of development permits. The audit can be used to inform adaptive management recommendations to improve the implementation of existing policies and rules.

Monitoring Program Example: *Skagit County has adopted a Monitoring and Adaptive Management (MAAM) program to monitor when agriculture is causing harm to critical areas and define steps to prevent harm using adaptive management. The MAAM program is defined in Resolution R20040211 and consists of two sub-programs: Water Quality Monitoring Program and Salmon Habitat Monitoring Program. Both programs have accumulated years of data and issued annual reports (http://www.skagitcounty.net/Common/Asp/Default.asp?d=SalmonStrategy&c=General&p=adaptmanagement.htm).*

Monitoring components to consider include:

1) Are regulations achieving no net loss to salmonid habitat protection? If not, why not?
2) How many exemptions, reasonable use exceptions and variances have been granted?
3) What types of development permits were granted exemptions?

4) What are the cumulative impacts associated with these exemptions?
5) Were habitat management plans administered to offset cumulative impacts? Was the result no net loss to salmonid habitat function? If not, why not.
6) Were mitigation measures coordinated with salmonid recovery and watershed management plan priorities?
7) Were mitigation measures enforced? If not, why not? Establishing and funding an enforcement program demonstrates a willingness to defend the policies and regulations adopted and implemented by the local government to protect public natural resources, such as salmonid habitat.

3.5 Protecting a Northwest Icon

Salmonids are an icon of Northwest tribal culture and intertwined in the identity of many communities. They contribute to our economy, inform us of the health of our environment, and are linked to the abundance of other species in both aquatic and terrestrial ecosystems. They sustain fisheries, food distribution and retail jobs to support our economy. They act as an indicator of ecosystem health because just like humans, they need clean water, food, shelter, safety and access to resources to subsist and prosper. They support the existence of many other species such as orca whales and bald eagles and contribute to creating habitat functions both in streams by moving substrate and in riparian zones by fertilizing vegetation with their carcasses.

> *"When we try to pick out anything by itself, we find that it is bound fast, by a thousand invisible cords that cannot be broken, to everything in the universe."*
> *– John Muir*

Local governments are in a unique position to restore and protect salmonid habitat and help return these iconic fish to thriving numbers by implementing policies and regulations modeled in this guidance document.

LITERATURE CITED

Bjornn, T.C. and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. In W.R. Meehan ed. Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. American Fisheries Society Special Publication 19:83-138.

Booth, Derek B. 2000. Forest Cover, Impervious-Surface Area, and the Mitigation of Urbanization Impacts in King County, Washington. King County Water and Land Resources Division. 18 pp.

Brennan, J.S. and H. Culverwell. 2004. Marine Riparian: An Assessment of Riparian Functions in Marine Ecosystems. Published by Washington Sea Grant Program, Seattle, WA. 34 pp.

Buchanan, J.B., D.H. Johnson, E.L. Greda, G.A. Green, T.R. Wahl, and S.J. Jeffries. 2001. Wildlife of Coastal and Marine Habitats. In Wildlife-Habitat Relationships in Oregon and Washington, Oregon State University:389-417.

Cederholm, C.J., D.H. Johnson, R.E. Bilby, L.G. Dominguez, A.M. Garrett, W.H. Graeber, E.L. Greda, M.D. Kunze, B.G. Marcot, J.F. Palmisano, R.W. Plotnikoff, W.G. Pearcy, C.A. Simenstad, and P.C. Trotter. 2000. Pacific Salmon and Wildlife – Ecological Contexts, Relationships, and Implications for Management. Special Edition Technical Report, Prepared for D.H. Johnson and T.A. O'Neil (managing directors), Wildlife-Habitat Relationships in Oregon and Washington. Washington Department of Fish and Wildlife, Olympia, Washington. Available at: http://wdfw.wa.gov/hab/salmonwild/. 138 pp.

Chamberlin, T.W., R.D. Harr, and F.H. Everest. 1991. In Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19:181-205.

EnviroVision, Herrera Environmental, and Aquatic Habitat Guidelines Working Group. Protecting Nearshore Habitat and Functions in Puget Sound: An Interim Guide. 2007. Available at: http://wdfw.wa.gov/hab/nearshore_guidelines/. 129 pp.

Everest, F.H., R.L. Beschta, J.C. Scrivener, K.V. Koski, J.R. Sedell, and C.J. Cederholm. 1987. Fine sediment and salmonid production: A paradox. In Salo and Cundy ed. Streamside management: forestry and fishery interactions. University of Washington, Institute of Forest Resources Contribution 57:98-142.

Fresh, K.L. 2006. Juvenile Pacific Salmon in Puget Sound. Puget Sound Nearshore Partnership Report No. 2006-06. Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington. Available at: http://pugetsoundnearshore.org/technical_reports.htm. 21 pp.

Good, T.P., R.S. Waples, and P. Adams (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Department of Commerce, NOAA Technical Memorandum: NMFS-NWFSC-66. 598 pp.

Governor's Salmon Recovery Office (GSRO). 1999. Statewide Strategy to Recover Salmon, Extinction is not an Option. Available at: http://www.governor.wa.gov/gsro/publications/strategy/default.asp. 324 pp.

Granger, T., T. Hruby Ph.D., A. McMillan, D. Peters, J. Rubey, D. Sheldon, S. Stanley, and E. Stockdale. 2005. Wetlands in Washington State - Volume 2: Guidance for Protecting and Managing Wetlands. Washington State Department of Ecology, Lacey, Washington. Available at: http://www.ecy.wa.gov/biblio/0506008.html. 394 pp.

Hicks, M. 2000. Evaluating Standards for Protecting Aquatic Life in Washington's Surface Water Quality Standards Temperature Criteria Draft Discussion Paper and Literature Summary. Washington State Department of Ecology, Lacey, Washington. Available at: http://www.ecy.wa.gov/biblio/0010070.html. 207 pp.

Interagency Committee for Outdoor Recreation (IAC). 2001. The 1999 Public and Tribal Lands Inventory Final Report. 60 pp.

Johannessen, J. and A. MacLennan. 2007. Beaches and Bluffs of Puget Sound. Puget Sound Nearshore Partnership Report No. 2007-04. Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington.

Kauffman, J.B., M. Mahrt, L.A. Mahrt, and W.D. Edge. 2001. Wildlife of Riparian Habitats. In Wildlife-Habitat Relationships in Oregon and Washington, Oregon State University:361-383.

Knutson, K.C. and V.L. Naef. 1997. Management Recommendations for Washington's Priority Habitats: Riparian. Washington Department of Fish and Wildlife, Olympia, Washington. Available at: http://wdfw.wa.gov/hab/ripxsum.htm. 181 pp.

May, C.W., R.R. Horner, J.R. Karr, B.W. Mar, and E.B. Welch. 1996. The Cumulative Effects of Urbanization on Small Streams in the Puget Sound Lowland Ecoregion. University of Washington, Seattle, WA. 24 pp.

May, C.W. 2003. Stream-Riparian Ecosystems in the Puget Sound Lowland Eco-Region: A Review of Best Available Science. Watershed Ecology LLC. 76 pp.

McElhany, P., Rucklelshaus, M.H., Ford, M.J., Wainwright, T.C., and Bjokstedt, E.P. (2000) Viable Salmonid Populations and the recovery of Evolutionary Significant Units. NOAA Technical Memorandum: NMFS –NWFSC-42. 127pp.

Merz, J.E., J. Setka, and A. Gray. 2008. The Ecology of Pacific Salmonids: Bio 303, Port Hadlock, Washington. December 2-3, 2008. Presented by the Northwest Environmental Training Center.

Mumford, T.F. 2007. Kelp and Eelgrass in Puget Sound. Puget Sound Nearshore Partnership Report No. 2007-05. Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington. Available at: www.pugetsoundnearshore.org. 27 pp.

National Marine Fisheries Service (NMFS). 2007. Adaptive Management for ESA-Listed Salmon and Steelhead Recovery: Decision Framework and Monitoring Guidance. Available at: http://www.nwr.noaa.gov/Salmon-Recovery-Planning/ESA-Recovery-Plans/upload/Adaptive_Mngmnt.pdf. 56 pp.

National Marine Fisheries Service (NMFS). 2008. Implementation of the National Flood Insurance Program in the State of Washington Phase One Document – Puget Sound Region. NMFS Tracking No.: 2006-00472. Available at:

https://pcts.nmfs.noaa.gov/pls/pcts-pub/biop_query?reg_inclause_in=('NWR')&s_region=. 213 pp.

National Research Council (NRC). 1996. Upstream, Salmon and Society in the Pacific Northwest. National Academy Press, Washington, D.C. 452 pp.

Pentilla, D. 2007. Marine Forage Fishes in Puget Sound. Puget Sound Nearshore Partnership Report No. 2007-03. Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington. Available at: http://www.pugetsoundnearshore.org/technical_reports.htm. 23 pp.

Quinn, TP. 2005. The Behavior and Ecology of Pacific Salmon and Trout. University of Washington Press, Seattle. 378 pp.

Rapp, Cynthia and Abbe, Timothy. 2003. A Framework for Delineating Channel Migration Zones. Prepared for Washington State Department of Ecology and Washington State Department of Transportation. 135 pp.

R2 Resource Consultants, CH2M HILL, and Shapiro & Associates. 2000. Tri-County Urban Issues ESA Study: Guidance Document. Prepared for the Tri-County Urban Issues Advisory Committee, Bellevue, Washington.

Simenstad, C. A., K. L. Fresh, and E. O. Salo. 1982. The Role of Puget Sound and Washington Coastal Estuaries in the Life History of Pacific Salmon: An Unappreciated Function. In Kennedy, V.S. ed. Estuarine Comparisons, Academic Press, New York, New York:343-363.

Smith, Carol J., Ph.D. 2005. Salmon Habitat Limiting Factors in Washington State. Washington State Conservation Commission, Olympia, Washington. Available at: http://www.scc.wa.gov/index.php/174-Salmon-Habitat-Limiting-Factors-Reports/View-category/Page-6.html. 222 pp.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, and R.P. Novitzki. 1996. An Ecosystem Approach to Salmonid Conservation. ManTech Environmental Technology, Inc. Available at: http://www.nwr.noaa.gov/Publications/Reference-Documents/ManTech-Report.cfm?renderforprint=1. 356 pp.

Washington Department of Fisheries (WDF), Washington Department of Wildlife and Western Washington Treaty Indian Tribes. 1993. 1992 Washington State Salmon and Steelhead Stock Inventory. Available at: http://wdfw.wa.gov/fish/sassi/sassi.htm. 210 pp.

Washington Department of Fish and Wildlife (WDFW). 1997. Final Joint WDFW/Tribal Wild Salmonid Policy. Available at: http://wdfw.wa.gov/fish/wsp/wsp.htm.

Washington Department of Fish and Wildlife (WDFW). 2003. Design of Road Culverts for Fish Passage. Available at: http://wdfw.wa.gov/hab/ahg/. 110 pp.

Washington Department of Fish and Wildlife (WDFW). 2008. Statewide Steelhead Management Plan. Available at: http://wdfw.wa.gov/fish/steelhead/management_plan.htm. 42 pp.

Washington State Climate Advisory Team. 2007. Preparing for the Impacts of Climate Change in Washington: Draft Recommendations of the Preparation and Adaptation Working Groups. Available at: http://community.csc.noaa.gov/climateadaptation/index.php?option=com_docman&task=doc_details&gid=125&Itemid=32. 52 pp.

Washington State Department of Community, Trade and Economic Development (WDCTED). 2003. Protecting Critical Areas Within the Framework of the Washington Growth Management Act. Available at: http://www.cted.wa.gov/site/745/default.aspx. 77 pp.

Williams, G.D. and R.M. Thom. 2001. Marine and Estuarine Shoreline Modification Issues: White Paper. Battelle Marine Sciences Laboratory for Washington Department of Fish and Wildlife, Washington Department of Ecology, and Washington Department of Transportation. 99 pp.

Wofford, J. E. B., R. E. Gresswell, and M.A. Banks. 2005. Influence of barriers to movement on within-watershed genetic variation of coastal cutthroat trout. Ecological Applications 15:628-637.

GENERAL REFERENCE

Aetkin, J.K. 1998. The Importance of Estuarine Habitats to Anadromous Salmonids of the Pacific Northwest: A Literature Review. US Fish and Wildlife Service. 25 pp.

Brennan, J.S., K.F. Higgins, J.R. Cordell, V.A. Stamatiou. 2004. Juvenile Salmon Composition, Timing, Distribution, and Diet in Marine Nearshore Waters of Central Puget Sound 2001-2002. King County Department of Natural Resources and Parks, Seattle, WA. 164 pp.

Gende, S.M., R.T. Edwards, M.F. Wilson, and M.S. Wipfli. 2002. Pacific Salmon in Aquatic and Terrestrial Ecosystems: BioScience, v.52, No.10:917-928.

GeoEngineers. 2005. Examples of Regulatory Language for Nearshore and Marine Shoreline Protection. Published by the Puget Sound Action Team. 53 pp.

Green/Duwamish and Central Puget Sound Watershed Resource Inventory Area 9 (WRIA 9) Steering Committee. August 2005. Salmon Habitat Plan – Making Our Watershed Fit for a King. Prepared for the WRIA 9 Forum.

Shared Strategy for Puget Sound (SSPS). 2007. Puget Sound Chinook ESA Salmon Recovery Plan. Prepared for and adopted by the National Marine Fisheries Service. 470 pp.

PHOTO CREDITS

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Photo 4: Natural Estuary Habitat, Bob Zeigler, WDFW
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APPENDIX A
SALMONID RECOVERY IN WASHINGTON STATE

A.1 Salmonid Recovery Programs

The Salmon Recovery Act (SRA), Engrossed Substitute House Bill 2496 (RCW 77.85), was enacted by the Washington State legislature in 1998 to address the listings of salmon and steelhead runs as threatened or endangered under the federal endangered species act (ESA). The legislative intent was to begin activities required for the recovery of salmonid stocks as soon as possible.

The SRA called for the integration of local and regional activities into a statewide strategy and established a coordinated framework for responding to the salmonid crisis. Provided below is a list of the agencies and programs involved in the statewide strategy to recover salmon. This information is included to help local governments 1) understand the state's approach to recover and protect salmonids, and 2) coordinate restoration and protection priorities with state programs.

Salmon Recovery Funding Board

The SRA created the Salmon Recovery Funding Board (SRFB). The SRFB provides grant funds to protect or restore salmon habitat and assist related activities. More information available at: *http://www.rco.wa.gov/srfb/board/board.htm*.

Salmon Recovery Lead Entities

The SRA provided direction for the development of lead entities (LEs). There are currently 27 lead entity organizations in the state. LEs provide local leadership in the development of local salmon recovery strategies based on science and assessments in their local areas. Based on their strategies, LEs identify and sequence habitat projects to be funded by SRFB. LEs compile annual lists of salmon-related habitat projects in their area, and submit projects based on these lists and community needs for funding through the SRFB. LE's develop local salmon recovery strategies (based on science and assessments in their local areas). These strategies serve as the foundation of the recovery planning process. Lead Entity strategies can be found at: *http://www.rco.wa.gov/srfb/leadentities.htm*. LEs play a critical role in the effective implementation of recovery plans statewide and have a strong voice in each of the regional recovery boards planning processes.

Regional Recovery Boards

Regional Recovery Boards were established because the ESA requires the federal government to develop recovery plans for listed salmon. Regional recovery organizations prepare a recovery plan that gains regional consensus on measurable fish population results, integrates actions necessary in harvest, habitat, hydropower, and hatcheries, and gains commitments to achieve results. They coordinate a multitude of plans across watersheds into one regional plan and help connect local social, cultural, and economic needs and desires with science and ESA goals. The regional recovery plans are discussed in Chapter One.

Recreation and Conservation Office

The Recreation and Conservation Office (RCO) provides staff support to the SRFB and administers grant funding and contracts, including coordinating the Lead Entity Program and works closely with Regional Recovery Boards. In July 2009, under the SHB 2157, the Governor's Salmon Recovery Office (GSRO) will be located within the RCO. The GSRO coordinates and assists in the development, implementation, and revision of regional salmon recovery plans as part of a statewide strategy for salmon recovery. More information available at: *http://www.rco.wa.gov/*.

Regional Fisheries Enhancement Groups

In 1989, the legislature authorized the formation of regional fisheries enhancement groups (RFEGs). There are 14 RFEGs throughout the state covering a specific geographic region based on watersheds. These groups have a legislative mandate specific to salmon and steelhead, although salmon is the main focus (RCW 77.95). RFEGs are operated on a strictly nonprofit basis, and seek to maximize the efforts of volunteer and private donations to improve the salmon resource for all citizens of the state. Originally, the groups received most funding through WDFW. However, RFEGs have been applying for and receiving more and more outside funding. More information available at: *http://wdfw.wa.gov/volunter/index.htm*.

Marine Resources Committees

Over 100 Marine Resources Committee (MRC) members in eight counties (Clallam, Grays Harbor, Island, Jefferson, San Juan, Skagit, Snohomish and Whatcom) are doing projects to restore nearshore, intertidal and estuarine habitats, improve shellfish harvest areas, support salmon and bottom fish

recovery and identify and carry out protection strategies for marine species and habitats. More information available at: *http://www.nwstraits.org/*.

A.2 WDFW's Role in Salmonid Recovery

The Washington State Department of Fish and Wildlife (WDFW) is directed to seek resolution to the many conflicts that have critically reduced salmonid resources from their sustainable level; to restore and improve habitat; or identify ways to increase the survival of salmonids (RCW 77.95). WDFW is recognized as the state leader in providing the science that will make wild salmonid recovery a reality. Over the last decade, WDFW has worked with tribal governments and salmon recovery partners to restore salmonids, provide recreational opportunities, and support economically viable and sustainable fisheries. Harvest management, hatchery reform, hydropower agreements and habitat management technical guidance are some examples of how the Department is achieving wild salmonid recovery. More information available at: *http://wdfw.wa.gov/recovery.htm*.

WDFW Technical Assistance

WDFW regional biologists, including Watershed Stewards (WSTs), are available in each of the six regions (shown in Figure A.2) to provide technical assistance to lead entities, RFEGs and the recovery regions to develop and implement the Regional Recovery Plans for federally listed salmon[13]. WSTs work on implementing watershed planning and are the primary WDFW point of contact for public on salmonid recovery issues and provide a critical link between regional and local recovery efforts. WDFW also provides environmental engineering technical assistance for hydraulic projects. For more information contact WDFW Habitat Program at (360) 902-2534 or visit the website for regional office contact information: *http://wdfw.wa.gov/about/contact/*.

WDFW has regional staff assigned to provide technical assistance to local governments in the development of rules and regulations to implement salmon recovery plans. Regional staff that work with Growth Management Act, Shoreline Management Act and Priority Habitats and Species are available to provide mapping data to identify salmonid habitat conservation areas and management recommendations to inform policy and rule development. For the most recent

[13] The Washington Coastal regional recovery plan will go beyond federally listed species. Non-listed species will also be included.

contact information for regional staff, please consult the Fish and Wildlife Planner newsletter at: *http://wdfw.wa.gov/hab/fw_planner/index.htm* or contact WDFW Habitat Program at (360) 902-2534.

Figure A.1: WDFW Regions

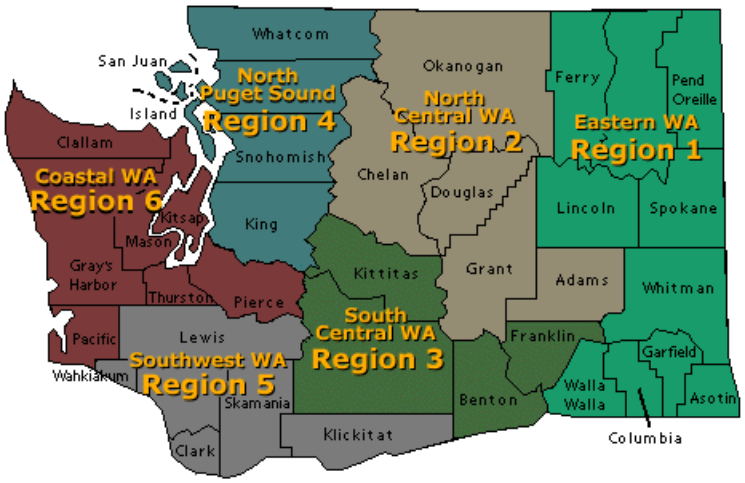

Figure A1: Washington Department of Fish and Wildlife

A.3 Salmonid Protection and Restoration Resources

Watershed Management Plans: The Watershed Planning Act (ESHB 2514/RCW 90.82) gives local citizens the opportunity to work with local, state, and tribal governments to write watershed plans for their community's present and future water needs. Developed by Water Resource Inventory Area (WRIA) planning units, plans must include water quality and may include in-stream flows, water quality, storage and fish habitat needs. Plans adopted by county council may then receive funds from Ecology for drafting and implementing a Detailed Implementation Plan. More information available at: *http://www.ecy.wa.gov/pubs/0806002.pdf*.

Habitat Limiting Factors Analysis: The SRA defined a habitat work schedule that included a habitat limiting factors analysis for salmon in streams, rivers, tributaries, estuaries, and subbasins in the region. Between 1998 and 2003, habitat limiting factors analyses were developed for 45 basins in Washington State (Smith 2005). These reports identify habitat factors limiting production of

salmon in the state in waters shared by salmon, steelhead and trout. More information available at: *http://www.scc.wa.gov/index.php/174-Salmon-Habitat-Limiting-Factors-Reports/View-category/Page-6.html*.

Habitat Work Schedule (HWS): HWS is a centralized web-based tool that helps LEs and others interested in salmon recovery map habitat restoration projects and track the progress of recovery plan implementation. Because the HWS System is centralized and web-based with public access, non-sensitive information is available for anyone to take a local, regional, or statewide view of salmon habitat projects in Washington State. More information available at: *http://hws.ekosystem.us/*.

Priority Habitats and Species (PHS) Data: WDFW maintains GIS data that includes anadromous fish distribution throughout the state. PHS also includes potential and documented forage fish habitat, kelp and eelgrass beds, wetlands, and other indicators of salmonid habitat. More information available at: *http://wdfw.wa.gov/hab/phspage.htm*.

SaSI: WDFW maintains the Salmonid Stock Inventory (SaSI), a compilation of data on all wild stocks and a scientific determination of each stock's status as: healthy, depressed, critical, unknown, or extinct. More information available at: *http://wdfw.wa.gov/fish/sasi/*.

Salmonscape: Salmonscape is another mapping program maintained by WDFW. This mapping application for the Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) characterizes salmonid habitat conditions and distribution of salmonid stocks in Washington. Data is co-managed by WDFW and the NW Indian Fisheries Commission. Salmonscape includes Fish Bits and SaSI data as well as the Ecosystem Diagnosis and Treatment (EDT) model establishing restoration and protection priorities within some watersheds. More information available at: *http://wdfw.wa.gov/mapping/salmonscape/index.html*.

Puget Sound Nearshore Partnership: In 2001, WDFW partnered with the U.S. Army Corps of Engineers to convene the Puget Sound Nearshore Partnership (PSNP) to build and implement an ecosystem restoration strategy. The PSNP includes state, federal, local, and tribal governments as well as academic scientists, ports, non-profits, industry representatives and citizens. PSNP produces and organizes scientific resources that can aid local government

decision-making. PSNP also initiated a grant program, the Estuary and Salmon Restoration Program (ESRP) awarded to restoration projects in the nearshore environment. Protection and restoration alternatives are considered in the context of the whole ecosystem. The PSNP has published a series of white papers that are sources of best available science related to salmonid protection and recovery available at: *http://www.pugetsoundnearshore.org/*.

Bonneville Power Subbasin Planning: In 2005 the Northwest Power and Conservation Council completed one of the largest locally led watershed planning efforts of its kind in the United States, an effort that resulted in separate plans for 58 tributary watersheds or mainstem segments of the Columbia River. These subbasin plans were developed collaboratively by state and federal fish and wildlife agencies, Indian tribes, local planning groups, fish recovery boards, and Canadian entities where the plans address transboundary rivers. Subbasin plans identify priority restoration and protection strategies for habitat and fish and wildlife populations in United States portion of the Columbia River system. More information available at:
http://www.nwcouncil.org/fw/subbasinplanning/Default.htm.

Washington State Department of Natural Resources Forest Practices Application Review System (FPARS): Many local governments rely on the FPARS water type maps to indicate stream type (fish bearing) and location. Caution should be taken when using these maps as they can often underestimate fish habitat in urbanized areas. A site visit should always be conducted to confirm stream type and location. More information available at:
http://fortress.wa.gov/dnr/app1/fpars/viewer.htm.

Washington State Department of Natural Resources Shorezone Inventory: This data covers all of Washington's saltwater shorelines from the Canadian border to the mouth of the Columbia River. It describes the geomorphic and biological resources of the intertidal and nearshore habitats. Features such as eroding cliffs, sand and gravel beaches, sandflats and wetlands are some of the geomorphic forms mapped. Visible macrobiotic, such as wetland grasses, intertidal algae, and subtidal vegetation such as eelgrass or kelp, are also mapped. More information available at:
http://www.dnr.wa.gov/ResearchScience/Topics/AquaticHabitats/Pages/aqr_nrsh_publications.aspx.

Washington State Department of Ecology Coastal Zone Atlas: The Coastal Zone Atlas includes aerial photographs of marine shorelines, habitat types, physical features, changes in land cover, etc. near Puget Sound, the outer coast, and the estuarine portion of the Columbia River. More information available at: *http://www.ecy.wa.gov/programs/sea/sma/atlas_home.html*.

Salmon Smart: A Guide to Help People Help Salmon: In 2000 the Washington Department of Fish and Wildlife published guidance to provide and introduction to salmon recovery projects and activities and an overview of how people can get involved. The document includes management recommendations as well as resources and organizations involved in recovery efforts. Although, much of the contact information is outdated, this guidance has useful tips for improving behaviors that degrade salmonid habitat. More information available at: *http://wdfw.wa.gov/outreach/salmon/salmonsmart/*.

A.4 Management Recommendations

WDFW has produced numerous management recommendations that are recognized sources of best available science. These include:

- Protecting Nearshore Habitat and Functions in Puget Sound: An Interim Guide: Science briefs on key nearshore habitats and recommendations for regulating common shoreline modification activities. Available at: *http://wdfw.wa.gov/hab/nearshore_guidelines/*.

- WDFW Aquatic Habitat Guidelines: An integrated approach to marine, freshwater, and riparian habitat protection and restoration. Guidelines include a series of white papers and guidance documents related to shoreline protection and restoration. Available at: *http://wdfw.wa.gov/hab/ahg/*.

- WDFW Forage Fish Management Recommendations: Management plan of forage fish resources and fisheries in Washington State. Available at: *http://wdfw.wa.gov/fish/forage/manage/foragman.pdf*.

- WDFW Management Recommendations for Washington's Priority Habitats: Riparian (Knutson and Naef 1997): Statewide riparian management recommendations based on the best available science.

Nearly 1,500 pieces of literature on the importance of riparian areas to fish and wildlife were evaluated, and land use recommendations designed to accommodate riparian-associated fish and wildlife were developed. These recommendations consolidate existing scientific literature and provide information on the relationship of riparian habitat to fish and wildlife and to adjacent aquatic and upland ecosystems. Available at: *http://wdfw.wa.gov/hab/ripxsum.htm*.

- Pacific Salmon and Wildlife – Ecological Contexts, Relationships, and Implications for Management (Cederholm et al. 2000): A technical report synthesizing scientific information linking salmon with wildlife species and the broader aquatic and terrestrial habitat functions in which they coexist. Available at: *http://wdfw.wa.gov/hab/salmonwild/*.

WDFW has also provided consultation on the production of other management recommendations. These include:

- Statewide Strategy to Recover Salmon (GSRO 1999): The goal of the Strategy is to "Restore salmon, steelhead and trout populations to healthy and harvestable levels and improve the habitats on which fish rely." The Strategy was designed as the state's long-term vision or guide for salmon recovery. The section titled “Linking Land Use Decisions and Salmon Recovery” is most applicable to local government planning programs. Available at: *http://www.governor.wa.gov/gsro/publications/strategy/default.asp*.

- Examples of Regulatory Language for Nearshore and Marine Shoreline Protection: This document contains a compilation of examples of existing regulatory language from Puget Sound jurisdictions that define, classify, protect and mitigate the functions, values and processes of the Puget Sound nearshore and marine shorelines. Available at: *http://www.mrsc.org/GovDocs/GovDocs.aspx?fm=I*.

- State of Washington Alternative Mitigation Policy Guidance for Aquatic Permitting Requirements from the Departments of Ecology and Fish and Wildlife: The intent of this guidance is to represent consensus on mitigation policy among the disciplines and the agencies responsible for

evaluating, approving, implementing and enforcing aquatic resource mitigation. Provides regulators and applicants with watershed ecosystem management recommendations when considering impacts and the use of preservation, mitigation banking, and off-site or out-of-kind mitigation as tools for salmon and watershed recovery. Available at: *http://wdfw.wa.gov/hab/ahg/altmtgtn.pdf*.

- Puget Sound Nearshore Partnership Technical Reports: The Nearshore Partnership is collecting and organizing technical information to maximize the effectiveness of nearshore restoration and protection projects being undertaken now and in the near future around the Puget Sound. Available at: *http://www.pugetsoundnearshore.org./technical_reports.htm*.

- Critical Areas Assistance Handbook: Protecting Critical Areas Within the Framework of the Washington Growth Management Act (WDCTED 2003): The Washington State Department of Community Trade and Economic Development (name changed to Department of Commerce as of July 1, 2009) published this guidance to provide local governments with model policies and regulations to protect critical areas. The guidance includes recommendation for special considerations for anadromous fish resources. Available at: *http://www.cted.wa.gov/site/745/default.aspx*.

- Washington State Department of Ecology Guidance for Protecting and Managing Wetlands: Volume 2: This document is the second part of a two-part document addressing wetlands in Washington and their protection and management. Volume 2 contains guidance primarily for local governments on protecting and managing wetlands and their functions based on the synthesis of the science in Volume 1. Available at: *http://www.ecy.wa.gov/biblio/0506008.html*.

A.5 Additional Resources

Adopt-a-Stream: The Adopt-A-Stream Foundation Fish & Wildlife Division was created to address degraded stream and wetland ecosystems. Drawing upon the expertise of its members, the team has surveyed multiple watersheds and successfully identified areas of erosion, fish passage barriers, and pollution sources, and other problem areas. The crew has rectified many of the issued

found by successfully completing stream and wetland restoration projects. More information available at: *http://www.streamkeeper.org/*.

American Rivers: American Rivers is a nonprofit organization working to protect and restore America's rivers for the benefit of people, wildlife, and nature. More information available at: *http://www.americanrivers.org/*.

Long Live the Kings: Long Live the Kings (LLTK) is a nonprofit organization committed to restoring wild salmon to the waters of the Pacific Northwest. LLTK helps those who make decisions about salmon to be successful. This organization pursues projects and partnerships that compel coordinated, scientifically-credible, and transparent changes to harvest, hatchery, and habitat management to protect and restore wild salmon. More information available at: *http://www.lltk.org/*.

Municipal Research and Services Center of Washington: The Municipal Research and Services Center (MRSC) is a nonprofit organization created in 1969 to continue programs established in 1934 under the Bureau of Governmental Research at the University of Washington. In 1997, Washington counties joined cities in funding MRSC, and in 2007, special districts were added. The MRSC mission is "working together for excellence in local government through professional consultation, research and information services." In addition to other functions, this organization provides information on environmental and natural resources issues that relate to Washington cities and counties, including links to governmental agencies and other environment-oriented Web sites. More information available at: *http://www.mrsc.org/subjects/environment/*.

Northwest Indian Fisheries Commission: The Northwest Indian Fisheries Commission (NWIFC) is a support service organization for 20 treaty Indian tribes in western Washington. The commission is composed of representatives from each member tribe who elect a chair, vice chair and treasurer. The role of the NWIFC is to assist member tribes in their role as natural resources co-managers. The commission provides direct services to tribes in areas such as biometrics, fish health and salmon management to achieve an economy of scale that makes more efficient use of limited federal funding. The NWIFC also provides a forum for tribes to address shared natural resources management issues and enables the tribes to speak with a unified voice in Washington, D.C. More information available at: *http://www.nwifc.org/*.

People for Puget Sound: People for Puget Sound is a citizens' group established to protect and restore the health of Puget Sound land and waters through education and action. More information available at: *http://www.pugetsound.org/*.

Puget Sound Partnership: The Puget Sound Partnership is a community effort of citizens, governments, tribes, scientists and businesses working together to restore and protect Puget Sound. More information available at: *http://www.psp.wa.gov/*.

Salmon Safe: Salmon-Safe is an independent nonprofit organization devoted to restoring agricultural and urban watersheds so that salmon can spawn and thrive. More information available at: *http://www.salmonsafe.org/*.

Soils for Salmon: Soils for Salmon is a nonprofit organization dedicated to educating builders, developers, landscapers, and local governments in practices that preserve and improve the soil on building sites and protect waterways. More information available at: *http://www.soilsforsalmon.org/*.

StreamNet: StreamNet is a cooperative information management and data dissemination project focused on fisheries and aquatic related data and data related services in the Columbia River basin and the Pacific Northwest. A variety of data are provided in tabular format and as maps and GIS layers maintained and disseminated through the Pacific States Marine Fisheries Commission (PSMFC). More information available at: *http://www.streamnet.org/*.

Washington Nature Mapping: A biodiversity database and layers of information about birds, mammals, reptiles, amphibians, fish, insects, and plants that provides information about the biological health of an area, a neighborhood, city, county, and state. More information available at: *http://depts.washington.edu/natmap/*.

Wild Fish Conservancy: A nonprofit conservation organization dedicated to the recovery and conservation of the region's wild-fish ecosystems. Through science, education and advocacy, WFC promotes technically and socially responsible habitat, hatchery and harvest management to better sustain the region's wild-fish heritage. More information available at: *http://www.wildfishconservancy.org/*.

APPENDIX B
DEFINITIONS

Anadromous Fish – Fish that spawn and rear in freshwater and mature in the marine environment. While most Pacific salmonids die after their first spawning, adult char (bull trout), cutthroat trout and steelhead can live for many years, moving in and out of saltwater and spawning each year. The life history of Pacific salmonids contains critical periods of time when these fish are more susceptible to environmental and physical damage than at other times. The life history of salmonids, for example, contains the following stages: upstream migration of adults, spawning, inter-gravel incubation, rearing, smoltification (the time period needed for juveniles to adjust their body functions to live in the marine environment), downstream migration, and ocean rearing to adults (WDCTED 2003).

Anadromous Fish Habitat – Habitat that is used by anadromous fish at any life stage at any time of the year, including potential habitat likely to be used by anadromous fish that could be recovered by restoration or management and includes off-channel habitat (WDCTED 2003).

Alevin – Newly hatched salmon; yolk sac is still attached (Merz et al. 2008).

Benthic – Pertaining to the bottom (of estuaries, rivers, streams, and lakes) (Merz et al. 2008).

Best Available Science – Current scientific information used in the process to designate, protect, or restore critical areas, that is derived from a valid scientific process as defined by WAC 365-195-900 through 925. Sources of the best available science are included in Citations of Recommended Sources of Best Available Science for Designating and Protecting Critical Areas published by the Washington State Department of Community, Trade and Economic Development (WDCTED 2003).

Best Management Practices (BMPs) – Conservation practices or systems of practices and management measures that: (A) Control soil loss and reduce water quality degradation caused by high concentrations of nutrients, animal waste, toxics, and sediment; (B) Minimize adverse impacts to surface water and ground

water flow and circulation patterns and to the chemical, physical, and biological characteristics of wetlands; (C) Protect trees and vegetation designated to be retained during and following site construction and use native plant species appropriate to the site for re-vegetation of disturbed areas; and (D) Provide standards for proper use of chemical herbicides within critical areas. The [city/county] shall monitor the application of best management practices to ensure that the standards and policies of this Title are adhered to (WDCTED 2003).

Buffer or Buffer Zone – An area that is contiguous to and protects a critical area which is required for the continued maintenance, functioning, and/or structural stability of a critical area (WDCTED 2003).

Channel Migration Zone (CMZ) – The lateral extent of likely movement along a stream or river during the next one-hundred (100) years as determined by evidence of active stream channel movement over the past one-hundred (100) years. Evidence of active movement over the one-hundred (100) year time frame can be inferred from aerial photos or from specific channel and valley bottom characteristics. The time span typically represents the time it takes to grow mature trees that can provide functional large woody debris to streams. A CMZ is not typically present if the valley width is generally less than two (2) bankfull widths, if the stream or river is confined by terraces, no current or historical aerial photographic evidence exists of significant channel movement, and there is no field evidence of secondary channels with recent scour from stream flow or progressive bank erosion at meander bends. Areas separated from the active channel by legally existing artificial channel constraints that limit bank erosion and channel avulsion without hydraulic connections shall not be considered within the CMZ (WDCTED 2003).

Channelized stream – A stream that has been straightened, runs through pipes or revetments, or is otherwise artificially altered from its natural, meandering course. (Knutson and Naef 1997)

Chinook – The largest species of the Pacific salmon, also commonly called “King.” Adults weigh about 22 pounds (10kg) and are generally 36 inches (91cm) long. Some Chinook can exceed 100 pounds (Merz et al. 2008).

Chum – A species of Pacific salmon. Chum are also referred to as dog salmon because they were commonly dried and used for feeding dog teams during winter. Chum migrate to sea shortly after spawning in lower river systems. Normal/max size is 26 inches (65cm) and 13 pounds (6kg) (Merz et al. 2008).

Coho – A species of Pacific salmon. Coho typically spawn in coastal streams. Historically coho spawned in Idaho, but due to dams are now extinct everywhere but coastal streams. Normal/max size is 30 inches (75cm) and 13 pounds (6kg) (Merz et al. 2008).

Cumulative Impacts or Effects – The combined, incremental effects of human activity on ecological or critical areas functions and values. Cumulative impacts result when the effects of an action are added to or interact with other effects in a particular place and within a particular time. It is the combination of these effects, and any resulting environmental degradation, that should be the focus of cumulative impact analysis and changes to policies and permitting decisions (WDCTED 2003).

Dissolved oxygen (DO) – The amount of oxygen dissolved in a liquid, such as water (Merz et al. 2008).

Drift Cell – Littoral drift, or shore drift, is the process by which beach sediment is moved along the shoreline. Drift results primarily from the oblique approach of wind-generated waves and can therefore change in response to short-term (daily, weekly, or seasonally) shifts in wind direction. Over the long term, however, many shorelines exhibit a single direction of net shore drift. Net shore-drift is determined through geomorphologic analysis of beach sediment patterns and of coastal landforms (Washington State Department of Ecology, *http://www.ecy.wa.gov/services/GIS/data/shore/driftcells.htm*).

Ecosystem – A biological community made up of land and water and organisms all interacting together (Merz et al. 2008).

Emergence – The time when the fry leave their gravel nest and move into the water column (Merz et al. 2008).

Estuary – A semi-protected coastal body of water where saltwater is measurably diluted with fresh water (Pritchard 1967 within Simenstad et al. 1982).

Evolutionarily Significant Unit (ESU): The smallest biological unit that can be considered to be a species under the Endangered Species Act as administered by the National Marine Fisheries Service (NMFS). A population or population group is considered to be an ESU if 1) it is substantially reproductively isolated from other conspecific population units, and 2) it represents an important component in the evolutionary legacy of the species. USFWS uses a similar term and concept called the distinct population segment (DPS), which is the wording used in the ESA itself. Thus, the ESU is the NMFS' interpretation of a DPS (WDFW 2008).

Fines – Ambiguous definition of small sediment (roughly <6mm diameter) that may clog inter-gravel pores, impacting permeability and hyporheic water quality (Merz et al. 2008). Fine sediment suffocates eggs and entombs alevins.

Fingerling – Salmonids usually at the parr stage of development (Merz et al. 2008).

Flood or Flooding – A general and temporary condition of partial or complete inundation of normally dry land areas from the overflow of inland waters and/or the unusual and rapid accumulation of runoff of surface waters from any source (WDCTED 2003).

Floodplain – The total land area adjoining a river, stream, watercourse, or lake subject to inundation by the base flood (WDCTED 2003).

Floodplain connectivity – Connection of river to floodplain features such as riparian forests, side channels, sloughs and wetlands (Merz et al. 2008).

Floodway – The channel of a river or other watercourse and the adjacent land area that must be reserved in order to discharge the base flood without cumulatively increasing the surface water elevation more than one (1) foot. Also known as the "zero rise floodway" (WDCTED 2003).

Flows – The rate at which a volume of water passes a given point in a stream or river; usually measured in cubic feet per second (cfs) (Merz et al. 2008).

Frequently Flooded Areas – Lands in the floodplain subject to a one percent (1%) or greater chance of flooding in any given year and those lands that provide

important flood storage, conveyance, and attenuation functions, as determined by the [director] in accordance with WAC 365-190-080(3). Frequently flooded areas perform important hydrologic functions and may present a risk to persons and property. Classifications of frequently flooded areas include, at a minimum, the 100-year floodplain designations of the Federal Emergency Management Agency and the National Flood Insurance Program (WDCTED 2003).

Fry – Early lifestage of salmonids. Typically juveniles that can swim and catch their own food. Next life stage after alevin, and before smolt. The third freshwater stage of salmonid development; when egg mass is no longer present and fish develops characteristic markings usually within weeks of hatching. Upon reaching 1.25 inches in length, fish are sometimes called “fingerlings” or “parr” (Merz et al. 2008).

Functions and Values – The beneficial roles served by critical areas including, but are not limited to, water quality protection and enhancement; fish and wildlife habitat; food chain support; flood storage, conveyance and attenuation; ground water recharge and discharge; erosion control; wave attenuation; protection from hazards; historical, archaeological, and aesthetic value protection; educational opportunities; and recreation. These beneficial roles are not listed in order of priority. Critical area functions can be used to help set targets (species composition, structure, etc.) for managed areas, including mitigation sites (WDCTED 2003).

Geologically Hazardous Areas – Areas that may not be suited to development consistent with public health, safety, or environmental standards, because of their susceptibility to erosion, sliding, earthquake, or other geological events as designated by WAC 365-190-080(4). Types of geologically hazardous areas include: erosion, landslide, seismic, mine, and volcanic hazards (WDCTED 2003).

Gravel – Round rocks (64- 2mm) within the streambed which are sometimes used by salmonids in the building of a redd (Merz et al. 2008).

Ground Water – Water in a saturated zone or stratum beneath the surface of land or a surface water body (WDCTED 2003). Groundwater in the floodplain is called hyporheic.

Habitat – The sum total of all the living and non-living factors that surround and potentially influence a plant or animal. Most salmonid habitats are described in terms of physical features such as water depth, temperature, velocity or sediment type (Merz et al. 2008).

Habitat Management Plan – A habitat management plan is prepared by a qualified professional and must identify existing conditions and how the management plan will improve habitat functions over existing conditions to ensure no net loss of salmonid habitat functions. A five year monitoring plan must be included.

Homing – The behavior of returning to the stream where an individual salmonid was hatched (Merz et al. 2008).

Hydraulic Project Approval (HPA) – A permit issued by the Washington Department of Fish and Wildlife for modifications to waters of the state in accordance with Chapter 75.20 RCW (WDCTED 2003).

Hyporheic Zone – The saturated substrata beneath a stream or river channel and under the riparian zone where groundwater and surface water mix (May 2003).

Impervious Surface – A hard surface area that either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development or that causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development. Common impervious surfaces include, but are not limited to, rooftops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled macadam or other surfaces which similarly impede the natural infiltration of stormwater (WDCTED 2003).

Incubation – The period of time (variable dependent on temperature) from when an egg is fertilized until swim-up (Merz et al. 2008).

Landslide Hazard Areas – Areas that are potentially subject to risk of mass movement due to a combination of geologic landslide resulting from a combination of geologic, topographic, and hydrologic factors. These areas are typically susceptible to landslides because of a combination of factors including:

bedrock, soil, slope gradient, slope aspect, geologic structure, ground water, or other factors (WDCTED 2003).

Large Woody Debris – Logs or rootwads typically >1 m in length and >10 cm in diameter. Provide important features that support several salmonid life stages and macroinvertebrate production (Merz et al. 2008).

Littoral zone – The region of land bordering a body of water (Merz et al. 2008).

Migrating – Moving from one place to another to live, mate or breed (Merz et al. 2008).

Mitigation – Avoiding, minimizing, or compensating for adverse critical areas impacts. Mitigation, in the following sequential order of preference, is: (A) Avoiding the impact altogether by not taking a certain action or parts of an action; (B) Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps, such as project redesign, relocation, or timing, to avoid or reduce impacts; (C) Rectifying the impact to wetlands, critical aquifer recharge areas, and habitat conservation areas by repairing, rehabilitating, or restoring the affected environment to the conditions existing at the time of the initiation of the project; (D) Minimizing or eliminating the hazard by restoring or stabilizing the hazard area through engineered or other methods; (E) Reducing or eliminating the impact or hazard over time by preservation and maintenance operations during the life of the action; (F) Compensating for the impact to wetlands, critical aquifer recharge areas, and habitat conservation areas by replacing, enhancing, or providing substitute resources or environments; and (G) Monitoring the hazard or other required mitigation and taking remedial action when necessary. Mitigation for individual actions may include a combination of the above measures (WDCTED 2003).

Natal stream – Stream of birth (Merz et al. 2008).

Native Vegetation – Plant species that are indigenous to the area (WDCTED 2003).

Natural Production: Fish that spawn or rear entirely in the natural environment. These fish maybe the offspring of natural or hatchery production (WDFW 2008).

Natural Stock: Fish that are produced by spawning and rearing in the natural habitat, regardless of parentage (WDFW 2008).

No Net Loss – No net loss means that the impacts of land use and/or development, whether permitted or exempt from permit requirements, be identified and mitigated such that there are no resulting adverse impacts on ecological functions, habitats or processes (Jefferson County Draft SMP, December 2008).

Ordinary High Water Mark (OHWM) – That mark which is found by examining the bed and banks and ascertaining where the presence and action of waters are so common and usual, and so long continued in all ordinary years, that the soil has a character distinct from that of the abutting upland in respect to vegetation (WDCTED 2003).

Parr – Young salmonid with large, oval, dark marks (that may or may not be present) on sides. Parr marks are believed to be used for camouflage. Parr usually live in freshwater for 1 to 2 years. Parr marks usually disappear during the smolting process (Merz et al. 2008).

Pelagic – Of or in the open ocean or open water (Merz et al. 2008).

Pink - A species of Pacific salmon with very large spots on back and large oval block blotches on both lobes of tail. Spawning adults take on a dull gray coloration on back and upper side with a creamy-white color below. Also known as humpbacks or “humpies”, males develop a pronounced hump on backs as they near spawning (Merz et al. 2008). Pink salmon live for only two and a half years.

Pool – A relatively deep, still section in a stream (Merz et al. 2008).

Population: A group of interbreeding salmonids of the same species of hatchery, wild, or unknown parentage that have developed a unique gene pool, that breed in approximately the same place and time, and whose progeny tend to return and breed in approximately the same place and time. They often, but not always, can be separated from another population by genotypic or demographic characteristics (WDFW 2008).

Qualified Professional – A person with experience and training in the pertinent scientific discipline (fisheries, wetland science, freshwater biology, marine biology, or hydrogeology). A qualified professional must have obtained a B.S. or B.A. or equivalent degree in biology, environmental studies, fisheries, geomorphology or related field, two years of related professional work experience, and experience assessing habitat impacts and drafting management recommendations to avoid no net loss (WDCTED 2003).

Rearing habitat – Rivers, streams, estuaries, or nearshore areas where juvenile fish find the food and shelter they need in order to grow (Merz et al. 2008).

Redd – A salmonid nest; dug out of the streambed's gravel by adult female (Merz et al. 2008).

Refugia – Habitat sanctuaries from extreme environmental events (Merz et al. 2008).

Restoration – Measures taken to restore an altered or damaged natural feature including: (A) Active steps taken to restore damaged wetlands, streams, protected habitat, or their buffers to the functioning condition that existed prior to an unauthorized alteration; and (B) Actions performed to reestablish structural and functional characteristics of the critical area that have been lost by alteration, past management activities, or catastrophic events (WDCTED 2003).

Riffle – A shallow gravel area of a stream that is characterized by increased velocities and gradients. (Merz et al. 2008). Riffle crests/pool tailouts are where most salmonid spawn.

Riparian Habitat – Areas adjacent to aquatic systems with flowing water that contain elements of both aquatic and terrestrial ecosystems that mutually influence each other. The width of these areas extends to that portion of the terrestrial landscape that directly influences the aquatic ecosystem by providing shade, fine or large woody debris, nutrients, organic and inorganic debris, terrestrial insects, or habitat for riparian-associated wildlife. Widths are measured from the ordinary high water mark or from the top of bank if the ordinary high water mark cannot be identified. It includes the entire extent of the floodplain and the extent of vegetation adapted to wet conditions as well as adjacent upland plant communities that directly influence the stream system.

Riparian habitat areas include those riparian areas severely altered or damaged due to human development activities (WDCTED 2003).

Riparian vegetation – Vegetation that requires the continuous presence of water, or conditions that are more moist than normally found in the area (Knutson and Naef 1997).

Run – (A)The movement of fish inshore or upstream for spawning, usually at a specific time period (i.e. fall-run, spring-run, winter-run) (Merz et al. 2008); or (B) An area of a stream characterized by smooth surface, moderate depth, and moderate current velocity (intermediate between a pool and a riffle).

Salmonid – Fish that belong to the Salmonidae family, including salmon, trout, char, whitefish, grayling, as well as similar Eurasian species (Merz et al. 2008).

Shorelines – All of the water areas of the state as defined in RCW 90.58.030, including reservoirs and their associated shorelands, together with the lands underlying them except: (A) Shorelines of statewide significance; (B) Shorelines on segments of streams upstream of a point where the mean annual flow is twenty cubic feet per second (20 cfps) or less and the wetlands associated with such upstream segments; and (C) Shorelines on lakes less than twenty (20) acres in size and wetlands associated with such small lakes (WDCTED 2003).

Shorelands or Shoreland Areas – Those lands extending landward for two hundred (200) feet in all directions as measured on a horizontal plane from the ordinary high water mark; floodways and contiguous floodplain areas landward two hundred (200) feet from such floodways; and all wetlands and river deltas associated with the streams, lakes, and tidal waters which are subject to the provisions of Chapter 90.58 RCW (WDCTED 2003).

Smolt – Life stage when young salmonids often migrate downstream from freshwater to saltwater. When parr become smolts, they lose their spots and turn silvery. Distinct physiological change allows the smolting salmonid to live in saltwater (Merz et al. 2008).

Smoltification – Process of morphological and physiological adjustment that young salmonids of a certain size undergo to live in saltwater. The process includes changes in shape, color and density (Merz et al. 2008).

Sockeye – A species of Pacific salmon also known as the "red" salmon. Dark blue-black back with silvery sides; no distinct spots on backs, dorsal fins, or tails. Spawning adults develop dull, green colored heads with brick red to scarlet bodies. The landlocked version is known as "kokanee" (Merz et al. 2008). Most populations of sockeye include lake or reservoir rearing for at least two years.

Spawn – To bring forth a new generation of salmonid by digging nests in the stream bed and depositing fertilized eggs into them (Merz et al. 2008).

Special Flood Hazard Areas – The land in the floodplain within an area subject to a one percent (1%) or greater chance of flooding in any given year. Designations of special flood hazard areas on flood insurance map(s) always include the letters A or V (WDCTED 2003).

Species, Candidate – Any fish or wildlife species that is native to the State of Washington that will be reviewed by the Washington Department of Fish and Wildlife for possible state listing as endangered, threatened, or sensitive. A species will be considered for candidate listing if evidence suggests its status meets the criteria for endangered, threatened, or sensitive listings. Candidate species will be managed by WDFW, as needed to ensure the long-term survival of populations in Washington (Knutson and Naef 1997).

Species, Endangered – Any fish or wildlife species that is native to the State of Washington that is seriously threatened with extinction throughout all or a significant part of its range (Knutson and Naef 1997). Federal definition in the 1973 Endangered Species Act available at: *http://www.fws.gov/endangered/whatwedo.html*).

Species, Sensitive – Any fish or wildlife species that is native to the State of Washington that is vulnerable or declining, and are likely to become endangered or threatened throughout all or a significant part of its range, without cooperative management or the removal of threats (Knutson and Naef 1997).

Species, Threatened – Any fish or wildlife species that is native to the State of Washington that is likely to become endangered within the foreseeable future throughout all or a significant part of its range (Knutson and Naef 1997). Federal

definition in the 1973 Endangered Species Act available at: *http://www.fws.gov/endangered/whatwedo.html*.

Steelhead – The anadromous form of the rainbow trout. A small percentage are repeat spawners (Merz et al. 2008).

Stock: A group of fish within a species, which is substantially reproductively isolated from other groups of the same species (WDFW 2008).

Turbidity – The measurement of suspended particles within the water column. Turbidity affects the amount of light penetration in the water column and can impair gill functions in fish (Merz et al. 2008).

Velocity – The speed of flowing water (Merz et al. 2008).

Water Resource Inventory Area (WRIA) – One of sixty-two (62) watersheds in the State of Washington, each composed of the drainage areas of a stream or streams, as established in Chapter 173-500 WAC as it existed on January 1, 1997 (WDCTED 2003).

Watercourse – Any portion of a channel, bed, bank, or bottom waterward of the ordinary high water line of waters of the state including areas in which fish may spawn, reside, or through which they may pass, and tributary waters with defined beds or banks, which influence the quality of fish habitat downstream. This definition includes watercourses that flow on an intermittent basis or which fluctuate in level during the year and applies to the entire bed of such watercourse whether or not the water is at peak level. This definition does not include irrigation ditches, canals, stormwater run-off devices, or other entirely artificial watercourses, except where they exist in a natural watercourse that has been altered by humans (WDCTED 2003).

Watershed – The specific land area that drains into a river system or other body of water (Merz et al. 2008).

Wild - A fish stock that is sustained by natural spawning and rearing in the natural habitat, regardless of parentage (includes native) (WDF et al. 1993).

Wetlands – Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from non-wetland areas to mitigate the conversion of wetlands. For identifying and delineating a wetland, local government shall use the Washington State Wetland Identification and Delineation Manual (WDCTED 2003).