ESA Recovery Plan for the White Salmon River Watershed

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Prepared by
National Marine Fisheries Service
Northwest Region

DISCLAIMER

Endangered Species Act (ESA) recovery plans delineate reasonable actions which the best available information indicates are necessary for the conservation and survival of listed species. Plans are published by the National Marine Fisheries Service (NMFS), usually with the assistance of recovery teams, state agencies, local governments, salmon recovery boards, non-governmental organizations, interested citizens of the affected area, contractors, and others. ESA recovery plans do not necessarily represent the views, official positions, or approval of any individuals or agencies involved in the Plan formulation, other than the NMFS. They represent the official position of NMFS only after they have been signed by the Northwest Regional Administrator. ESA recovery plans are guidance and planning documents only; identification of an action to be implemented by any public or private party does not create a legal obligation beyond existing legal requirements. Nothing in this plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in any one fiscal year in excess of appropriations made by Congress for that fiscal year in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation. Approved recovery plans are subject to modification as dictated by new information, changes in species status, and the completion of recovery actions.

The White Salmon River Watershed Recovery Plan straddles two NMFS Recovery Domains: the lower Columbia/Willamette River Recovery Domain, and the middle Columbia River (MCR) Steelhead Recovery sub-domain of the Interior Columbia River Recovery Domain. As such, the White Salmon River Watershed Recovery Plan is appended to both the lower Columbia/Willamette River and the MCR Steelhead Recovery Plans.

With respect to both the lower Columbia/Willamette River Recovery Plan and the MCR Steelhead Recovery Plan to which the White Salmon Watershed Recovery Plan is appended, where areas of disagreement arose between a management unit plan and a species level, evolutionarily significant unit or distinct population segment plans, NMFS worked with the relevant parties to resolve the differences, and, in a few cases, identified in the evolutionarily significant unit/distinct population segment plans, decided not to incorporate the disputed material in the evolutionarily significant unit or distinct population segment plans. NMFS reserves the right to decide whether or not to incorporate any such disputed materials into the species level plans.

ESA recovery plans provide important context for NMFS determinations pursuant to section 7(a)(2) of the ESA. However, recovery plans do not place any additional legal burden on NMFS or the action agency when determining whether an action would jeopardize the continued existence of a listed species or adversely modify critical habitat. The procedures for the section 7 consultation process are described in 50 CFR 402 and are applicable regardless of whether or not the actions are described in a recovery plan.

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Acronyms and Abbreviations

BIA	Bureau of Indian Affairs
BKD	Bacterial Kidney Disease
BPA	Bonneville Power Administration
BMP	Best Management Practice
CAO	Critical Areas Ordinance
CBFWA	Columbia Basin Fish and Wildlife Authority
CEO	County Environmental Ordinance
cfs	cubic feet per second
CSMEP	Collaborative System-wide Monitoring and Evaluation Project
CWT	Coded wire tag
CUP	Conditional Use Permits
CR	Columbia River
CZO	County Zoning Ordinance
DNA	Deoxyribonucleic Acid
DPS	Distinct Population Segment
EDT	Ecosystem Diagnosis and Treatment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESHB	Engrossed Substitute House Bill
ESU	Evolutionarily Significant Unit
FCRPS	Federal Columbia River Power System
FERC	Federal Energy Regulatory Commission
FMEP	Fisheries Management and Evaluation Plan
FMP	Forest Management Plan
FPO	Floodplain Management Ordinance
GIS	Geographic Information System
HCD	Habitat Conservation Plan
HGMP	Hatchery and Genetic Management Plans
HCD	Habitat Conservation Plan
ICTRT	Interior Columbia Technical Recovery Team
IHN	Infectious Hemotapoietic Necroses
ISAB	Independent Scientific Advisory Board
km	kilometer
LCR	Lower Columbia River
LCFRB	Lower Columbia Fish Recovery Board
LUMA	Land Use Management Area
LWD	Large Woody Debris
LWS	Little White Salmon
MaSA	Major Spawning Area
MCR	Middle Columbia River
MCRFEG	Middle Columbia River Fisheries Enhancement Group
MEA	Management Emphasis Area

MPG	Major Population Group
NEPA	National Environmental Policy Act
NFH	National Fish Hatchery
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPCC	Northwest Power and Conservation Council
NPDES	National Pollution Discharge Elimination System
NPPC	Northwest Power Planning Council
NRC	National Research Council
NRCS	Natural Resources Conservation Service
O&M	Operation and Maintenance
ODFW	Oregon Department of Fish and Wildlife
PCSRF	Pacific Coastal Salmon Recovery Fund
PFMC	Pacific Fisheries Management Council
PIT	Passive Integrated Transponder
PNAMP	Pacific Northwest Aquatic Monitoring Partnership
RCW	Revised Code of Washington
RM	River-Mile
RM&E	Research, Monitoring, and Evaluation
RPA	Reasonable and Prudent Alternative
SEPA	State Environmental Policy Act
SMP	Shorelines Master Plan
SRFB	Salmon Recovery Funding Board
SSB	Substitute Senate Bill
TMDL	Total Maximum Daily Load
TRT	Technical Recovery Team
TUs	Thermal Units
UCD	Underwood Conservation District
URB	Upriver Bright
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geographic Survey
VSP	Viable Salmonid Population
WAGIT	Washington Gorge Implementation Team
WDF	Washington Department of Fisheries
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WDOE	Washington Department of Ecology
WRIA	Water Resource Inventory Area
W/LC TRT	Willamette/Lower Columbia Technical Recovery Team
YN	Yakama Nation, also Confederated Tribes and Bands of the Yakama Nation

Recovery Planning Glossary

Abundance: In the context of salmon recovery, unless otherwise qualified, abundance refers to the number of adult fish returning to spawn.

Adaptive management: Adaptive management in salmon recovery planning is a method of decision making in the face of uncertainty. An overall implementation plan incorporates a monitoring, evaluation, and feedback framework in which the results of actions become feedback on design and implementation of future actions.

Anadromous fish: Species hatched in freshwater, migrate to and mature in salt water, and return to freshwater to spawn.

Baseline monitoring: In the context of recovery planning, scientists conduct baseline monitoring to establish historical and/or current conditions to measure progress (or lack of progress).

Broad-sense recovery goals: Goals defined in the recovery planning process, that go beyond the requirements for delisting, to address, for example, other legislative mandates or social, economic, and ecological values. Local recovery planning groups usually developed these goals.

Compliance monitoring: Determining whether recovery implementation or actions are meeting a specific performance standard, environmental standard, regulation, or law.

Delisting criteria: Criteria incorporated into Endangered Species Act (ESA) recovery plans that define both biological viability (biological criteria) and alleviation of the causes for decline (threats criteria based on the five listing factors in ESA section 4[a][1]), and that, when met, would result in a determination that a species is no longer threatened or endangered and can be proposed for removal from the Federal list of threatened and endangered species. These criteria are a National Marine Fisheries Service (NMFS) determination and may include both technical and policy considerations.

Diel flow: Flow that occurs during a 24-hour period.

Distinct Population Segment (DPS): A listable entity under the ESA that meets tests of discreteness and significance according to U.S. Fish and Wildlife Service (USFWS) and NMFS policy. A population is considered distinct (and hence a “species” for purposes of conservation under the ESA) if it is discrete from and significant to the remainder of its species based on factors such as physical, behavioral, or genetic characteristics, it occupies an unusual or unique ecological setting, or its loss would represent a significant gap in the species’ range.

Diversity: All the genetic and phenotypic (life history, behavioral, and morphological) variation within a population. Variations could include anadromy *v.* lifelong residence in freshwater, fecundity, run timing, spawn timing, juvenile behavior, age at smolting, age at maturity, egg size, developmental rate, ocean distribution patterns, male and female spawning behavior, physiology, molecular genetic characteristics, etc.

Effectiveness monitoring: Monitoring set up to test cause-and-effect hypotheses about recovery actions: Did the management actions achieve their direct effect or goal? For example, did fencing a riparian area to exclude livestock result in recovery of riparian vegetation?

ESA recovery plan: A plan to recover a species listed as threatened or endangered under the U.S. ESA. The ESA requires that recovery plans, to the extent practicable, incorporate (1) objective, measurable criteria that, when met, would result in a determination that the species is no longer threatened or endangered; (2) site-specific management actions that may be necessary to achieve the Plan's goals; and (3) estimates of the time required and costs to implement recovery actions.

Evolutionarily Significant Unit (ESU): A group of Pacific salmon or steelhead trout that is (1) substantially reproductively isolated from other conspecific units and (2) represents an important component of the evolutionary legacy of the species.

Extinct: There are no individuals of this former population or species anywhere.

Extirpated: Zero population or individuals in a certain area but conspecifics exist elsewhere.

Factors for decline: Five general categories of causes for decline of a species, listed in the ESA section 4(a)(1)(b): (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

Functionally extirpated: A species or population that has been extirpated from an area; although a few individuals may occasionally be found, they are not thought to constitute a population.

Hyporheic zone: Area of saturated sediment and gravel beneath and beside streams and rivers where groundwater and surface water mix.

Implementation monitoring: An examination to determine whether the responsible public or private implementing entity performed the activity and/or completed it as planned.

Independent population: Any collection of one or more local breeding units whose population dynamics or extinction risk over a 100-year time period is not substantially altered by exchanges of individuals with other populations.

Indicator: A variable used to forecast the value or change in the value of another variable.

Integrated hatchery program: The purpose of an integrated hatchery program is to increase abundance, while minimizing the genetic divergence of a hatchery broodstock from a naturally spawning population. To maintain the genetic characteristics of a local, natural population among hatchery-origin fish, an integrated program attempts to minimize the genetic effects of domestication. The expected result is a reduction of the genetic risks that hatchery-origin fish may pose to the naturally spawning population.

Interim regional recovery plan: A recovery plan intended to lead to an ESA recovery plan but that is not yet complete. These plans might address only a portion of an ESU or lack other key components of an ESA recovery plan.

Intrinsic potential: The estimated relative suitability of a habitat for spawning and rearing of anadromous salmonid species under historical conditions inferred from stream characteristics including channel size, gradient, and valley width.

Intrinsic productivity: The expected ratio of natural-origin offspring to parent spawners at levels of abundance below carrying capacity.

Kelts: Steelhead that are returning to the ocean after spawning and have the potential to spawn again in subsequent years (unlike most salmon, steelhead do not necessarily die shortly after spawning).

Large Woody Debris (LWD): A general term for wood naturally occurring or artificially placed in streams, including branches, stumps, logs, and logjams. Streams with adequate LWD tend to have greater habitat diversity, a natural meandering shape, and greater resistance to flooding.

Legacy effects: Impacts from past activities that continue to affect a stream or watershed in the present day.

Limiting factor: Physical, biological or chemical features (e.g., inadequate spawning habitat, high water temperature, insufficient prey resources) experienced by the fish that result in reductions in Viable Salmonid Population (VSP) parameters (abundance, productivity, spatial structure, and diversity). Key limiting factors are those with the greatest impacts on a population's ability to reach its desired status.

Locally developed recovery plan: State, tribal, regional, and local planning entities throughout the region drafted plans to address the ESA as well as other mandates and recovery needs. Local and regional citizen and business groups were also involved in these planning efforts.

Maintained status: Population status in which the population does not meet viability criteria but does support ecological functions and preserve options for ESU/DPS recovery.

Major Population Group (MPG): A group of salmonid populations that is geographically and genetically cohesive. The MPG is a level of organization between demographically independent populations and the ESU or DPS.

Management Unit: A geographic area defined for recovery planning purposes on the basis of state, tribal or local jurisdictional boundaries that encompass all or a portion of the range of a listed species, ESU or DPS.

Metrics: Quantification of a characteristic of a situation or process; for example, the number of natural-origin salmon returning to spawn to a specific location is a metric for population abundance.

Morphology: The form and structure of an organism, with special emphasis on external features.

Natural-origin fish: Fish spawning and rearing in the wild, regardless of parental origin.

Parr: The stage in anadromous salmonid development between absorption of the yolk sac and transformation to smolt before migration seaward.

Phenotype: Any observable characteristic of an organism, such as its external appearance, development, biochemical or physiological properties or behavior.

Piscivorous: (Adj.) Describes fish that eat other fish.

Productivity: The average number of surviving offspring per parent. Used as an indicator of a population's ability to sustain itself or its ability to rebound from low numbers. The terms "population growth rate" and "population productivity" are interchangeable when referring to measures of population production over an entire life cycle. Often expressed as the number of recruits (adults) per spawner or the number of smolts per spawner.

Recovery domain: A NMFS-defined administrative unit for recovery planning based on ESU boundaries, ecosystem boundaries, and existing local planning processes. Recovery domains may contain one or more listed ESUs.

Recovery goals: Goals incorporated into a locally developed recovery plan, which may include recovery, delisting, reclassification, and/or other goals. Broad-sense goals are a subset of recovery goals.

Recovery plan supplement: A NMFS supplement to a locally developed recovery plan that describes how the plan addresses ESA requirements for recovery plans. The supplement also proposes ESA delisting criteria for the ESUs addressed by the plan, since a determination of these criteria is a NMFS decision.

Recovery scenarios: Scenarios that describe a target status for each population within an ESU, generally consistent with Technical Recovery Team (TRT) recommendations for ESU viability.

Redd: A female salmonid constructs a nest, or redd, in streambed gravels where she deposits her eggs and males fertilize them.

Recovery strategy: Statements that identify the assumptions and logic-the rationale-for the species' recovery program.

Riparian area: Area with distinctive soils and vegetation between a stream or other body of water and the adjacent upland.

Salmonid: Fish of the family *Salmonidae*, including salmon, trout, char, grayling, and whitefish. In general usage, the term usually refers to salmon, trout, and char.

Segregated hatchery program: The intent of a segregated hatchery program is to maintain a genetically distinct hatchery population. The only way to reduce risk (genetic and ecological) to natural populations from segregated programs is to minimize the contribution of hatchery fish to natural spawning.

Smolt: A juvenile salmonid that is undergoing physiological and behavioral changes to adapt from freshwater to saltwater as it migrates toward the ocean.

Spatial structure: Characteristics of a fish population's geographic distribution. Current spatial structure depends upon the presence of fish, not merely the potential for fish to occupy an area.

Stakeholders: Agencies, groups, or private citizens interested in or affected by recovery planning and/or actions.

Technical Recovery Team (TRT): NMFS convenes work groups, the TRTs, to develop technical products related to recovery planning. Planning forums unique to specific states, tribes, or regions both complement and use TRTs and other technical products to identify recovery actions.

Threats: Human activities or natural events (e.g., road building, floodplain development, fish harvest, hatchery influences, volcanoes) that cause or contribute to limiting factors. Threats may exist in the present or be likely to occur in the future.

Viability criteria: NMFS appointed TRTs to define criteria to describe a VSP based on the biological parameters of abundance, productivity, spatial structure, and diversity. NMFS and others use these viability criteria as technical input into the recovery planning process and provide a technical foundation for development of biological delisting criteria.

Viability curve: A curve describing combinations of abundance and productivity that yield a particular risk or extinction level at a given level of variation over a specified time frame.

Viable Salmonid Population (VSP): An independent population of Pacific salmon or steelhead trout that has a negligible risk of extinction over a 100-year time frame.

VSP parameters: Abundance, productivity, spatial structure, and diversity. These describe characteristics of salmonid populations that are useful in evaluating population viability. See NOAA Technical Memorandum NMFS-NWFSC-42, *viable salmonid populations and the recovery of evolutionarily significant units*, McElhany et al., June 2000.

Executive Summary

The Endangered Species Act (ESA) of 1973 requires National Oceanic and Atmospheric Administration (NOAA)'s National Marine Fishers Service (NMFS) to develop recovery plans for species listed under the Act. The purpose of recovery plans is to identify actions needed to restore threatened and endangered species to the point that they are again self-sustaining elements of their ecosystems and no longer need the protections of the ESA. Recovery plans are not regulatory documents; they are guidance for anyone involved in species recovery efforts as well as for the various state, Federal, tribal, and local entities whose activities and jurisdictions may affect endangered species. A recovery plan provides a roadmap for restoring a listed species or population to biological viability and greater likelihood of long-term survival.

This is a plan for re-establishing the White Salmon River populations of lower Columbia River (LCR) Chinook salmon, LCR coho salmon, Columbia River (CR) chum salmon, and MCR steelhead. The Plan aims for these populations to contribute to the conservation and survival of their respective Evolutionarily Significant Units (ESUs)/Distinct Population Segments (DPSs)[1] (Table ES-1).

The White Salmon River fall and spring Chinook salmon are included in the LCR Chinook salmon (*Oncorhynchus tshawytscha*) ESU, which NMFS listed as threatened on March 24, 1999 and reconfirmed June 28, 2005. The ESU includes all naturally spawned populations of Chinook salmon in the CR and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point east of Hood River in Oregon and the White Salmon River in Washington. The White Salmon River spring Chinook salmon are considered extirpated (Good et al. 2005; Myers et al. 2006).

The White Salmon River coho salmon are part of the LCR coho salmon (*Oncorhynchus kisutch*) ESU, which NMFS listed as threatened on June 28, 2005. The ESU includes all naturally spawned coho salmon populations in the CR and its tributaries from the mouth of the CR to a transitional point east of the Hood and White Salmon Rivers. The White Salmon River coho salmon are considered extinct (Good et al. 2005; Myers et al. 2006).

The White Salmon chum salmon are part of the CR chum salmon *(Oncorhynchus keta*) ESU, which NMFS listed as threatened on March 25, 1999. The CR chum salmon ESU includes all naturally spawning populations in the CR and its tributaries in Washington and Oregon. Presently, all CR chum salmon spawning populations are located downstream of Bonneville Dam. Annual fish passage reports (U.S. Army Corps of Engineers (USACE), 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008) for Bonneville Dam provided data that adult

[1] An 'evolutionarily significant unit' (ESU) of Pacific salmon (Waples 1991) and a 'distinct population segment' (DPS) of steelhead (71 FR 834, January 5, 2006) are considered to be 'species,' as defined in section 3 of the ESA.

chum salmon continue to pass upstream of Bonneville Dam, with adult counts averaging 139 and ranging from a low of 46 to high of 411 from 2000 to 2008.

The White Salmon River historically included a population of MCR steelhead (*Oncorhynchus mykiss*). The MCR steelhead DPS is made up of steelhead populations in Oregon and Washington tributaries of the CR upstream of the Hood and Wind River systems, up to and including the Yakima River. The White Salmon steelhead population is considered "functionally extirpated" for the following reasons: the population's current lack of access to sufficient habitat to support sustained natural production; the presence of a large in-basin hatchery release program below the dam that uses out-of-basin broodstock (ICTRT 2007a); and only a few individual fish may still be present from the original White Salmon population. Functionally extirpated populations are those with so few remaining numbers that there are not enough fish or habitat in suitable condition to support a fully functional population.

Table ES-1. ESA listed DPS/ESU in the White Salmon River

Species	ESU/DPS	Status	Federal Register Notice	
Chinook salmon (*Oncorhynchus tshawytscha*)	LCR Chinook salmon	Threatened	70 FR 37160	6/28/2005
Coho salmon (*O. kisutch*)	LCR coho salmon	Threatened	70 FR 37160	6/28/2005
Chum salmon (*O. keta*)	CR chum salmon	Threatened	70 FR 37160	6/28/2005
Steelhead (*O. mykiss*)	MCR steelhead	Threatened	71 FR 834	1/5/2006
Critical Habitat Designation	LCR Chinook salmon, CR chum salmon, LCR coho salmon, MCR steelhead		70 FR 52630	9/2/2005

Context of Plan Development

This recovery plan provides direction for potential recovery of the White Salmon River's historical salmon and steelhead populations. This plan builds on the past and current efforts of the many parties currently working to rebuild populations and improve their habitat. This approach reflects NMFS's belief that it is critically important to base ESA (4f) recovery plans on the many state, regional, tribal, local, and private conservation efforts that are already underway. NMFS initiated a process that incorporated input from the Yakama Nation (YN), Washington Department of Fish and Wildlife (WDFW), Klickitat County, the Washington State Governor's Salmon Recovery Office, other Federal and state agencies, local governments, and the public. That process produced the White Salmon Recovery Plan.

Currently, there are 18 ESA-listed species of Pacific salmon and steelhead in the Pacific Northwest. For the purpose of recovery planning for these species, NMFS Northwest Region designated five geographically based “recovery domains”: Interior Columbia, Willamette/lower Columbia, Puget Sound and Washington Coast, Oregon Coast and the Southern Oregon/Northern California Coast. The White Salmon watershed is in an area where the Interior Columbia and Willamette/lower Columbia recovery domains overlap.

In each domain, NMFS has worked with state, tribal, and local entities and other Federal entities to develop planning forums that build to the extent possible on ongoing, locally led recovery efforts. NMFS defined “Management Units” based on jurisdictional boundaries as well as areas where local planning efforts were underway. In the LCR there are three management units for the LCR ESUs, these are 1) Oregon; 2) Washington; 3) the White Salmon River ESUs (not including the Steelhead DPS). In the MCR steelhead recovery domain the management units are 1) Oregon; 2) Washington Gorge, which, in turn, NMFS subdivided into three planning areas, White Salmon, Klickitat, and Rock Creek; 3) Yakima Basin; 4) Southeast Washington.

NMFS intends to incorporate the White Salmon Watershed Recovery Plan as an appendix to both the LCR Salmon and Steelhead Recovery Plan and the MCR Steelhead Recovery Plans since the White Salmon River watershed has ESA-listed species in both of the two NMFS Recovery Domains.

For each domain, NMFS appointed a team of scientists, nominated for their geographic and species expertise, to provide a solid scientific foundation for recovery plans. The charge of each TRT was to define ESU/DPS structures, develop recommendations on biological viability criteria for each ESU or DPS and its component populations, provide scientific support to local and regional recovery planning efforts, and provide scientific evaluations of proposed recovery plans. The Willamette/lower Columbia Technical Recovery Team (W/LC TRT) provided technical support for the LCR ESUs recovery plan, while the Interior Columbia Technical Recovery Team (ICTRT), provided technical support for the White Salmon Steelhead Recovery Plan. These TRTs included biologists from NMFS, states, tribal entities, and academic institutions.

All the TRTs used the same biological principles for developing their recommendations for ESU/DPS and population viability criteria-criteria to be used, along with criteria based on mitigation of the factors for decline, to determine whether a species has recovered sufficiently to be downlisted or delisted. A NMFS technical memorandum, *Viable Salmon Populations and the Recovery of Evolutionarily Significant Units* describes these principles (McElhany et al. 2000). The memorandum defines VSPs in terms of four parameters: abundance, population productivity or growth rate, population spatial structure, and diversity. A viable ESU/DPS is naturally self-sustaining, with a high probability of persistence over a 100-year time period. Each TRT made recommendations using the VSP framework and based on data availability, the unique biological characteristics of the ESUs/DPSs and habitats in the domain, and the members’ collective experience and expertise. Although NMFS has encouraged the TRTs to develop regionally specific approaches for evaluating viability and identifying factors limiting recovery, all the TRTs are working from a common scientific foundation.

Physical Setting

The White Salmon watershed drains approximately 386 square miles in south central Washington (Figure ES-1). The river begins along the south slope of Mt. Adams and flows south 45 miles to enter the CR at Underwood, Washington at river-mile (RM) 168.3. White Salmon River salmon populations pass one mainstem CR dam, Bonneville Dam, during their migration to and from the Pacific Ocean.

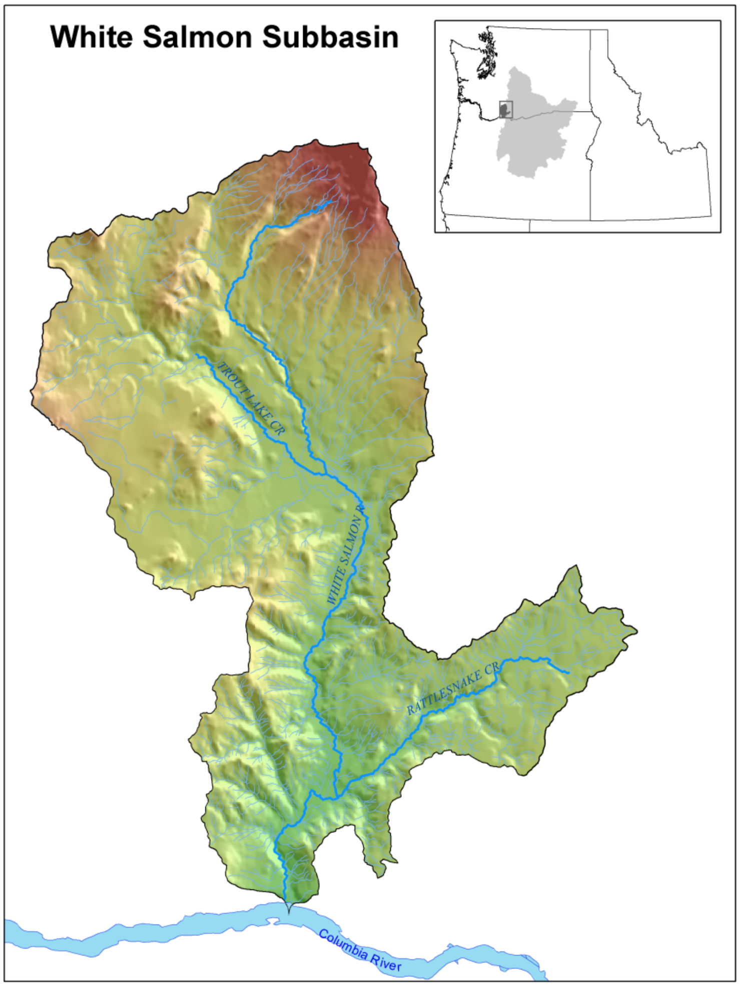

Figure ES-1. White Salmon watershed in Washington State (NPCC 2004)

Salmon and steelhead production in the White Salmon River watershed dropped significantly in the early 1900s after construction of Condit Dam at RM 3.3 on the White Salmon River. Condit Dam's original owners built a fish ladder; however, high flows twice destroyed the ladder and subsequent owners did not reconstruct it after 1919.

Fish passage, either through removal of the dam or installation of upstream and downstream fish passage facilities has been under evaluation as part of the Federal Energy Regulatory Commission (FERC) re-licensing process. PacifiCorp Power, the owner of Condit Dam, rejected the proposal to install fish passage facilities and is currently removing the dam. This Plan includes a proposal to establish or re-establish natural production of salmon and steelhead in the White Salmon watershed, based on natural re-colonization of the habitat above the dam after removal. Recovery actions may also include implementation of hatchery augmentation of populations and/or hatchery preservation of genetic stocks.

The White Salmon watershed is part of both of Washington State's LCR salmon recovery domain and the MCR Steelhead Recovery sub-domain. White Salmon River is within parts of Skamania, Yakima, and Klickitat counties. In addition, the watershed falls within the state's Water Resource Inventory Area (WRIA) 29b. Half of the watershed lies within the Gifford Pinchot National Forest and supports timber production and recreational uses.

The White Salmon watershed contains lands the YN ceded to the United States in the Treaty of June 9, 1855. Within this area, the Tribe reserves the right "to hunt and fish at all usual and accustomed places." An in-lieu fishing site is located at the mouth of the White Salmon River, allowing tribal fishers to launch boats in an enclosed area and move out into the C R to their usual and accustomed fishing grounds.

Ecosystem Conditions

Condit Dam, at RM 3.3 on the mainstem White Salmon River, blocked all anadromous fish migration to historical habitats in the upper drainage. Dam removal began on October 26, 2011. Historical operations at Condit Dam altered flows in the lower White Salmon River, causing flows to drop to as low as 15 cubic feet per second (cfs) in the 1.1-mile bypass reach. Average natural flows are about 700 cfs. Power peaking at the dam affected the river system, causing diel flow variations and impairing watershed processes, such as the transportation of spawning gravels and Large Woody Debris (LWD) to areas downstream of the project (NPCC 2004). The lack of sediment transport into these reaches has affected habitat conditions downstream of Condit Dam. Conditions in the lower river below the former location of Condit Dam and under the former reservoir are anticipated to change substantially in response to the removal of the dam and subsequent stabilization actions.

Upstream of Condit Dam, the White Salmon River has a relatively constant natural flow pattern because of glacial melt and a large water storage capacity. Tributary stream flows drop to low levels in the summer and peak in the winter. Upstream of the dam, Northwestern Lake occupied the portion of the river between Buck Creek and the dam. Removal of the dam is exposing the lakebed. The coarseness of substrate sediment in the former lakebed is variable, with coarser material deposited at the top of the former reservoir and finer material downstream. Riparian vegetation is currently non-existent, and banks will be unstable until restoration actions are completed.

The extent of time it will take to re-establish channel and watershed processes in the former lakebed and the area below the former dam is unknown. Upstream of the former Northwestern Lake, some tributaries have warm water temperature, sparse riparian vegetation, high nutrient levels, low instream LWD abundance, and poor pool volume and frequency. Biologists have documented fish-borne diseases, Bacteria Kidney Disease (BKD) and Black Spot in the watershed (section 5.6, Predation, Competition and Disease).

Populations and Major Population Groups

Historically, MCR steelhead, likely ranged up the White Salmon River to the falls at RM 16 and into Buck, Spring, Indian, and Rattlesnake creeks (NPCC 2004). Based on accessible spawning habitat and a combination of notes, diary logs, and interviews (Lane and Lane Associates 1981), biologists assume that spring Chinook salmon and coho salmon were present historically in the watershed. Husum Falls, RM 7.6, may have blocked fall Chinook salmon migration and created a partial barrier for steelhead and coho salmon (NPCC 2004). All anadromous fish passage to historical habitats in the White Salmon drainage above RM 3.3 ended after construction of Condit Dam and the failure of the fish ladder in 1919. Now that Condit Dam has been removed, populations are anticipated to repopulate the watershed.

Presently, the historical spring Chinook salmon population is considered extirpated (Good et al. 2005; Myers et al. 2006), the historical steelhead population is considered functionally extirpated (ICTRT 2007b), the historical coho salmon population is considered extinct (Good et al. 2005; Myers et al. 2006), and the historical fall Chinook salmon population is considered at very high risk of extinction (ICTRT 2006; McElhany et al. 2004; Ford et al. 2011).

Biological Viability Criteria

White Salmon River fall Chinook salmon

The W/LC TRT gave the White Salmon River fall Chinook salmon population a weighted average extinction risk score of 0.86 on a scale of 0 to 4, with 0 = extirpation or nearly so, and 4 = very low extinction risk. This suggests that the population is at a very high risk of extinction (McElhany et al. 2004). Most W/LC TRT members considered hatchery strays to heavily influence the in-river fall-run Chinook salmon population, although some team members included the Spring Creek National Fish Hatchery (NFH) in their diversity evaluation as a potential source for re-establishing a native-run.

White Salmon River spring Chinook salmon

The W/LC TRT rated the White Salmon River spring-run Chinook salmon with a weighted average extinction risk score of 0.07, indicating the population is likely extirpated. The team concluded that any population that may have been historically present is currently extirpated because of construction of Condit Dam.

White Salmon River coho salmon

McElhany et al. weighted the White Salmon coho salmon population with an average extinction risk score of 0.39, indicating that the population is likely very near extinction (2004) or extinct (Good et al. 2005).

White Salmon River chum salmon

The lower Columbia Fish Recovery Board (LCFRB) identified the entire population of upper Gorge Chum salmon, which includes the historical population of chum salmon spawning in the White Salmon River, to have a very low viability (LCFRB 2004). Bonneville Reservoir inundates most of historical habitat for this population. T

White Salmon River steelhead

The ICTRT classified the White Salmon River steelhead population as functionally extirpated (ICTRT 2008). The ICTRT considers extirpated populations as those entirely cut off from anadromy. Functionally extirpated populations are those with so few remaining that there are not enough fish or habitat in suitable condition to support a fully functional population. The ICTRT identified one historical Major Spawning Area (MaSA) within the White Salmon watershed. A few individuals from the original population may have been spawning in the reach below Condit Dam and some evidence suggests that resident *O. mykiss* may have retained anadromous potential (Allen et al. 2006a and 2006b; Allen, personal communication, 2008).

Limiting Factors

Chapter 5 discusses in-watershed and out-of-watershed factors and related threats influencing the viability of the White Salmon River salmon and steelhead populations. NMFS defines limiting factors as the biological and physical conditions that limit a species' viability - e.g., high water temperature and defines threats as those human activities or naturally induced actions that cause the limiting factors. For example, removing the vegetation along the banks of a stream (the threat) can cause higher water temperatures (the limiting factor), because the stream is no longer shaded. Analysis of limiting factors and threats across the species' entire life cycle forms the basis for designing recovery strategies and actions.

"Threats" are present or likely anthropogenic activities or natural events that cause or contribute to the factors limiting the species' recovery. The development of threat reduction strategies can be complex, especially when human activities that pose threats to the species satisfy otherwise "beneficial" societal or cultural functions (e.g., flow management may threaten the species by reducing summer flows an increasing water temperatures, but the flow management may support an agricultural economy or protect human safety and property through flood prevention). In such circumstances, it is desirable to manage a threat in such a way that it minimizes or eliminates the negative impacts to the species, while retaining essential societal or cultural functions.

Blocked Passage

Until recently, blockage of fish passage upstream of Condit Dam was the single greatest factor limiting salmon abundance and productivity in the White Salmon River watershed. When the dam was in place, fall Chinook salmon accessed only a small percentage of their historical spawning and rearing habitat in the watershed. While the area directly below the dam was not "blocked," the hydraulics and substrate composition of this habitat had changed rendering it unsuitable for spawning. With the removal of Condit Dam, the hydraulics and substrate composition is evolving and now can support natural spawning though the habitat and substrates directly influence by the Bonneville Dam pool continue to limit spawning. Bonneville Dam has also flooded 80 percent of the spawning area used by chum salmon (NPCC 2004).

Tributary Habitat

The upstream habitats are currently being re-occupied by anadromous fish now that access has been provided. Spawning and rearing habitat upstream of the dam may eventually limit anadromous salmonid population abundance in the White Salmon River. Opportunities exist to improve upstream habitats to support future population levels. Sections 5.2, Freshwater Habitat and 6.2, Freshwater Habitat Strategies and Actions, for further discussion on tributary habitat.

Hatchery Practices and Releases

Chinook salmon

Most of the fish spawning naturally in the White Salmon River were assumed to be hatchery-origin tule fall Chinook salmon based on CWT recoveries. Spring Creek NFH began marking all of its hatchery production in 2004 and as a result, recent spawning ground surveys have shown that the majority of the tule fall Chinook salmon returning to the White Salmon River are of natural origin (Roler 2011). Spring Creek NFH tule fall Chinook salmon were originally derived from White Salmon tule fall Chinook salmon and are anticipated to contribute to natural production now that Condit Dam has been removed. Stray upriver bright (URB) hatchery fall Chinook salmon may adversely affect productivity of the tule fall Chinook salmon in the White Salmon River. These hatchery-origin strays are from releases at the Little White Salmon (LWS) NFH, located 3 miles downstream from the White Salmon River, and other releases in and below the Bonneville Pool. No facility releases hatchery-produced Chinook salmon into the White Salmon River watershed.

Coho salmon

Biologists found coho salmon from past releases by the LWS NFH to stray into the White Salmon watershed. Coho salmon releases from LWS NFH ended in 2004. Biologists consider these strays along with releases from other upstream Columbia Basin hatchery programs as the source of naturally spawning coho salmon in the White Salmon River.

Chum salmon

There are no hatchery chum salmon programs releasing fish above Bonneville Dam, although some incubated at the Washougal Hatchery and released as fry into Duncan Creek may be among those that ascend the Bonneville ladders.

Steelhead

Releases of Skamania stock winter steelhead and summer steelhead may limit the diversity of any naturally produced winter steelhead in the watershed. Scientists consider neither as part of the LCR or MCR steelhead DPSs. Fisheries managers terminated the releases of Skamania stock hatchery steelhead in 2010 in anticipation of breaching Condit Dam.

Harvest

Harvest currently does not limit the abundance or diversity of White Salmon River populations of steelhead, spring Chinook salmon, coho or chum salmon. All of these populations are extirpated or functionally extirpated (Good et al. 2005; ICTRT 2007b). Any coho salmon, chum salmon, steelhead, and spring Chinook salmon found in the White Salmon River are strays from other basins. To protect naturally produced coho salmon, spring Chinook salmon, fall Chinook salmon, and steelhead in the White Salmon River, sport fisheries may only retain hatchery fish that are adipose fin-clipped and release all unmarked salmon and steelhead https://fortress.wa.gov/dfw/erules/efishrules/ (accessed January 3, 2013). Ocean and mainstem fisheries heavily harvest fall Chinook salmon, and harvest rates are likely to affect the rate of population growth once additional habitat in the watershed becomes available (section 5.4, Harvest, for further discussion).

Federal Columbia River Hydrosystem

Much of the mainstem Columbia and Snake rivers' current conditions are altered compared to historic conditions. The development of hydropower and water storage projects within the CR Basin have resulted in the inundation of many mainstem spawning and shallow-water rearing areas (e.g., loss of spawning gravels and access to spawning and rearing areas); altered water quality (e.g., reduced spring turbidity levels), water quantity (e.g., seasonal changes in flows and consumptive losses resulting from use of stored water for agricultural, industrial, or municipal purposes), water temperature (e.g., including generally warmer minimum winter temperatures and warmer maximum summer temperatures), water velocity (e.g., reduced spring flows and increased cross-sectional areas of the river channel), food (e.g., alteration of food webs, including the type and availability of prey species), and safe passage (e.g., increased mortality rates of migrating juveniles and steelhead kelts) (Williams et. al 2005; Ferguson et. al 2005).

Model studies indicate that the hydrosystem has decreased the delivery of suspended particulate matter to the LCR and estuary by about 40 percent (as measured at Vancouver, Washington) and has reduced fine sediment transport by 50 percent or more (Bottom et al. 2005). Overbank flow events, important to habitat diversity, have become rare, in part because flow management and irrigation withdrawals prevent high flows and in part because diking and revetments have increased the "bankfull" flow level (from about 18,000 to 24,000 m3/s). The dynamics of estuarine habitat have changed in other ways relative to flow. With increasing flow, the availability of shallow (between 10 cm and 2 m depth), low-velocity (less than 30 cm/s) habitat now appears to decrease at a steeper rate than during the 1880s, and the flow absorption capacity of the estuary appears to have declined.

The CR Estuary Module, at http://www.nwr.noaa.gov/Salmon-Recovery-Planning/ESA-Recovery-Plans/Estuary-Module.cfm (accessed April 11, 2012) provides more information on factors that may limit viability of anadromous salmonids in the CR Estuary.

Predation, Competition and Disease

Because of Bonneville Dam's reservoir habitat, the abundance of predatory native and exotic fishes in the lower river has increased. Primary predators of juvenile salmonids in the CR include northern pikeminnow, smallmouth bass, and walleye. Terns, cormorants, and sea lions also consume large numbers of salmonids.

Hatchery steelhead juvenile releases into the White Salmon River probably led to competition with any natural origin smolts produced below the former Condit Dam, but hatchery managers have terminated these releases. Hatchery adults that stray into the White

Salmon River may compete for spawning and rearing habitat. Spawning of later returning URB fall Chinook salmon can reduce the productivity of naturally spawning tule fall Chinook salmon through redd superimposition.

Researchers have reported BKD and Black Spot throughout the White Salmon watershed (Allen et al. 2006a, 2006b). Now that Condit Dam has been removed, diseased fish may introduce other pathogens and diseases into the watershed. The effects of disease on current or any potential future populations are unknown.

Ocean Conditions

The effects of ocean conditions on abundance of Pacific salmon and steelhead vary among species and populations within species. Migration patterns in the ocean may differ dramatically and expose different stocks to different conditions in different parts of the ocean. Ocean survival of salmonids has been dramatically affected by widespread changes in ocean conditions; smolt-to-adult survival rates generally vary 10-fold between good and bad years.

Climate Change

Climate change represents a potentially significant threat to recovery of White Salmon River salmon and steelhead populations. Changes in climate may adversely affect salmon and steelhead by exacerbating existing problems with water quantity (e.g., lower summer stream flow) and water quality (e.g., higher summer water temperatures) and could be detrimental to many populations of salmonids and native fish species throughout the CR Basin. Changing conditions could also affect salmonid health and survival in the ocean through a variety of mechanisms, including increased ocean temperatures, increased stratification of some waters, changes in the upwelling season, shifts in the distribution of salmonids, long-term variability in winds and ocean temperatures, increased acidity, and increased atmospheric and oceanic variability (NMFS 2008a, Supplemental Comprehensive Analysis Chapter 5), available at http://www.nwr.noaa.gov/Salmon-Hydropower/Columbia-Snake-Basin/upload/Final_SCA_Ch1_7.pdf (accessed April 11,2012). See also ISAB 2007.

Recovery Goals and Criteria

The primary goal of this plan is to restore White Salmon River salmon and steelhead populations to viable status. McElhany et al. (2000) defines a VSP as an independent population that has negligible risk of extinction over a 100-year timeframe.

The visions, goals, and actions of many of the parties involved in the White Salmon recovery planning process may go beyond ESA delisting. These visions for broad-sense recovery incorporate ESA delisting goals. During the process of achieving broad-sense recovery goals, NMFS could delist White Salmon River salmon and steelhead. Broad-sense recovery goals incorporate many local and traditional uses, including those associated with rural and Native American values, which are important in the Pacific Northwest.

Biological Viability Criteria

One of the main tasks assigned to the TRTs was to develop biologically based criteria for ESA-listed salmon and steelhead. Viability criteria identify characteristics and conditions that, when met, would describe viable populations and a viable ESU or DPS.

The TRTs based their approaches to recovery on guidance from the NMFS Technical Memorandum *Viable Salmonid Populations and the Recovery of Evolutionarily Significant* Units (McElhany et al. 2000). This memorandum provides general direction for setting viability objectives at the ESU/DPS and component population levels. In their VSP guidelines, McElhany et al. (2000) recommend that a viable DPS population should be large enough to:

- Have a high probability of surviving variation observed in the past and expected future
- Be resilient to environmental and anthropogenic disturbances
- Maintain genetic diversity
- Support/provide ecosystem functions

NMFS organized the viability guidelines provided by McElhany et al. (2000) around four major considerations: abundance, productivity, spatial structure, and diversity. ESU-level viability criteria consider the appropriate distribution and characteristics of component populations to maintain the ESU/DPS in the face of longer-term ecological and evolutionary processes (ICTRT 2005a). NMFS adopted the ICTRT and W/LC TRT-defined viability criteria as the biological criteria for delisting of the ESUs and DPS that include the listed White Salmon populations discussed in this Plan.

Recovery Strategy and Actions

Chapter 6 describes the recovery strategies for the White Salmon River salmon and steelhead populations. The recovery strategies for each population contain three key components: 1) reintroducing naturally produced salmon and steelhead into historical habitat upstream of the former Condit Dam, 2) improving and increasing habitat for salmon and steelhead production downstream of Buck Creek, 3) improving habitat upstream of Buck Creek in anticipation of the growth of anadromous populations. The Plan also recommends that harvest or hatchery actions do not impede efforts to improve salmon and steelhead viability.

Table ES-2 lists the strategies and actions proposed as an integrated approach to address limiting factors and threats to salmon and steelhead and achieve broad-sense goals in four categories: freshwater habitat, hatcheries, harvest, and hydrosystem operations.

The Plan also proposes a number of actions focused on data gathering and analysis. These efforts are needed to monitor the current population status and habitat conditions and to improve the likelihood that efforts to reintroduce salmon and steelhead in the White Salmon are efficient and successful.

Together, NMFS expects the proposed strategies and actions to increase abundance, productivity, spatial structure, and diversity of White Salmon River salmon and steelhead.

The strategies and actions build from past and current efforts to restore passage and improve habitat conditions in the watershed.

Introduction/Restoration of Anadromous Salmonid Populations

In anticipation of the removal of Condit Dam, the White Salmon Working Group, made up of Federal, state, and tribal fisheries managers, as well as representatives of PacifiCorp (Condit Dam operators), developed several options for the reintroduction of salmon and steelhead into the White Salmon River. The group fleshed out each option with a description of the biological basis for the approach, operational and maintenance needs, and monitoring and evaluation needs. For details about the options and considerations, see Appendix I.

Fall Chinook salmon Reintroduction Plan Options

1. Salvage adipose-fin present Coded-Wire-Tag (CWT) - negative tule fall Chinook salmon from the White Salmon River in the fall of 2010 to start tule fall Chinook salmon restoration.
2. The Spring Creek NFH would spawn adults and rear eggs. The hatchery would acclimate and release the resulting juveniles at White Salmon Ponds.
3. No salvage effort in the White Salmon River or at Spring Creek NFH.
4. Salvage adipose-fin present CWT - negative tule fall Chinook salmon returning to the White Salmon River and outplant above Condit Dam prior to removal.

The White Salmon Working Group recommended the outplant Option 4 because they believed habitat is currently available above Condit Dam that can support natural spawning tule fall Chinook salmon. The White Salmon Working Group completed the salvage of native fish in late summer and early fall of 2011 prior to breaching the dam.

Spring Chinook salmon Reintroduction Plan Options

1. Natural colonization, i.e. no reintroduction efforts from outside sources.
2. Wild Klickitat spring Chinook salmon as brood source for juvenile release into the White Salmon River. Eggs collected and reared at Klickitat Hatchery, juveniles acclimated and released at White Salmon Ponds.
3. Klickitat Hatchery spring Chinook salmon as brood source for juvenile releases into upper White Salmon River (from Klickitat Hatchery thinning release or other surplus juveniles).
4. Klickitat Hatchery integrated stock spring Chinook salmon as brood source for juvenile release into White Salmon River, in future years (broodstock source would be hatchery-reared offspring of wild fish).
5. Transport surplus Klickitat Hatchery adults to White Salmon River.
6. Trap and transport Klickitat wild adults to White Salmon River.
7. Monitor natural escapement and production for 4-5 years then evaluate need and suitability of Option 4.

The White Salmon Working Group recommended Option 7. Under this option Working Group members propose to monitor escapement of spring Chinook salmon into the upper White Salmon River, including the proportion of Carson stock hatchery spring Chinook salmon on the spawning grounds. The White Salmon Working Group will also monitor spring Chinook salmon smolt production in the upper White Salmon. The 4-5 year monitoring period will determine if natural production is occurring and the source of that production. The monitoring period will also allow time for the development of the Klickitat Hatchery integrated spring Chinook salmon program and determine whether production capacity at this facility is available. The White Salmon Working Group considered the Klickitat Hatchery spring Chinook salmon program the best source of broodstock for reintroduction, even though it is not part of the LCR Chinook salmon ESU. The two nearest populations of spring Chinook salmon within the LCR ESU are in the Lewis River in Washington and the Sandy River in Oregon. Each of these basins have spring Chinook salmon hatchery programs, but reintroduction efforts in the Lewis River Basin require current local production in the Lewis River is needed for reintroduction efforts in that basin, while broodstock collection and funding shortfalls constrain production in the Sandy River. The result is the unavailability of a suitable source of LCR spring Chinook salmon to support the reintroduction efforts in the White Salmon River.

Coho salmon Reintroduction Plan Options

1. Natural re-colonization, i.e., no reintroduction efforts from outside sources.
2. Juveniles from Washougal and/or Bonneville/Cascade hatcheries released into White Salmon River.
3. Collection of wild adult broodstock in Klickitat River with spawning and rearing at hatchery facility and juvenile release in White Salmon River.
4. Collection of wild adult broodstock in White Salmon River with spawning and rearing at hatchery facility and juvenile release in White Salmon River.
5. Monitor natural escapement and production for 4-5 years then evaluate need and suitability of Options 2, 3, or 4.

The White Salmon Working Group decided on Option 5 for coho salmon. As described for spring Chinook salmon, White Salmon Working Group members propose to monitor escapement, hatchery- and natural-origin coho salmon on the spawning grounds, and juvenile production in the White Salmon River watershed. Sources of stray hatchery coho salmon include releases from Bonneville Hatchery and releases into the Klickitat and the Umatilla river basins. All of these releases derive from hatchery programs that are part of the LCR coho salmon ESU. A recovery team will use the results of the monitoring to determine future reintroduction activities.

Chum salmon Reintroduction Plan Options

1. Natural re-colonization, i.e., no reintroduction efforts from outside sources.
2. Active adult outplanting in years after Condit Dam removal.

3. Active stocking of juvenile chum salmon or outplanting of eggs in egg baskets and hatch boxes via WDFW's Washougal Hatchery or Willard NFH.
4. Initiate provisional hatchery program for chum salmon using existing US Fish and Wildlife Service (USFWS) hatcheries (White Salmon Ponds) for spawning and subsequent outplanting using chum salmon captured at Bonneville Dam.

The White Salmon Working Group decided on Option 1 for chum salmon. The group chose this option because of the uncertainty regarding the status of chum salmon above Bonneville Dam. This option calls for expanded spawning ground surveys in the Bonneville Pool using the mainstem chum salmon spawning habitat criteria developed for the population below Bonneville Dam. Those conducting surveys should focus in the lower reaches of suitable tributaries and include habitat suitability assessments for the reservoir and the tributaries.

Steelhead Reintroduction Plan Options

1. Natural re-colonization, i.e., no reintroduction efforts from outside sources.
2. Wild donor from local watershed as brood source for juvenile release into the White Salmon River. Eggs collected and reared at suitable hatchery, juveniles acclimated and released at White Salmon Ponds.
3. White Salmon resident *O. mykiss* as brood source, with locally suitable anadromous wild donor stock spawned for juvenile release into upper White Salmon River.
4. White Salmon steelhead captive brood program using captured outmigrating juveniles.
5. White Salmon steelhead kelt reconditioning. Recondition local spawners to enhance survival.

Based on the potential to re-establish natural production of steelhead in the watershed, the White Salmon Working Group decided Option 1, natural re-colonization, was the best approach. The indication that the (resident) population of *O. mykiss* in the White Salmon River above the former Condit Dam still produces smolts, even though the construction of Condit Dam and the end of passage in 1919 eliminated anadromy, was the basis of the group's decision. Recent monitoring in the White Salmon River above Condit Dam has identified *O. mykiss* juveniles displaying smolt behavior and morphology. Passive Integrated Transponder (PIT)-tagged juveniles have been detected passing Bonneville Dam, with one being recovered at the tern colony on East Sand Island (B. Allen personal communication, 2007). In addition, biologists detected an individual juvenile *O. mykiss* PIT-tagged above Condit Dam in September 2004 at 98 mm and again as an adult ascending Bonneville Dam in July 2006. Genetic analysis of juvenile *O. mykiss* collected in the upper watershed above Husum Falls found differences from hatchery trout released in the watershed; additional samples are needed, however, to confirm this finding (Allen et al. 2006a).

Additional research by Carmichael (Ruzycki et al. 2003) in the Grande Ronde and by Thrower et al. (2004) in Alaska supports the theory that even though the population is functionally extirpated, there is some potential for re-establishing anadromous steelhead in the White Salmon River watershed. Using resident *O. mykiss* above the former Condit Dam could provide a genetic link to historical anadromous *O. mykiss*.

Restoration of Habitat Impacted by Condit Dam and Formerly Occupied by Northwestern Lake

At the time this document was prepared, PacifiCorp had breached the dam and was in the process of removing the structure. PacifiCorp is currently implementing numerous decommissioning management plans that address protection of aquatic biota, bank stabilization, management of sediment and erosion, revegetation, and several other projects. The condition of the habitat downstream of the dam and that habitat recently occupied by the dam will be unknown for a period of time. A Research, Monitoring and Evaluation (RM&E) entity will complete an assessment of habitat conditions after the dam is fully removed and stabilization efforts are complete. Based on this information, a proposed Washington Gorge Management Unit entity will identify priority restoration actions. These will likely include riparian planting and bank stabilization, as well as other actions to be determined.

Habitat Improvement Upstream of Buck Creek in Anticipation of Future Population Growth

Biologists have completed, or are in the process of completing, assessments of current habitat condition in the upper watershed (particularly Rattlesnake Creek). Based on this information, the Plan identified actions that would improve habitat in the upper watershed in anticipation of eventual anadromous fish population growth and occupation of existing habitat. Actions include placement of LWD, planting and management of riparian areas, improvements in passage, reduction of sediment inputs, reduction of anthropogenic effects on stream flow, and other actions.

Table ES-2. Recovery Strategies and Actions for White Salmon River Salmon and Steelhead Populations

Action Type	Specific Action(s)
Dam Removal and Species Reintroductions	
Complete dam removal	Complete removal of Condit Dam
Restore channel, stabilize banks, replant banks, and restore habitat in inundated area previously occupied by the reservoir, as well as the habitats impacted downstream of the former Condit Dam site	Implement PacifiCorp's Decommissioning Management Plans
	Restore channel mainstream above the former Condit Dam
	Restore riparian condition
	Dredge mouth of White Salmon River if needed
Restore populations	Implement reintroduction plan for the White Salmon River salmonids
Post-Dam Removal RM&E	
Baseline habitat data collection	Gather information needed to identify and prioritize habitat actions that will provide the greatest opportunity to contribute to recovery
Population monitoring: - Monitor population abundance and productivity - Monitor proportion and origin of hatchery salmon and steelhead on the spawning grounds	Install & maintain large multiplexing PIT-tag detectors in the lower White Salmon mainstem and in Buck & lower Rattlesnake creeks. Report findings
	Implement population monitoring in the White Salmon River & major anadromous-accessible tributaries.
	Install two small stationary instream PIT-tag detectors in the lower most portion of Spring Creek

Action Type	Specific Action(s)
- Assess the resident trout contribution to smolts downstream of the former Condit Dam; assess change in resident population after steelhead re-colonization/reintroduction	Pit-tag 3,000 juvenile salmonid each year upstream and downstream of the former Condit Dam to track individual movement and seasonal growth rates
	Conduct adult spawning ground surveys and monitor
	Create and maintain fish counts & biological database
	Mark adults for mark-recapture population estimates
	Derive estimates of salmonid population abundance & complete reporting
- Genetic analyses	Compare adult and smolt genetic analyses to ongoing adult salmon escapement estimates of WDFW and smolt outmigration estimates of United States Geographic Survey (USGS) studies in the White Salmon River
Habitat Restoration	
Protect and conserve existing natural ecological processes	Protect existing habitat from future degradation through land use planning
	Protect existing habitat from future degradation though land management plans, conservation easements, acquisitions, re-classification of lands as natural areas
Restore vegetation along stream sections that exceed state standards for temperature	Identify stream segments that are excessively warm; within those areas, work with willing landowners to implement actions to increase density of riparian vegetation where sparse; implement programs to protect existing riparian vegetation, reduce sediment inputs to streams
Restore passage and connectivity to habitats blocked or impaired by artificial barriers	In cooperation with irrigation district and others, remove or replace barriers inhibiting upstream passage including dikes, culverts, and irrigation structures, provide/upgrade screening of irrigation diversions
	Indian Creek culvert replacement
Reduce nutrient inputs	Reduce runoff of nutrients from septic tanks, dairies, agricultural lands, and other sources
Improve LWD abundance and recruitment	In cooperation with landowners plan, design and install stable wood and other large debris in streambeds and develop approaches to ensuring long-term LWD recruitment
	In cooperation with landowners develop grazing strategies that promote riparian recovery
Invasive species	Eradicate invasive plant species from riparian areas
Restore channel	With willing landowners, stabilize stream banks, restore natural channel form, reduce sediment inputs as needed from roads
Reduce anthropogenic effects on stream flow	Quantify anthropogenic effects on stream flow and identify priority actions
	With willing landowners, implement water conservation measures
	Improve irrigation conveyance and efficiency
	Employ Best Management Practices (BMP)s with willing landowners
	Protect/restore springs with willing landowners
	Increase pool habitat
	Restore wetlands with willing landowners
	Hydrologically disconnect roads from streams

Action Type	Specific Action(s)
	Control road/stream interactions by reducing erosion potential
Public awareness	Public awareness regarding restoration projects and importance of wood in streams and riparian areas
Harvest	
Harvest management	Manage harvest for low impact fisheries and rapid anadromous fish population growth
	Adjust tributary harvest regulations in areas where harvest significantly impacts salmon and steelhead population growth
Hatcheries	
Reintroduction: Hatchery production	Rehabilitate White Salmon Ponds and update intake screen
Hydrosystem and Mainstem Predation	
Maintain or improve hydropower operations and facilities at Bonneville Dam to enhance salmon and steelhead survival	Decrease water travel time during smolt outmigration
Maintain or improve hydropower operations and facilities at Bonneville Dam to enhance salmon and steelhead survival	Improve operation of adult passage, maintain high standards of adult fish passage at Bonneville Dam
Reduce predation on salmonids	Reduce predation by pinnipeds, piscivores, cormorants and Caspian terns

Implementation and Cost Estimates

This plan provides specific management strategies and actions needed to address re-establishing viable anadromous salmonid populations in the White Salmon River watershed. These actions represent activities with the greatest potential for protecting and recovering salmon and steelhead, as well as for achieving broad-sense recovery goals. Implementation of recovery actions is not a one time or short-term initiative. The programs and actions will likely need sustaining, evaluating, adjusting, and augmenting over the full recovery period.

NMFS encourages the formation of a planning group for the Washington Gorge Management Unit, a forum or entity that would take responsibility for coordinating implementation of the White Salmon River Watershed Recovery Plan. Implementing the proposed recovery actions for MCR steelhead in the Washington Gorge Management Unit, which includes the White Salmon watershed, would be a primary task for a Washington Gorge Area Regional Board, subject to state, tribal, and local government concurrence and the opportunity for public involvement and comment.

Chapter 7 provides cost estimates developed by the Washington Gorge Implementation Team (WAGIT) for implementing the proposed habitat actions described in Chapter 6 for the White Salmon drainage. The Plan identified numerous RM&E actions. The results of studies will help to identify the priority actions within the watershed. The estimated RM&E actions will cost roughly $1,540,000 over a 5-year period. Implementation of PacifiCorp's decommissioning plans is estimated to cost $0.9 to $1.1 million. Additional actions could cost up to $15,100,000. The total cost over a 5-year period for restoring anadromous populations in the White Salmon River could be as much as $16,781,000. Funding is not yet available to cover $13,200,000 of this cost.

Monitoring, Research and Adaptive Management Framework

As part of implementing the White Salmon Recovery Plan, the proposed Washington Gorge Management Unit or another entity will design a detailed monitoring and evaluation program, which will be incorporated into an adaptive management framework based on the principles and concepts laid out in the NMFS guidance document, *Adaptive Management for Salmon Recovery: Evaluation Framework and Monitoring Guidance* (available at http://www.nwr.noaa.gov/Salmon-Recovery-Planning/ESA-Recovery-Plans/Other-Documents.cfm (accessed April 11, 2012).

The White Salmon monitoring and evaluation program will build on existing programs designed for monitoring tributary habitat in the White Salmon River. Additionally, the program will provide 1) a clear statement of the metrics and indicators by which progress toward achieving goals can be assessed, 2) a plan for tracking such metrics and indicators, 3) a decision framework in which new information from monitoring and evaluation can be used to adjust strategies or actions aimed at achieving the Plan's goals.

1 Introduction

The ESA of 1973 requires NOAA's NMFS to develop recovery plans for species listed under the Act. The purpose of recovery plans is to identify actions needed to restore threatened and endangered species to the point where they are again self-sustaining elements of their ecosystems and no longer need the protection of the ESA.

This is a plan for the recovery of White Salmon River populations of fall Chinook salmon and steelhead, and for establishing or re-establishing spring Chinook salmon, coho, and chum salmon populations in the White Salmon River so that they can contribute to the conservation and survival of the threatened LCR Chinook salmon, LCR coho salmon, and CR chum salmon ESUs, and the threatened MCR steelhead DPS.[2]

The White Salmon River drains approximately 386 square miles in southwestern Washington and joins the CR at Underwood, Washington, CR RM 163 (See Figure 1-1).

Salmon and steelhead production in the White Salmon River watershed dropped significantly in the early 1900s after construction of Condit Dam at RM 3.3 on the White Salmon River. Although the original owners constructed Condit Dam with a fish ladder, high flows twice destroyed the ladder, which was not rebuilt after 1919. The dam blocked access to most of the historical range of both spring and fall Chinook salmon, steelhead, and coho salmon populations that once spawned in the watershed. PacifiCorp breached Condit Dam in October 2011 and is currently removing the dam. This recovery plan includes the proposal developed as part of the FERC decommissioning process to re-establish natural production of spring and fall Chinook salmon, coho, chum salmon, and steelhead in the White Salmon watershed, based on natural re-colonization of the habitat above the dam after removal is complete. In addition, the Bonneville Dam reservoir inundated much of the historical spawning habitat of the chum salmon population that historically spawned in the watershed (NMFS 2005). Some salmon and steelhead currently spawn and rear in accessible habitat below Condit Dam.

The watershed's native salmon and steelhead populations are not viable and their respective ESUs/DPSs are now listed for protection under the ESA. The MCR steelhead population in the White Salmon River is considered functionally extirpated (ICTRT 2008) and also the LCR spring Chinook salmon and coho salmon and the CR chum salmon are considered extirpated (Myers et al. 2006).

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[2] An 'evolutionarily significant unit' (ESU) of Pacific salmon (Waples 1991) and a 'distinct population segment' (DPS) of steelhead (71 FR 834, January 5, 2006) are considered to be 'species,' as defined in section 3 of the ESA.

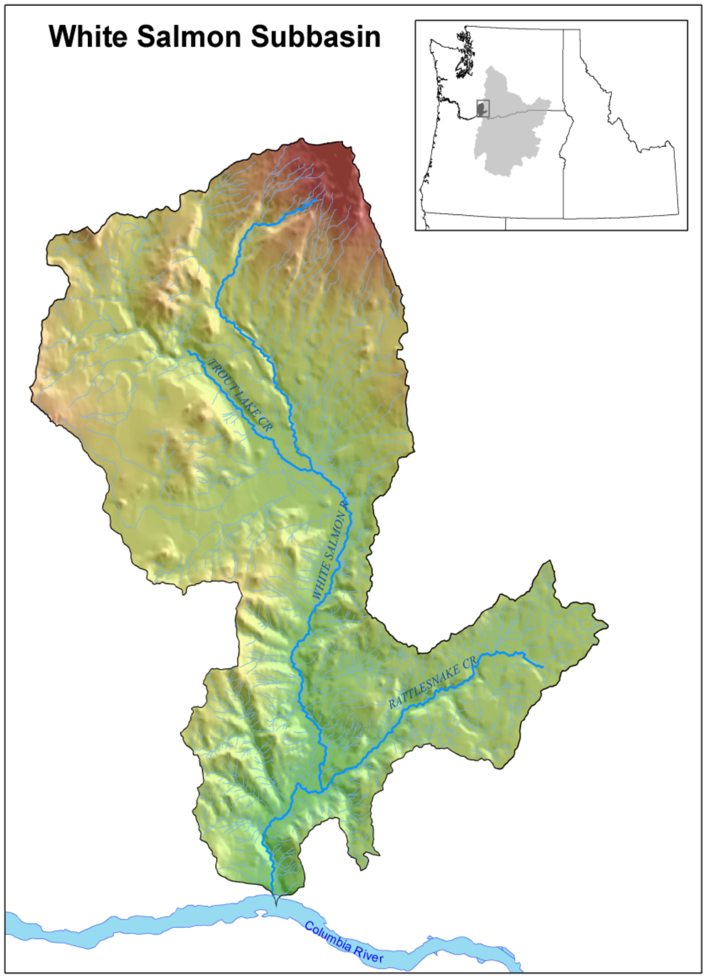

Figure 1-1. White Salmon watershed in Washington State

NMFS developed this recovery plan with participation and technical contributions from the YN, WDFW, Klickitat County, Washington State Governor's Salmon Recovery Office, other Federal and state agencies, local governments, and the public. While NMFS is the agency responsible for recovery planning for salmon and steelhead under the ESA, NMFS believes it is critically important to base ESA recovery plans for salmon and steelhead on the many state, regional, tribal, local, and private conservation efforts already underway throughout the region, and has attempted to do so in this plan.

1.1 Purpose of Plan

A recovery plan provides a roadmap for restoring a listed species or population to the point where it becomes a viable component of its ecosystem. Recovery plans are not regulatory; they are guidance for recovery efforts. This Plan describes the current status of the White Salmon River salmon and steelhead populations and their habitat in the White Salmon watershed. The Plan also identifies the major limiting factors and threats affecting the populations and proposes strategies and actions designed to aid in population recovery by building on past and current efforts. Finally, the Plan provides an implementation and adaptive management framework for making needed future adjustments on the road to recovery.

1.1.1 ESA Requirements

Section 4(f) of the ESA requires that a recovery plan be developed and implemented for species listed as endangered or threatened under the statute. ESA section 4(a)(1) lists factors for re-classification or delisting, which are to be addressed in recovery plans:

a. Present or threatened destruction, modification, or curtailment of [the species'] habitat or range

b. Over-utilization for commercial, recreational, scientific, or educational purposes

c. Disease or predation

d. Inadequacy of existing regulatory mechanisms

e. Other natural or human made factors affecting its continued existence

ESA section 4(f)(1)(B) directs that recovery plans, to the extent practicable, incorporate:

a. Description of such site-specific management actions as may be necessary to achieve the Plan's goal for the conservation and survival of the species;

b. Objective, measurable criteria which, when met, would result in a determination, in accordance with the provisions of this chapter, that the species be removed from the list;

c. Estimates of the time required and the cost to carry out those measures needed to achieve the Plan's goal and to achieve intermediate steps toward that goal.

Once a species is deemed recovered, and therefore removed from a listed status, section 4(g) of the ESA requires the monitoring of the species for not less than 5 years to ensure that it retains its recovered status.

1.1.2 Coordination with Others

This Plan has been developed to achieve consistency with other related planning and management efforts.

Federal Treaty and Trust Responsibilities

Northwest Indian Tribes have legally enforceable rights reserving to them a share of the salmon harvest. In the Treaties of 1855 between the U.S. Government and the Confederated Tribes of the Warm Springs Reservation of Oregon, the Confederated Tribes and Bands of the Yakama Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce Tribe, the tribes, in exchange for the preponderance of their lands, reserved the rights to fish within their reservations and "at all other usual and accustomed places." The usual and accustomed places are understood to include the millions of acres of aboriginal land ceded to the United States in the 1855 treaties, which extends to the upper Columbia and Snake River Basins, and includes most of the geographic range of the middle Columbia steelhead DPS. A complex history of treaties, executive orders, legislation, and court decisions have culminated in the recognition of tribes as co-managers who share management responsibilities and rights for fisheries in the Columbia Basin.

Achieving the basic purpose of the ESA (to bring the species to the point that it no longer needs the protection of the Act) may not by itself fully meet these rights and expectations, although it will lead to major improvements in the current situation. Ensuring a sufficient abundance of salmon to sustain harvest is an important element in fulfilling trust and treaty rights as well as garnering public support for these plans. ESA and tribal trust responsibilities complement one another. Both depend on a steady upward trend toward ESA recovery and delisting in the near term, while making aquatic habitat, harvest, and land management improvements for the long-term.

It is appropriate for recovery plans to take these considerations into account and plan for a recovery strategy that includes harvest. In some cases, increases in the naturally spawning populations may be sufficient to support harvest. In others, the recovery strategy may include appropriate use of hatcheries to support a portion of the harvest. So long as the overall plan is likely to achieve the recovery of the listed ESU/DPS, it will be acceptable as a recovery plan.

The NMFS Regional Administrator, in testimony before the U.S. Senate Indian Affairs Committee (June 2003), emphasized the importance of this co-manager relationship: "We have repeatedly stressed to the region's leaders, tribal and non-tribal, the importance of our co-management and trust relationship to the tribes. NMFS enjoys a positive working relationship with our Pacific Northwest tribal partners. We view that relationship as crucial to the region's future success in recovery of listed salmon."

Treaty Indian fishing rights in the CR Basin are under the continuing jurisdiction of the U.S. District Court for the District of Oregon in the case of *U.S. v. Oregon*, No. 68-513 (filed in 1968). The parties to *U.S. v. Oregon* are the United States acting through the Department of Interior (USFWS and Bureau of Indian Affairs (BIA)) and Department of Commerce (NMFS), the Warm Springs, Umatilla, Nez Perce, Yakama, and Shoshone-Bannock Tribes, and the states of Oregon, Washington, and Idaho. In *U.S. v. Oregon*, the Court affirmed that the treaties reserved for the tribes 50 percent of the harvestable surplus of fish destined to pass through their usual and accustomed fishing areas.

The White Salmon watershed contains lands ceded to the United States by the YN in the Treaty of June 9, 1855. Within this area, the Tribe reserves the right "to hunt and fish at all usual and accustomed places." An in-lieu fishing site is located in the White Salmon River upstream of the bridge at the mouth. This location allows tribal fishers to launch boats in an enclosed area and move out into the CR to their usual and accustomed fishing sites.

Several historical seasonal encampments and fishing areas used by local Indian bands were located on the White Salmon and its tributaries. Historically, before European settlement of the area, significant fisheries and winter village sites were located at the mouth of the White Salmon, at Husum Falls, RM 7.6 and at the falls at BZ Corner, RM 12.4. Another important winter village was located at Trout Creek (Lane and Lane Associates 1981). The Yakama people occupied the entire Rattlesnake Creek drainage. Villages were located near the confluence of the White Salmon River and Rattlesnake Creek, and another approximately four miles up the creek. The upper White Salmon watershed also contains current and historical huckleberry fields traditionally used by the YN. Archaeological sites throughout the area testify to the importance of the White Salmon watershed as a seasonal and perennial area of aboriginal use. Present day tribal groups whose treaty reserved fisheries were affected by Condit Dam are the Confederated Tribes and Bands of the Yakama Indian Nation, Confederated Tribes of the Warm Springs Reservation of Oregon, Confederated Tribes of the Umatilla Reservation of Oregon, and the Nez Perce Tribe of Idaho (Lane and Lane Associates 1981).

Other Federal, State and Local Responsibilities

To ensure consistency in goals, strategies, and actions and to eliminate duplication of effort, planners and program administrators have endeavored to achieve consistency between ESA recovery plans, the Northwest Power and Conservation Council (NPCC) fish and wildlife program, the State of Washington watershed management and salmon recovery programs, and local planning and regulatory efforts.

This Recovery Plan builds upon the White Salmon Subbasin Plan (NPCC 2004), which was developed for the NPCC by the YN, WDFW, and other Federal, state, and local entities. The Plan contains an assessment and inventory of fish and wildlife resources in the watershed, as well as a management plan identifying locally informed fish and wildlife protection and restoration priorities. The NPCC adopted the White Salmon Subbasin Plan into its Fish and Wildlife program. Additional scientific data are drawn from other more recent sources, including technical products developed by TRTs appointed by NMFS for the Interior Columbia and Willamette/lower Columbia Willamette lower Columbia recovery domains and studies completed by the YN Fisheries, the U.S. Geological Survey (USGS), USFWS, and the Underwood Conservation District (UCD).

This Plan is the product of a process initiated by NMFS, involving technical input from the YN, WDFW, Klickitat County, the Washington State Governor’s Salmon Recovery Office, LCFRB, other Federal agencies, state agencies, local governments, and the public. The Plan’s recovery strategy for White Salmon River salmon and steelhead includes recommendations by these parties.

1.2 Context of Plan Development

Currently, there are 18 ESA-listed ESUs/DPSs of Pacific salmon and steelhead in the Pacific Northwest. For the purpose of recovery planning for these species, NMFS Northwest Region designated five geographically based “recovery domains”: Interior Columbia; W/LC; Puget Sound and Washington Coast; the Oregon Coast; and the Southern Oregon/Northern California Coast.

The White Salmon watershed is in an area of overlap between the Interior Columbia and W/LC recovery domains. Columbia River Chinook salmon, coho, and chum salmon are included in the W/LC domain. A run of fall Chinook salmon continues to exist in the watershed. Chum, coho and spring Chinook salmon are considered extinct, extirpated, or functionally extirpated (Myers et al. 2006).

The range of the middle Columbia River Steelhead DPS includes the White Salmon River watershed. The White Salmon River steelhead population is considered functionally extirpated. The entire recovery plan for the White Salmon River population of Middle Columbia River steelhead was not included in the *Middle Columbia River Steelhead Distinct Population Segment ESA Recovery Plan*. The Middle Columbia River plan explains that while the White Salmon watershed, which historically supported a population of Middle Columbia River steelhead, is part of the Washington Gorge management unit, the recovery plan for that population was being finalized as part of the *Lower Columbia ESA Recovery Plan*. The reason for including the White Salmon River population of Middle Columbia steelhead in the Lower Columbia ESA Recovery Plan was because the White Salmon River also includes single populations of three listed ESUs of salmon (Lower Columbia River Chinook and coho salmon and Columbia River chum). The need for an ecosystem approach warranted addressing all the listed salmonids that spawn in the White Salmon watershed in one plan. However, the delisting criteria, actions, and costs for the White Salmon River steelhead population are included in the Middle Columbia DPS plan in order to have all the information on the Middle Columbia steelhead DPS in one place. The Middle Columbia River steelhead DPS recovery plan will be updated to include the White Salmon Management Unit plan as an appendix. However, inclusion of the White Salmon Management Unit plan does not alter the recovery criteria articulated for the White Salmon River steelhead population in the Middle Columbia River steelhead DPS recovery plan.

Technical Recovery Teams (TRT)

For each domain, NMFS appointed a team of scientists, nominated for their geographic and species expertise, to provide a solid scientific foundation for recovery plans. The charge of each TRT was to define ESU/DPS structures, develop recommendations on biological viability criteria for each ESU or DPS and its component populations, provide scientific support to local and regional recovery planning efforts, and provide scientific evaluations of proposed recovery plans. Both the W/LC TRT and the ICTRT did work relevant to the White Salmon populations. Each TRT included scientists from NMFS, states, tribal entities, academic institutions, and other Federal agencies.

All the TRTs used the same biological principles for developing their recommendations for ESU/DPS and population level viability criteria-criteria to be used, along with criteria based on mitigation of the factors for decline, to determine whether a species has recovered sufficiently to be downlisted or delisted. These principles are described in a NMFS technical memorandum, *Viable Salmon Populations and the Recovery of Evolutionarily Significant Units* (McElhany et al. 2000). VSPs are defined in terms of four parameters: abundance, productivity or growth rate, spatial structure, and diversity. A viable ESU/DPS is naturally self-sustaining, with a high probability of persistence over a 100-year time period. Each TRT made recommendations using the VSP framework and based on data availability, the unique biological characteristics of the ESUs/DPSs and habitats in the domain, and the members' collective experience and expertise. Although NMFS has encouraged the TRTs to develop regionally specific approaches for evaluating viability and identifying factors limiting recovery, all the TRTs are working from a common scientific foundation.

1.2.1 Planning Forum

In each of the W/LC and Interior Columbia recovery domains, NMFS has worked with state, tribal, local, and other Federal entities to develop planning forums that build to the extent possible on ongoing, locally led recovery efforts. NMFS defined "Management Units" based on jurisdictional boundaries as well as areas where local planning efforts were underway. The W/LC Domain has four management units: 1) Oregon, 2) Washington, 3) White Salmon and 4) Upper Willamette. The middle Columbia, a sub-domain of the Interior Columbia, also has four management units: 1) Oregon; 2) Washington Gorge, which, in turn, is subdivided into three planning areas; White Salmon, Klickitat, and Rock Creek; 3) Yakima Basin; 4) Southeast Washington.

NMFS works with recovery planning forums developed by the State. In Washington State these forums typically include representatives from state, tribal, local governments, and other stakeholders. The appropriate jurisdictions have not yet established a planning forum for the Washington Gorge Management Unit. Therefore, NMFS has worked independently with the YN, Klickitat County, WDFW, and local entities to develop the recovery plan for White Salmon River salmon and steelhead populations. NMFS encourages creation of a local planning forum that could provide guidance for further development and implementation of recovery plans for the Washington Gorge Management Unit.

1.3 How NMFS Intends to Use the Plan

Although recovery plans are not regulatory and their implementation is voluntary, they are important tools that help to do the following:

- Provide context for regulatory decisions
- Guide decision making by Federal, state, tribal, and local jurisdictions
- Provide criteria for status reporting and delisting decisions
- Organize, prioritize, and sequence recovery actions
- Organize research, monitoring, and evaluation efforts

NMFS will encourage Federal agencies and non-Federal jurisdictions to take recovery plans under serious consideration as they make the following sorts of decisions and allocate their resources:

- Actions carried out to meet Federal ESA section 7(a)(1) obligations
- Actions that are subject to ESA sections 4d, 7(a)(2), or 10
- Hatchery and Genetic Management Plans and permit requests
- Harvest plans and permits
- Selection and prioritization of basin and watershed planning actions
- Development of research, monitoring, and evaluation programs
- Revision of land use and resource management plans

- Other natural resource decisions at the state, tribal, and local levels

NMFS will emphasize recovery plans in ESA section 7 (a)(2) consultations, section 10 permits, and application of the section 4(d) rule by considering:

- Delisting criteria that address both viability and threats
- Description of limiting factors and threats (factors for decline)
- Description of a recovery program (site specific management actions necessary to achieve recovery of the species)
- Estimates of the time and cost to carry out measures to achieve the Plans' goals

In implementing these programs, recovery plans will be used as a reference and a source of context, expectations, and goals. Under section 7 of the ESA, NMFS staff will encourage the Federal "action agencies" to describe in their biological assessments how their proposed actions will affect specific populations, the limiting factors identified in the recovery plans, and any mitigating measures and voluntary recovery activities in the action area.

2 Biological Background

This chapter describes population and habitat characteristics for the White Salmon River salmon and steelhead populations. The chapter also discusses hatchery production and releases and harvest management in the White Salmon River watershed.

2.1 Populations and Major Population Groups

Lower Columbia River Chinook salmon

White Salmon River fall and spring Chinook salmon are included in the LCR Chinook salmon (*Oncorhynchus tshawytscha*) ESU, which NMFS listed as threatened on March 24, 1999, and reaffirmed on June 28, 2005. The ESU includes all naturally spawned populations of Chinook salmon in the CR and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point east of Hood River in Oregon and the White Salmon River in Washington. The historical site of Celilo Falls on the CR is considered the transitional point for this ESU, since it may have been a migration barrier to Chinook salmon at certain times of year (Myers et al. 1998). The ESU exhibits three major life history types: fall-run (tules), late fall-run (brights), and spring-run. The White Salmon River historically supported two of these life history strategies: fall-run Chinook salmon tules (Figure 2-1), and spring-run Chinook salmon (Figure 2-2).

There is no direct documentation of a historical (pre-Condit Dam) population of naturally spawning spring Chinook salmon (Myers et al. 2006). Fulton (1968) speculated that tribal members historically caught Chinook salmon upstream of Husum Falls, which were likely spring Chinook salmon, citing Bryant (1949) and USFWS (1951). These reports, however, did not indicate direct observations. Evermann and Meek (1898) surveyed the White Salmon River in August and September. No Chinook salmon were observed in August, possibly due to conditions not being conducive to observation due to flooding from the CR and to investigating only the lower mile of the river. Additionally, LeMier and Smith (1955) interviewed a long time resident who was unable to confirm the presence of spring Chinook salmon in the watershed.

Even though documentation of direct observations of spring Chinook salmon by 20th-centery residents, Myers et al. 2006 determined, based on the historically available habitat, that spring Chinook salmon were historically present in the basin. The observation of a spring Chinook salmon redd above Husum Falls on September 20, 2012, further supports the historical presence of spring Chinook salmon in the basin (personal communication R. Engle, USFWS, 2012). The determination that the redd observed belonged to spring Chinook salmon was based on the timing of the redd (prior to tule fall Chinook salmon spawning), the size (too large for resident trout), and its location above Husum Falls (no fall Chinook salmon have been observed above Husum Falls).

LeMier and Smith (1955) evaluated the capacity of the White Salmon River to support salmon if passage was re-established. Under conditions existing in 1955, they estimated the river could support 732 spring Chinook salmon and 452 fall Chinook salmon, but noted that conditions in the White Salmon River were degraded substantially in 1955 relative to historical levels. Ecosystem Diagnosis and Treatment (EDT) modeling indicated the historic potential abundance of fall Chinook salmon was roughly 775 adults. This figure is less than the estimated current potential without harvest, which suggests some error in the model assumptions or the reporting of results (Allen and Connolly 2005). The EDT modeling indicated the historic potential abundance of spring Chinook salmon was roughly 825 adults.

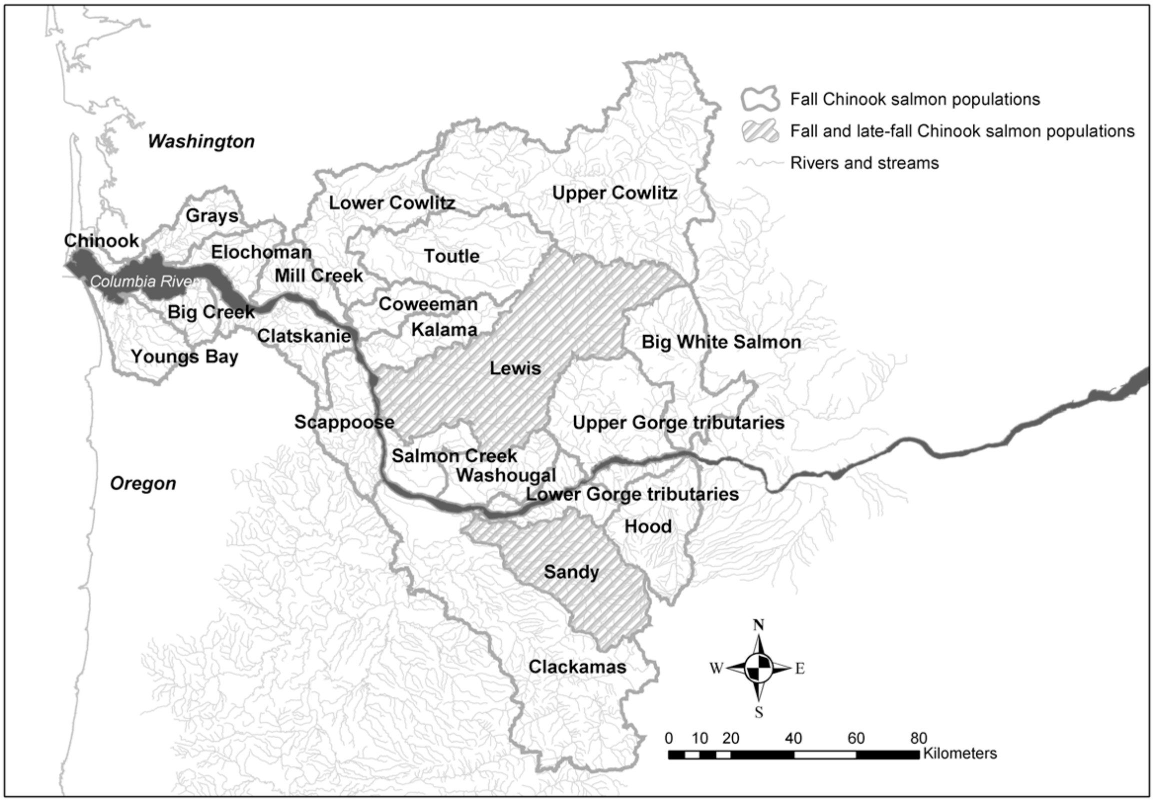

Figure 2-1. Historical fall and late fall demographically independent populations in the lower Columbia River Chinook salmon ESU (Myers et al. 2006)

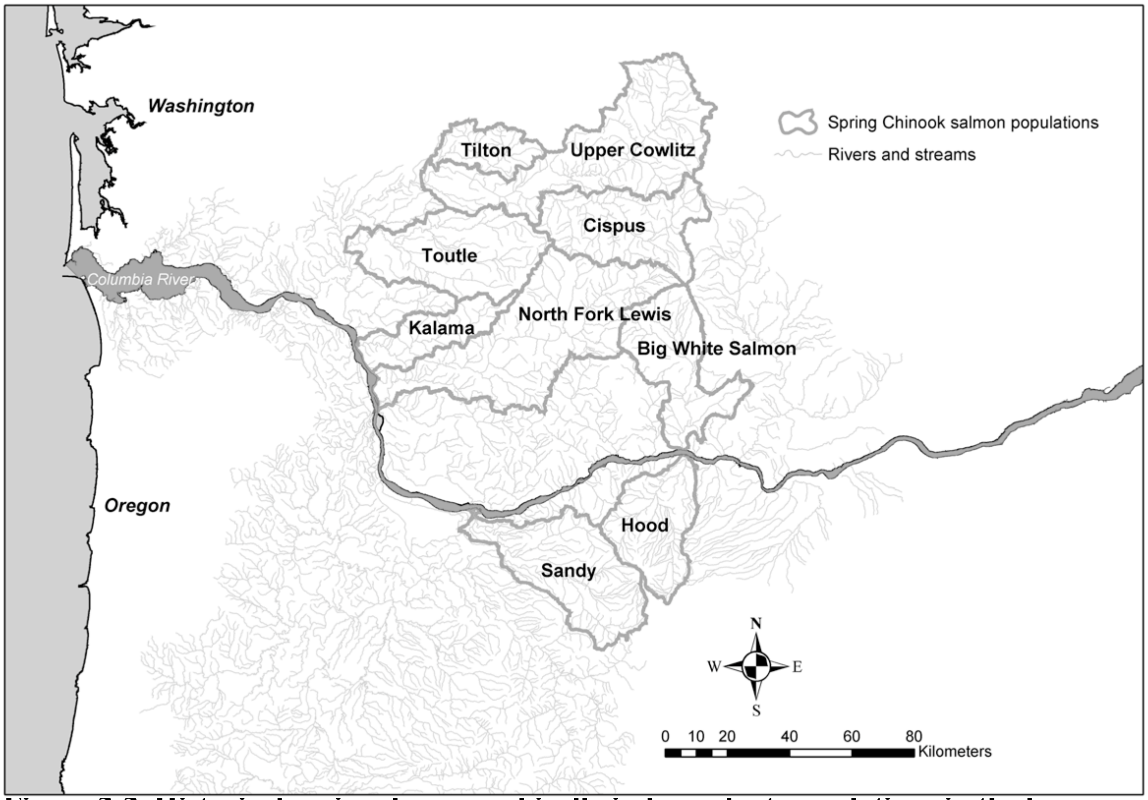

Figure 2-2. Historical spring demographically independent populations in the lower Columbia River Chinook salmon ESU (Myers et al. 2006)

Lower Columbia River coho salmon

White Salmon River coho salmon are part of the LCR coho salmon (*Oncorhynchus kisutch*) ESU, which NMFS listed as threatened on June 28, 2005. The ESU includes all naturally spawned coho salmon populations in the CR and its tributaries from the mouth of the CR to a transitional point east of the Hood River in Oregon and the White Salmon River in Washington (Figure 2-3). At the time of listing, biologists identified only two naturally spawning populations: the Sandy River and the Clackamas River populations in Oregon.

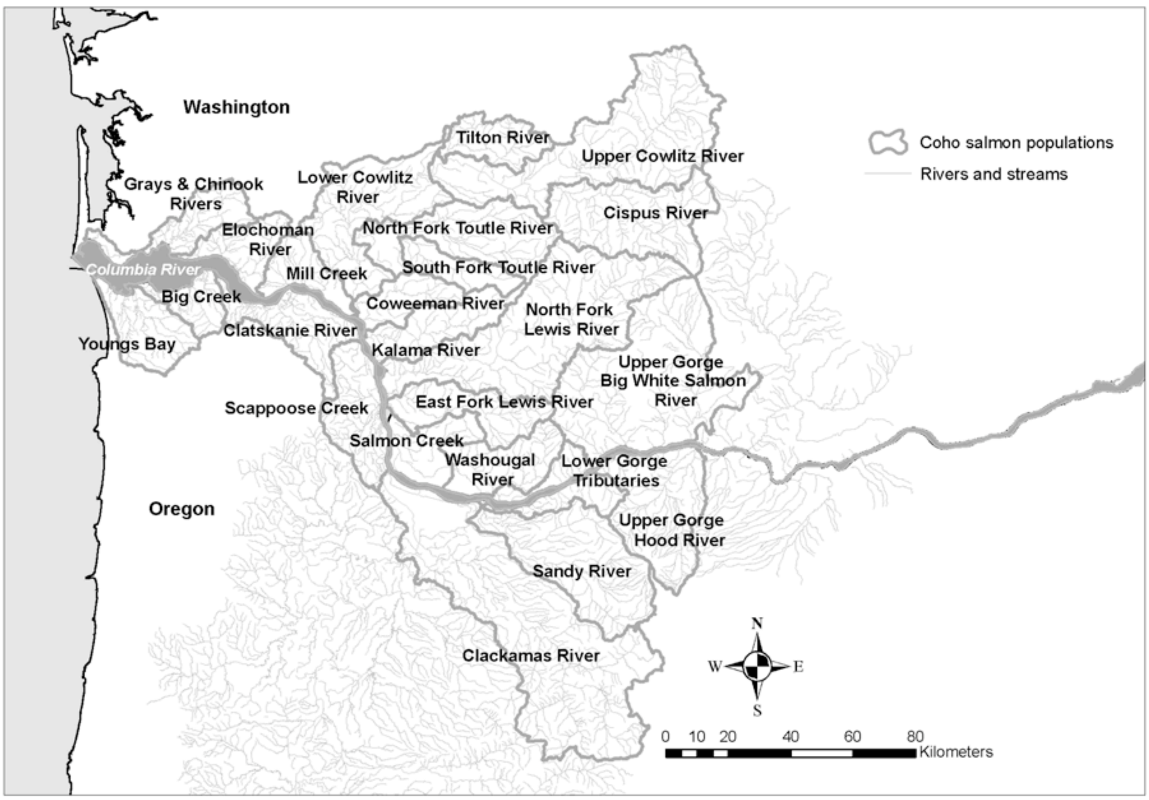

Figure 2-3. Historical demographically independent populations in the lower Columbia River Coho salmon ESU (Myers et al. 2006)

***Columbia River chum salmon* -** White Salmon River chum salmon were part of the upper Gorge Tributaries population of CR chum salmon *(Oncorhynchus keta*) ESU, which NMFS listed as threatened on March 25, 1999, and reaffirmed on June 28, 2005. The ESU includes all naturally spawning populations in the CR and its tributaries in Washington and Oregon (Figure 2-4).

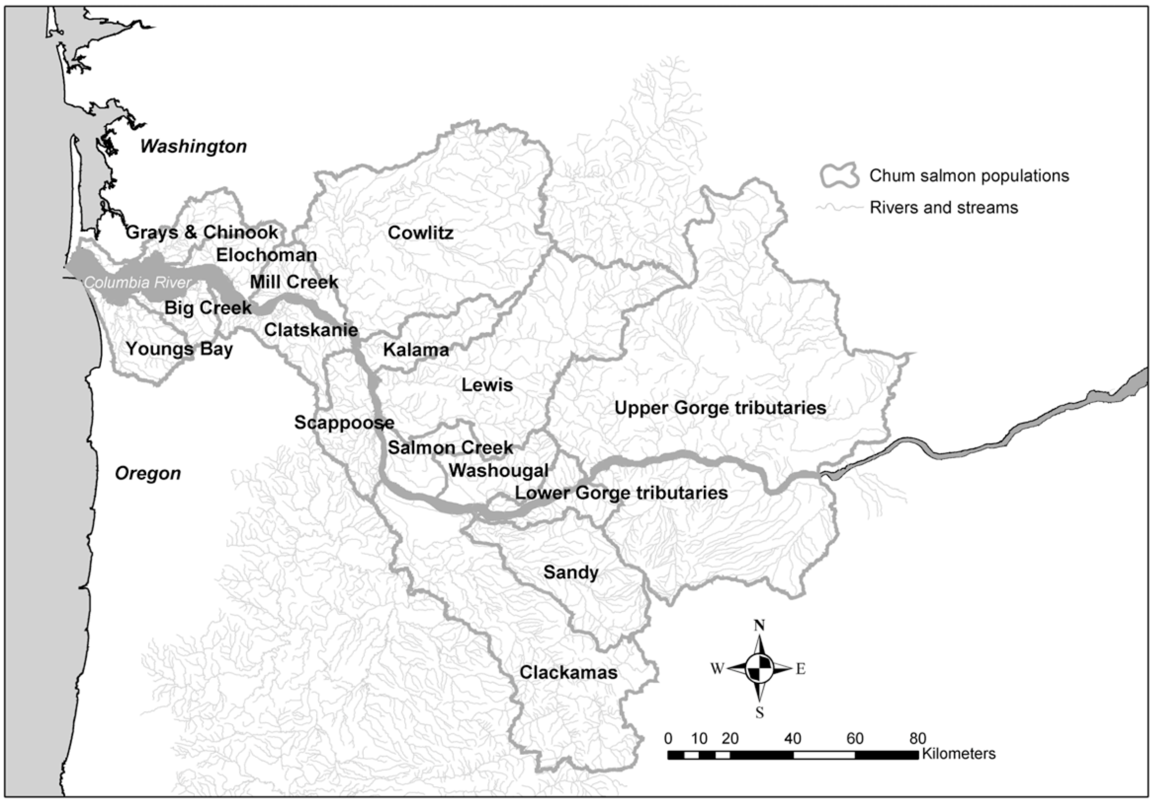

Figure 2-4. Historical demographically independent populations in the Columbia River chum salmon ESU (Meyers et al. 2006)

Middle Columbia River Steelhead

White Salmon River steelhead are part of the MCR Steelhead (*Oncorhynchus mykiss*) DPS, which NMFS listed as threatened on January 5, 2006. This DPS includes all naturally produced steelhead in the CR Basin upstream of the Wind River in Washington and the Hood River in Oregon (exclusive) to the Yakima River in Washington. Excluded are steelhead from the Snake River Basin (Busby et al. 1996). The MCR Steelhead DPS includes the only populations of inland winter steelhead in the United States (in the Klickitat and White Salmon rivers, Washington, and in Fifteenmile Creek, Oregon). The ICTRT identified 20 populations within the DPS (16 summer-run and 4 winter-run). In addition the ICTRT identified the historical populations that have been extirpated in Willow Creek due to dam construction in the Deschutes River Basin (ICTRT 2004). Figure 2-5 shows populations within the DPS. The White Salmon population was initially considered to be one of the extirpated populations, (however, later analysis defined the population as being functionally extirpated (ICTRT 2007b).

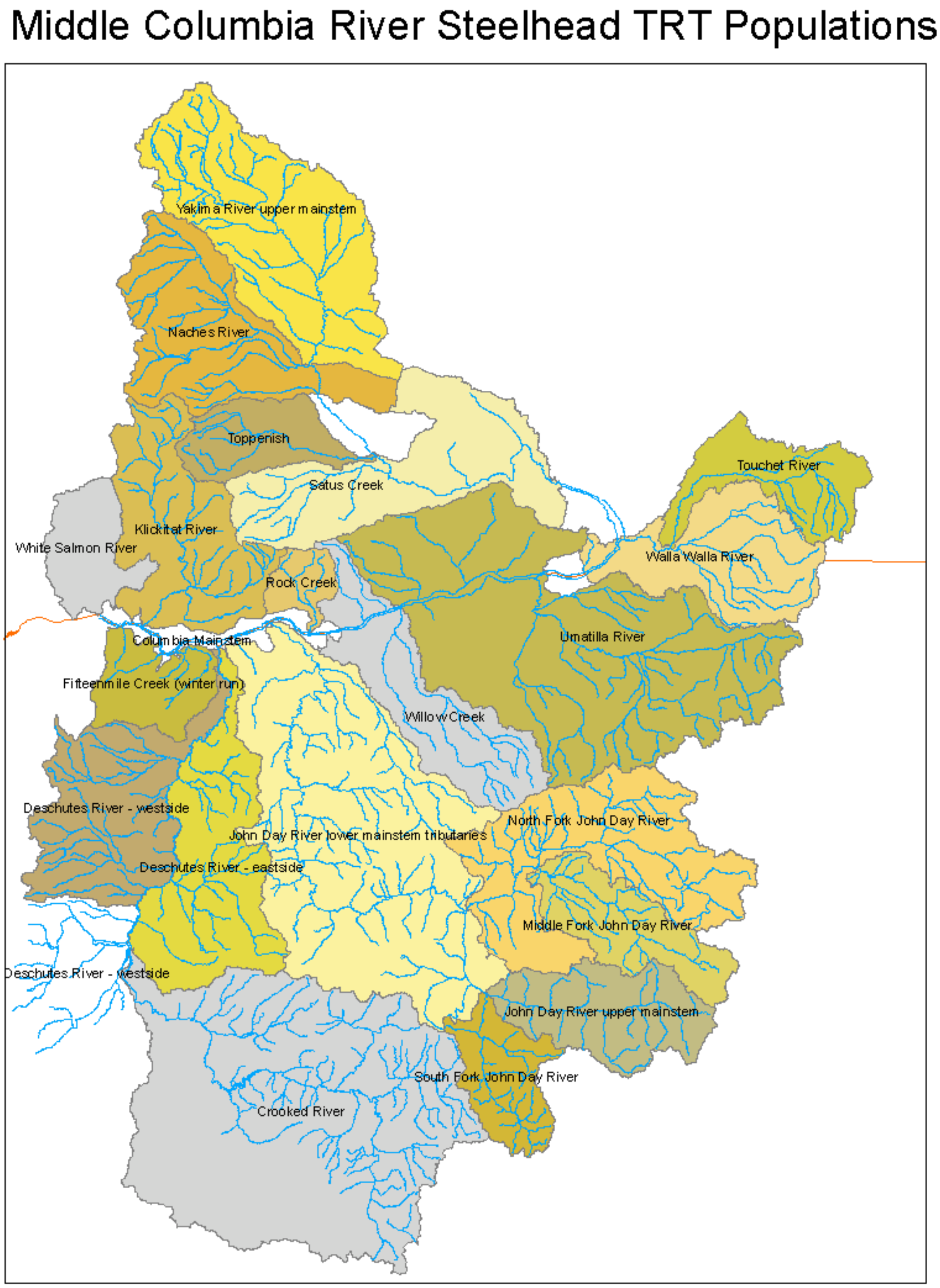

Figure 2-5. Historical summer and winter steelhead populations in the middle Columbia River DPS (ICTRT 2004; ICTRT 2007b). Note populations in gray are extirpated or functionally extirpated

2.2 Physical Setting

The White Salmon River watershed drains approximately 386 square miles in south central Washington. The river begins along the south slope of Mt. Adams and flows south 45 miles to enter the CR at Underwood, Washington at CR RM 168.3. Elevation in the watershed ranges from 12,307 feet on Mt. Adams to 72 feet at the river's mouth.

The White Salmon River watershed lies primarily within Klickitat County, however, the lower river below the top end of the former Northwestern Lake is shared with Skamania County, and the headwaters of the watershed also extend into Skamania and Yakima counties. These counties have a combined human population of 395,000 with less than 9,000 people living in the White Salmon watershed, http://www.ofm.wa.gov/pop/smallarea/default.asp (accessed April 11, 2012). The watershed falls within Washington State's WRIA 29b. Half of the watershed lies within the Gifford Pinchot National Forest and supports timber production and recreational uses.

Several reaches of the White Salmon River have received special designations because of their scenic value. The nine-mile reach from the confluence of Gilmer Creek near BZ Corner to Buck Creek was designated a Federal Wild and Scenic River in 1986. The upper White Salmon from the headwaters to the boundary of the Gifford Pinchot National Forest, and Cascade Creek from its headwaters to its confluence with the White Salmon River was designated as a National Wild and Scenic River in 2005. The reach from the former location of Condit Dam, RM 3.3, to the mouth is within the boundaries of the CR Gorge National Scenic Area. Recovery actions within these designated scenic areas should be coordinated with the U.S. Forest Service (USFS) to ensure the scenic values are maintained.

2.3 Ecosystem Conditions

The watershed lies within a transitional ecosystem area. Western portions of the watershed receive moderate to heavy precipitation. Eastern portions of the watershed are substantially more arid. Vegetation reflects this transitional location, with mixed forests covering about 95 percent of the watershed and grasslands and shrub steppe dominating remaining areas (Haring 2003). Trout Lake Valley, the major watershed valley, is surrounded by hills to the west and rolling plateaus to the east.

The White Salmon River and tributaries carve a watershed that is often rugged and steep, reflecting its past volcanic activity (Figure 2-6). From its headwaters, the White Salmon cuts sharply through mountains with precipitous cliffs and deeply incised canyons, dropping more than 5,000 feet in elevation before it reaches Trout Lake near RM 26, with a gradient change of 200 feet per mile (4 percent) between RM 35 and RM 30. The White Salmon loses another 1,800 feet in elevation from Trout Lake to the Columbia River. Gradient drops an average of 100 feet per mile (2 percent) from RM 17 to RM 12 as the river flows through a steep gorge with several falls. Tributaries between RM 7.6 and 16.3 are inaccessible to fish because of high falls at their mouths (NPCC 2004; WDFW and YN 1990).

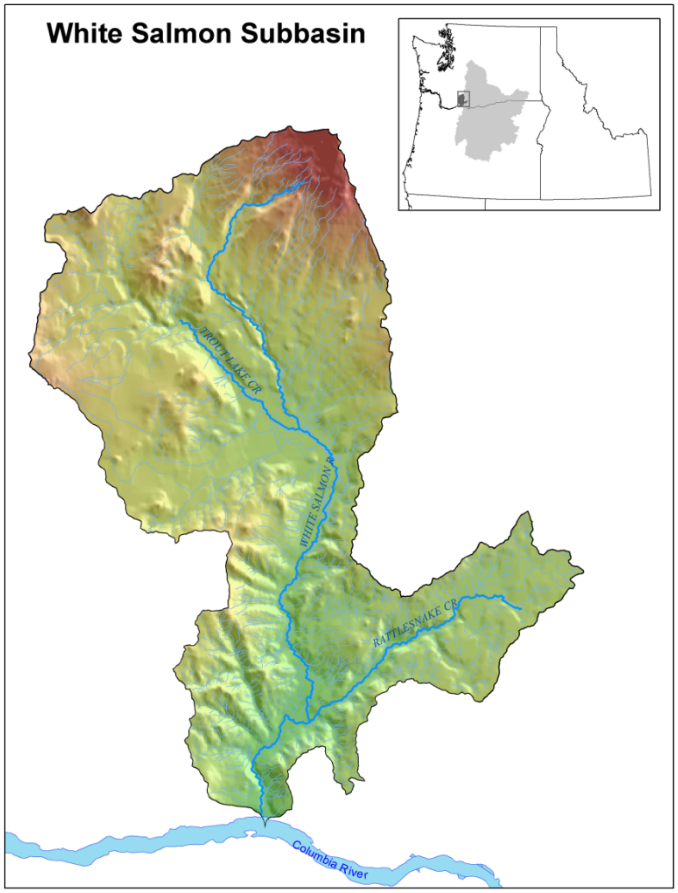

Figure 2-6. White Salmon River watershed topography and hydrology (NPCC 2004)

2.3.1 Hydrology

The White Salmon River mainstem naturally has a relatively constant natural flow pattern because of glacial melt, large water recharge, and storage capacity. Today this constant flow regime continues throughout the mainstem. Recharged water is released mostly in the middle portion of the mainstem canyon between the Trout Lake Valley and Husum Falls. Peak flows in the mainstem reflect snowmelt runoff, increasing from an average daily flow of 644 cfs during fall months to flows of 1,538 cfs in the spring (Haring 2003).

Operations at Condit Dam altered flows in the White Salmon River below the dam, causing flows to drop to as low as 15 cfs in the 1.1-mile bypass reach compared to natural flows of about 700 cfs. Power peaking at the dam affected the river system by causing diel flow variations and by impairing watershed processes, such as the transportation of spawning gravels and LWD to areas downstream of the project (NPCC 2004). The dam was breached in October, 2011 and flows will return to the natural condition as the final stages of dam removal are completed.

Tributary reaches of the White Salmon generally have more volatile flows than the mainstem, dropping to low levels in the summer and peaking in the winter. Some tributaries flow only during high flow events and are dry the remainder of the year (NPCC 2004). Some of these tributaries may also be affected by exempted wells that can reduce recharge rates and flows.

2.3.2 Migration Barriers

Condit Dam, constructed at RM 3.3, was completed in 1913 and blocked upstream migration of anadromous fish since that time, as well as causing high mortality for outmigrating juveniles. The dam was breeched in 2011 and completely removed by October 2012. Anadromous salmonids now have complete access to habitat upstream of RM 3.3.

Prior to construction of the dam, the upstream limit of all anadromous fish migration in the White Salmon River, except for possibly Pacific lamprey, was the upper falls at Big Brother Falls, RM 16.2, which is approximately 29 feet high. Historic reports of steelhead occurring above Big Brother Falls (Lane and Lane Associates1981) were apparently large resident rainbow trout (*O. mykiss*) confused as being steelhead (Chapman et al. 1990; Bair et al. 2002). BZ Falls at RM 12.4, about 15 to 17 feet high, is likely to be the upstream limit for all salmonids, except for steelhead. Steelhead will likely be able to pass BZ Falls, but the upstream extent of the potential steelhead habitat will not extend beyond Big Brother Falls. Downstream of BZ Falls, Husum Falls, RM 7.6, was probably the historical barrier to fall-run Chinook salmon, sea-run coastal cutthroat trout, and perhaps coho salmon. Blasting shortly after the construction of Condit Dam reduced the height of the falls (Lane and Lane Associates 1981). In its current configuration, Husum Falls is not a barrier to the passage of adult resident or anadromous salmonids, except at low fall flows, and will likely be a barrier to the upstream passage of juvenile salmonids and adult chum salmon. Numerous barrier falls 4 feet in height or greater on the river between Husum and Big Brother Falls will be partial or complete barriers to the upstream migration of juvenile salmonids (LeMier and Smith 1955).

Barriers also restrict salmon and steelhead production in several White Salmon tributaries. With the exception of steelhead, and possibly coho salmon under ideal flow conditions, the falls at RM 1.5 on Rattlesnake Creek and RM 0.8 on Mill Creek will be barriers to upstream migration for all salmonids. A 4-foot high diversion dam at RM 1.9 on Buck Creek will be a barrier to the upstream migration of salmonids < 9 inches in length (Bair et al. 2002). A waterfall at RM 3.2 on Buck Creek and the hydro project dam at RM 0.7 on Spring Creek will be complete barriers to upstream salmonid migration, as is a double-fall (72-82 feet) at RM 10.6 on Rattlesnake Creek (Allen et al. 2003).

2.3.3 Riparian Function and Conditions

In comparison to other CR subbasins, the White Salmon watershed is lightly to moderately developed. However, historical logging practices, including mainstem splash damming, and associated road building and inappropriate riparian grazing have likely resulted in modification of flows, increased sedimentation, reduced riparian vegetation, loss of LWD, and increased summer temperature in some areas (NPCC 2004).

Until 1974, timber harvest typically extended to the edge of the stream/river. These practices were restricted in 1974 and have been further restricted in subsequent modifications of the Washington State Forest Practices Rules http://www.dnr.wa.gov/Publications/fp_rules_history.pdf (accessed April 11, 2012). Additionally, the USFS prohibits harvest in riparian areas along fish bearing streams www.reo.gov/general/aboutNWFP.htm (accessed July 13, 2010).

Grazing has occurred since the late 1800s in the Rattlesnake Creek watershed and Trout Lake Valley, reducing native vegetation. Large historic marsh areas in the upper Rattlesnake Creek watershed were drained in the early 1900s to improve grazing conditions (Haring 2003). Today timber practices have improved, grazing is better managed, and wetland draining has stopped. Nevertheless, many impacts of past land use actions remain in the watershed (Haring 2003). Residential development is occurring with increasing frequency in the lower watershed and along State Route 141; however, construction within the riparian area is largely prohibited.

Some habitat areas in the White Salmon River and tributaries remain healthy, but land use activities affect many areas. EDT modeling results suggest that mainstem habitat is in better shape than tributary habitat, with maximum temperatures, minimum temperatures, and dissolved oxygen remaining at optimum levels (Allen and Connolly 2005). The EDT modeling was completed prior to removal of the dam in 2011, and the model results do not reflect current conditions in the former lakebed or downstream of the dam. New data collected since the modeling was completed indicate that temperature meets Washington state water quality standards throughout the anticipated anadromous range with the exception of Rattlesnake Creek, which occasionally approaches lethal temperatures in some locations in some years (White and Plumb 2004; White and Plumb 2005; White and Cochrane 2005; Connolly 2003; Morris 2005). Habitat surveys completed in the watershed indicate that large wood and pools are low in frequency throughout the Rattlesnake watershed and many of the existing pools are of poor quality (shallow with little cover) (Allen and Connolly 2006a). Unscreened diversions in some locations may potentially affect juvenile survival. Nutrient levels in many portions of the watershed are quite high, up to two times the EPA recommended standard (White and Plumb 2004, 2005; White and Cochrane 2005, Environmental Protection Agency (EPA) 2000).

2.4 Life History Characteristics

2.4.1 White Salmon River Chinook salmon

This section describes fall and spring Chinook salmon populations in the White Salmon River watershed.

Abundance and Productivity

The W/LC TRT recognizes two historical independent Chinook salmon populations in the watershed: White Salmon River fall-run Chinook salmon and White Salmon River spring-run Chinook salmon (Myers et al. 2003; Myers et al. 2006). These historical Chinook salmon populations are considered to be part of the Gorge stratum (or Major Population Group (MPG)) of the lower Columbia Chinook salmon ESU (Myers et al. 2006). These populations are described below.

Fall Chinook salmon

Biologists consider tule fall Chinook salmon native to the system, although the historical size of the fall-run to the White Salmon River is unknown. Past hatchery records indicate that fall-run Chinook salmon in the LWS and White Salmon rivers began spawning in early September, with peak egg takes in the later part of the month (September 21, 1901); 12,840,700 eggs were collected in 1901 (Myers et al. 2003; Myers et al. 2006; Bowers, 1902).

The current stock origin for the naturally spawning tule fall Chinook salmon is considered mixed (NOAA 2005). Hatchery tule fall Chinook salmon were last released in the White Salmon River in the 1980s, but strays are commonly recovered in the river (WDFW 2003). The Spring Creek NFH is located on the CR approximately one mile west of the mouth of the White Salmon River.

Most of the fish spawning naturally in the White Salmon River were assumed to be hatchery-origin tule fall Chinook salmon based on CWT recoveries. The USFWS (2004) estimated natural-origin fall Chinook salmon escapement in the White Salmon River by subtracting the hatchery component calculated by expanding the number of CWT recovered during carcass surveys by the Spring Creek Hatchery brood year tag rate from the total tule escapement (Figure 2-7). Spring Creek NFH began marking all of its hatchery production in 2004 and as a result, recent spawning ground surveys have shown that the majority of the tule fall Chinook salmon returning to the White Salmon River are of natural origin (Roler 2011). The total number of fall Chinook salmon spawners (natural-origin and hatchery) has averaged 2,750 from 1998-2007, even with low returns in the early 2000s (USFWS 2004; Roler 2009). The recent 10-year average (2002-2011) for escapement of natural spawning tule fall Chinook salmon in the White Salmon River has increased to 3,127 adults (Roller 2012). Smith et al. (2007) determined that Spring Creek NFH tule fall Chinook salmon and natural-origin fall tule fall Chinook salmon in the White Salmon were genetically similar and were distinct from other tule fall Chinook salmon populations in the LCR ESU. Natural spawning tule fall Chinook salmon were also found to have not interbred with URB fall Chinook salmon that also spawn in the White Salmon River (Smith and Engle 2011).

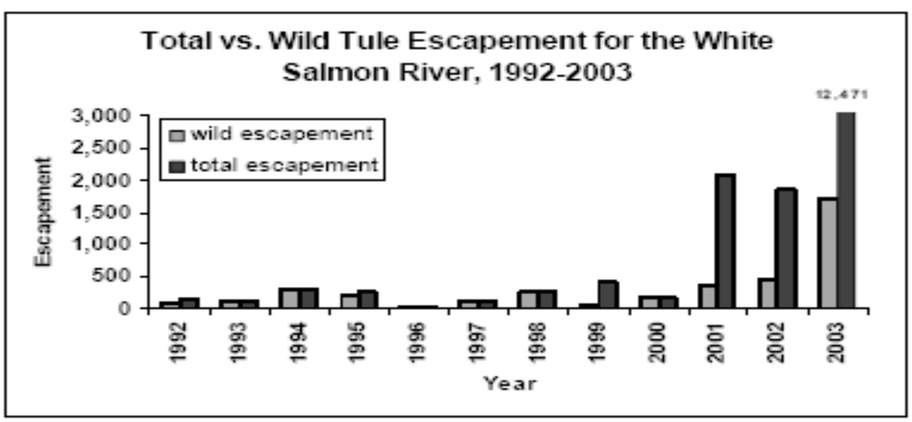

Figure 2-7. Wild and total tule fall Chinook salmon escapement for the White Salmon River from 1992-2003 (USFWS 2004)

Spring Chinook salmon

Biologists generally believe the White Salmon spring Chinook salmon population was historically significant, but declined to low numbers after construction of Condit Dam (LCFRB 2004). Fulton (1968) speculated that Chinook salmon historically caught by tribal members upstream of Husum Falls were likely spring Chinook salmon, citing Bryant (1949) and USFWS (1951) but these reports did not indicate direct observations of spring Chinook salmon. Evermann and Meek (1898) surveyed the White Salmon River in August and September and did not observe Chinook salmon in August, however, the conditions were not conducive to observation due to flooding from the CR, and only the lower mile of the river was investigated. If the life history timing of the White Salmon spring Chinook salmon were similar to other LCR spring Chinook salmon populations, adult spring Chinook salmon would be expected to be on the spawning grounds in the upper river during the month of August, not entering their natal river. Lane and Lane Associates (1981) document early indications of the presence or absence of spring Chinook salmon in the White Salmon River. Some of the persons interviewed remembered the presence of spring Chinook salmon, while others could not verify these observations. The W/LC TRT deduced that there was an historical population of spring Chinook salmon in the White Salmon River (Myers et al. 2006).

LeMier and Smith (1955) evaluated the capacity of the White Salmon River to support salmon if passage was provided upstream of Condit Dam. Under conditions existing in 1955, they estimated the White Salmon River could support 732 spring Chinook salmon and 452 fall Chinook salmon, but noted that conditions in the White Salmon River were degraded substantially in 1955 relative to historical levels. Chapman (1981), using instream flow measurements, estimated that in pristine conditions prior to the construction of Condit Dam the White Salmon River supported 625 adult Chinook salmon (spring and fall runs combined). Using similar methods, Young and Rybak (1987) estimated that the habitat upstream of Northwestern Reservoir could support 35,000 spring Chinook salmon smolts, and from 140 to 1,120 spring Chinook salmon adults. Chapman (1981) and Young and Rybak (1987) noted that the watershed has cool summer water temperatures and deep canyon pools, conducive to spring Chinook salmon holding and rearing. The EDT modeling effort estimated capacity for approximately 560 to 650 spring Chinook salmon in the watershed. W/LC TRT members generally believe that the construction of Condit Dam extirpated spring Chinook salmon in the White Salmon River and eliminated the genetic resources of the population (McElhany et al. 2004, p. 71). As recently as 2009, stray hatchery spring Chinook salmon have been observed holding and spawning below Condit Dam, but their reproductive success is unknown (McElhany et al. 2004; NPCC 2004; Engle et al. 2010).

Spatial Structure and Diversity

Prior to the construction of Condit Dam, spring Chinook salmon probably ranged up the White Salmon River to above Husum Falls, RM 12, and probably up to Big Brother Falls at RM 16.2 (Chapman 1981; Young and Rybak 1987). They may have also migrated into Rattlesnake Creek (NPCC 2004). Fall Chinook salmon were limited to spawning and rearing habitat below Husum Falls (NPCC 2004). This conclusion was confirmed using Radio-tagged adult fall Chinook salmon released above Condit Dam (Engle and Skalicky 2009).

Since 1913, Condit Dam has limited distribution for Chinook salmon to the 3.3-mile area below the dam. While the dam was in place, Chinook salmon spawned and reared in the lower White Salmon River below Condit Dam, (Figure 2.8). Most of these spawners were fall Chinook salmon and many were hatchery strays. In 2011, fisheries co-managers transported and released upstream of Northwestern Lake naturally spawning Chinook salmon entering the White Salmon River in order to preserve the year class. Any redds present downstream of the dam when it was breached would have been destroyed though scour and subsequent deposition of sediments.

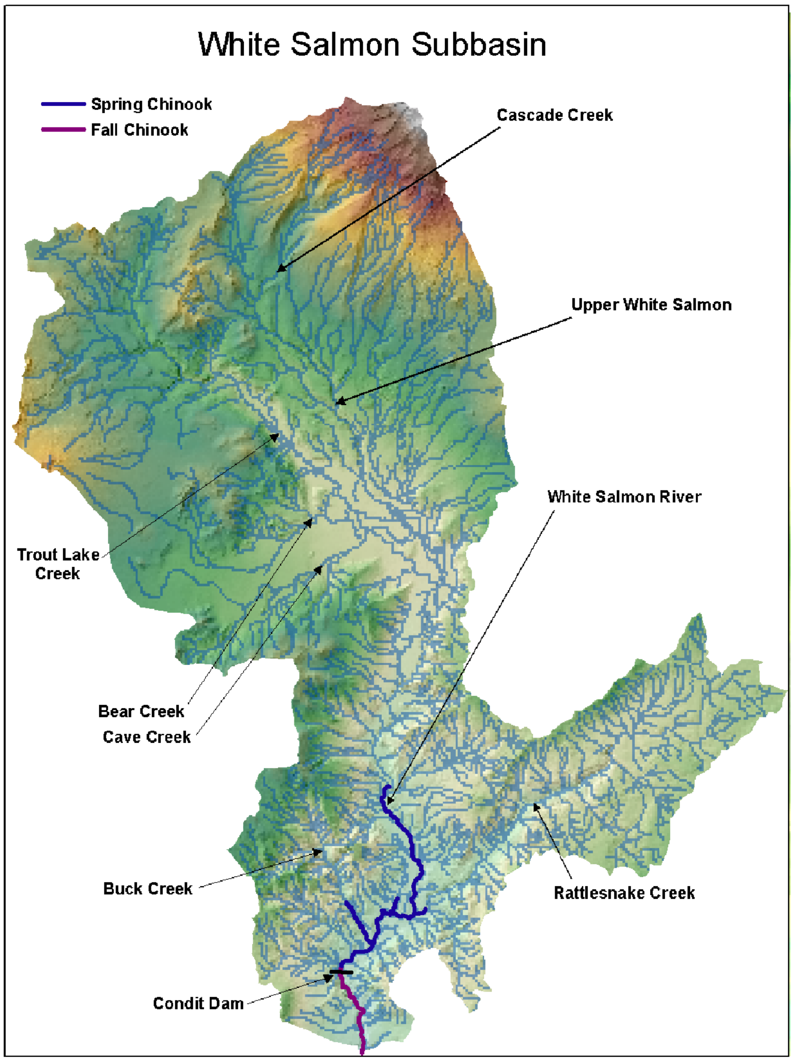

Figure 2-8. Possible extent of historic spawning distribution of Chinook salmon in the White Salmon River (NPCC 2004)

Key Habitat during Different Life Stages

Biologists consider White Salmon River fall-run Chinook salmon an ocean-type salmon because they migrate to the ocean as subyearlings. Tule Chinook salmon begin entering the CR in early August, with the greatest abundance in the estuary between late August and early September. Tule counts at Bonneville Dam generally peak between September 4 and

September 9. Most tules mature at age three, with very few five-year-olds. Fall Chinook salmon spawning in the White Salmon River peaks in late September through early October. The adults tend to spawn in mainstem rivers and large tributaries.

Since human activities have extirpated native spring-run Chinook salmon in the White Salmon River, scientists know little about their life history. Biologists would expect the historical spring-run Chinook salmon population to have a life history similar to other LCR ESU spring Chinook salmon populations. These spring Chinook salmon are a stream type because they primarily smolt as yearlings. Fecundity varies within and among Chinook salmon populations. Adult spring-run Chinook salmon enter the Columbia River from February to Mid-May and spawn from late July to late September (Fulton 1968).

Both fall and spring Chinook salmon generally spawn in stream reaches at least 10 feet wide. They construct redds in gravel and small cobble substrate in pool tailouts, riffles, and glides. Eggs remain in the gravel until emergence, which occurs from February to April depending on water temperatures. Emerging fry seek out shallow, low velocity areas in the stream channel, preferring backwater and dammed pools, along with glides. Shortly after fry colonization, however, tule fall Chinook salmon juveniles begin their outmigration, while the spring Chinook salmon juveniles can continue rearing until October. During the inactive or overwintering life stage, spring Chinook salmon juveniles prefer non-turbulent deeper water habitat types (primary pools) in the main channel, but also use slower portions of large cobble riffles. Yearling spring Chinook salmon outmigrate during the following spring.

Table 2-1 shows key habitat for fall and spring Chinook salmon during different life stages.

Table 2-1. Key habitat by life stage and time period for fall/spring Chinook salmon (NPCC 2004)

Life Stage	Relevant Months	Key Habitat Descriptions
Spawning	Tule Sep-Oct Spring Aug-Sep	Riffles, tailouts, and the swifter areas in glides containing a mixture of gravel and cobble sizes with flow of sufficient depth for spawning activity
Incubation	Aug-May	Riffles, tailouts, and the swifter areas of glides as described for spawning with sufficient flow for egg and alevin development
Fry Colonization	Feb-May	Shallow, slow velocity areas within the stream channel, including backwater areas, often associated with stream margins and back eddies and usually in relatively low gradient reaches
Active Rearing	Tule Feb-June Spring Mar-Oct	Relatively slow water habitat types, often near velocity shears, often associated with relatively low gradient stream channel reaches, including primary pools, backwaters, tailouts, glides, and beaver ponds
Inactive Rearing	Oct-Mar	Non-turbulent habitat types, particularly deeper water types within the main channel, but also including slower portions of large cobble riffles
Migrant	Tule, Age 0 Mar-Jun Spring, Age 1 Mar-May	All habitat types having sufficient flow for free movement of juvenile migrants

Life Stage	Relevant Months	Key Habitat Descriptions
Pre-spawning Migrant	Tule Aug-Oct Spring Feb-Sep	All habitat types having sufficient flow for free movement of sexually mature adult migrants
Pre-spawning Holding	Tule Aug-Oct Spring Aug-Sep	Relatively slow, deep water habitat types typically associated with (or immediately adjacent to) the main channel

2.4.2 White Salmon River coho salmon

Myers et al. (2006) included the historic coho salmon population in the White Salmon River as part of the Gorge Stratum within the lower Columbia coho salmon ESU. This section describes the White Salmon River coho salmon population.

Abundance and Productivity

The W/LC TRT determined that coho salmon are native to the White Salmon River based on habitat and historical presence of coho salmon in other CR gorge tributaries (Myers et al. 2006). Rich (1938) indicated that only a very small portion of the total CR coho salmon run migrated beyond Bonneville Dam. None of the early surveys of fisheries identified coho salmon in the White Salmon River, although the timing of these surveys did not coincide with coho salmon presence. Interviews with long-term residents and notes found in diaries indicate that coho salmon were likely present, but in low numbers (Lane and Lane Associates 1981; Cobb 1924).

Chapman (1981), using instream flow measurements, estimated that in pristine conditions prior to the construction of Condit Dam the White Salmon River supported 5,489 adult coho salmon. Young and Rybak (1987) estimated that the habitat could support 45,000 coho salmon smolts, and from 1,600 to 2,300 coho salmon adults. Scientists consider the current population in the White Salmon River extirpated (Johnson et al. 1991; Weitkamp et al. 1995; Schiewe 1996; Good et al. 2005). Good et al. (2005) suggested that recovery efforts could use existing hatchery programs to build naturally spawning populations. Currently, the size of this population is unknown. In a 2004 population status evaluation, W/LC TRT members found insufficient data to determine the productivity and abundance of the White Salmon River coho salmon population (McElhany et al. 2004). Some members noted that construction of Condit Dam probably resulted in the population's extirpation, as most historical spawning habitat for the population lies above the dam. Myers et al. (2006) in designating the historical population structure for coho salmon in the Gorge strata identified two populations above Bonneville Dam: Oregon tributaries and Hood River and Washington tributaries and the White Salmon River (including the Wind River, Spring Creek, and the LWS River).

The LCFRB Recovery Plan (LCFRB 2004) proposed an abundance goal for recovery of 150 fish. However, potential production estimates for coho salmon in the White Salmon River, completed for the NPCC subbasin planning (Allen and Connolly 2005; NPCC 2004) and for other efforts (Chapman et al. 1990; Washington Department of Fisheries (WDF) 1990) suggest that the drainage could support 950 to 2,300 coho salmon, if decision makers and scientists are able to restore passage to historical habitats above the dam.

Spatial Structure and Diversity

With the removal of Condit Dam, habitat that could potentially support coho salmon extends from the mouth up to RM 14 in the mainstem and into Buck, Spring, Indian, and Rattlesnake creeks (Figure 2-8) (NPCC 2004). This range may provide up to 21 miles of spawning and rearing habitat for coho salmon, with most potential spawning habitat above the location of the former Condit Dam. Prior to breaching the dam, hatchery strays occasionally use the area below Condit Dam (NPCC 2004).

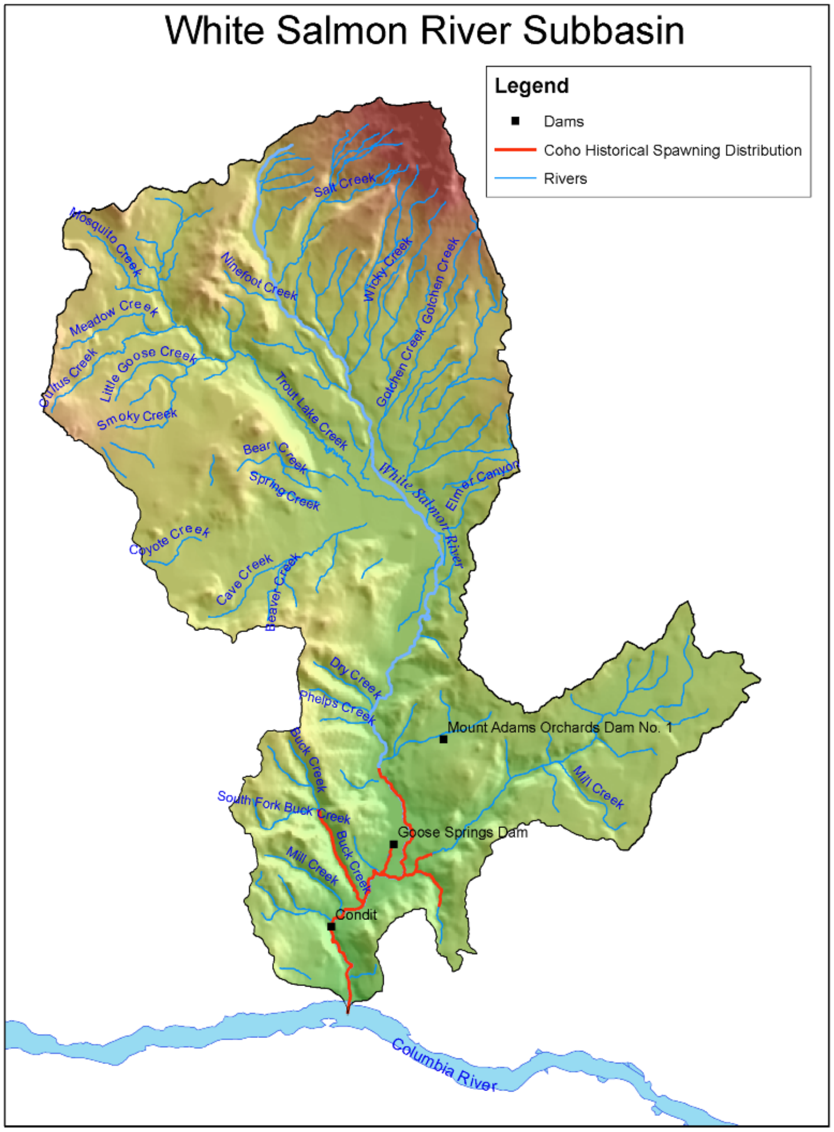

Figure 2-9. Potential extent of historical spawning distribution of coho salmon in the White Salmon River (McElhany et al. 2004)

Key Habitat during Different Life Stages

LCR coho salmon adults typically return to their spawning rivers from September through November, and typically spawn from October through January, with peak activity in November. Redds are constructed in gravel and small cobble substrate in pool tailouts, riffles, and glides, with sufficient flow depth for spawning activity. The eggs incubate in the gravel from October to May and generally emerge from February to April, depending on water temperatures. Emerging fry migrate to shallow, low velocity areas, which are associated with stream margins and back eddies.

After fry colonization, juvenile coho salmon seek out slow water habitat types near velocity shears, which are often associated with relatively low gradient stream reaches where they continue rearing until October. Preferred areas are primarily backwater and dammed pools. As winter approaches, juveniles become inactive and prefer off channel pool habitat over primary pool habitat for overwintering. Coho salmon yearling migration occurs the following spring, peaking in May.

Table 2-2 describes key habitat by life stage.

Table 2-2. Key habitat by life stage and time period for White Salmon River coho salmon (NPCC 2004)

Life Stage	Relevant Months	Key Habitat Descriptions
Spawning	Oct-Jan	Riffles, tailouts, and the swifter areas in glides containing a mixture of gravel and cobble sizes with flow of sufficient depth for spawning activity
Incubation	Oct-May	Riffles, tailouts, and the swifter areas of glides as described for spawning with sufficient flow for egg and alevin development
Fry Colonization	Mar-May	Shallow, slow velocity areas within the stream channel, including backwater areas, often associated with stream margins and back eddies and usually in relatively low gradient reaches
Active Rearing	0-age Mar-Oct 1-age Mar-May	Relatively slow water habitat types, often near velocity shears, often associated with relatively low gradient stream channel reaches, including primary pools, backwaters, tailouts, glides, and beaver ponds
Inactive Rearing	Oct-Mar	Non-turbulent habitat types, particularly deeper water types within the main channel, but also including slower portions of large cobble riffles
Migrant	Mar-May	All habitat types having sufficient flow for free movement of juvenile migrants
Pre-spawning Migrant	Sep-Nov	All habitat types having sufficient flow for free movement of sexually mature adult migrants
Pre-spawning Holding	Oct-Dec	Relatively slow, deep water habitat types typically associated with (or immediately adjacent to) the main channel

2.4.3 Upper Gorge chum salmon

This section describes the segment of the upper Gorge chum salmon population that historically occupied the White Salmon River.

Abundance and Productivity

Chum salmon that returned to the White Salmon River were part of the upper Gorge Tributaries population (McElhany et al. 2004). Annual fish passage reports by the U.S. Army Corps of Engineers (USACE) (2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008), for Bonneville Dam provided data that adult chum salmon continue to pass upstream of Bonneville Dam, with adult counts averaging 139 from 2000 to 2008 and ranging from a low of 49 to a high of 411. Recent chum salmon surveys by WDFW have identified fewer than five chum salmon carcasses above Bonneville Dam annually; no carcasses were observed in 2005 (Jenkins 2006), however researchers in Oregon observed chum salmon spawning at the mouth of Eagle Creek above Bonneville Dam in 2008 and 2009 (M. Weeber, personal communication 2010). Today, chum salmon are limited almost exclusively to habitats downstream of Bonneville Dam, with most spawning in Washington waters.

Biologists know little about the chum salmon production potential of the LCR or the White Salmon River. Chum salmon fecundity data are variable. In North America, the literature reports individual fecundity ranged from 2,018 to 3,977 eggs per female (Salo 1991). Fecundity data are available for wild chum salmon in the LCR, but not for the White Salmon River. Chum salmon broodstock collected from the lower Gorge population in 2007 had an average fecundity of 2,255 eggs and a range of 1,630 to 2,922 eggs (Hillson 2009).

In the upper Gorge Tributaries population, researchers assumed a 96 percent reduction in abundance due to the existence and operation of Bonneville Dam. They assumed impacts to be predominantly due to inundation of historical habitat by the reservoir (see spatial structure and diversity below), but to include about 5 percent passage mortality for juveniles and an additional 3 percent for adults (Tables 14-1 and 14-2 in NMFS 2008b).

Spatial Structure and Diversity

Small et al. (2006) analyzed genetic samples from populations in the coast, cascade, and gorge regions of the CR chum salmon ESU. They found significant heterogeneity in genotype distributions between zones and that collections formed regional groups in a neighbor joining tree. Cascade collections had higher allelic richness and private alleles, and the Cowlitz River supported genetically divergent fall and summer runs, the only summer chum salmon run extant in the CR drainage. They propose that chum salmon in the Cascade zone are remnants of original populations and they attributed the divergence between zonal groups to diverse ecological conditions in each zone, which promoted regional genetic adaptation, and to genetic drift experienced in small populations. No information is available regarding the historical diversity for chum salmon in the White Salmon River.

In the White Salmon River, the pool behind Bonneville Dam has inundated approximately 80 percent of the historical chum salmon spawning habitat, rendering it unusable (NPPC 2004).

Key Habitat during Different Life Stages

Chum salmon usually spawn in lower river reaches, dig their redds in the mainstem, tributaries or in side channels and tend to use shallower, slower running streams and side channels more frequently than do other salmonids. Water velocity in spawning areas varies widely for chum salmon. In Washington, Johnson et al. (1991) measured water velocities near 1,000 chum salmon redds and found that velocities where fish spawned varied from 0.0 to 5.5 ft/sec (0.0 to 167.6 cm/sec), and that over 80 percent of the fish spawned in velocities between 0.7 and 2.7 ft/sec (21.3 and 83.8 cm/sec). This range is similar to that found in other species of salmon.

One detectable difference between chum salmon populations in different areas is the time it takes for eggs to incubate, hatch, and emerge as alevins from the gravel. Differences between populations are caused by physical factors such as stream flow, water temperature, dissolved oxygen, and gravel composition, and by such biotic factors as genetics, spawning time, and spawning density, all of which can affect survival (reviewed in Bakkala 1970; Salo 1991). Scientists believe water temperature has the most influence on the rate of embryonic development in chum salmon (reviewed in Bakkala 1970; Koski 1975; Salo 1991). The amount of heat, measured in Thermal Units (TUs), required by fertilized chum salmon eggs to develop and hatch is about 400-600 TUs, and the heat required to complete yolk absorption is about 700-1,000 TUs. Lower water temperatures can prolong the time required from fertilization to hatching by 1.5-4.5 months.

Chum salmon do not typically have substantial freshwater rearing time. Most chum salmon juveniles begin seaward migration with minimal time spent in natal streams. Consequently, the period of estuarine residence appears to be the most critical phase in the life history of chum salmon and may play a major role in determining the size of the subsequent adult-run back to fresh water. Chum salmon juveniles, like other anadromous salmonids, use estuaries to feed before beginning long distance oceanic migrations. However, chum salmon and ocean-type Chinook salmon usually have longer residence times in estuaries than do other anadromous salmonids (Dorcey et al. 1978; Healey 1982).

Biologists know little about the seaward migration of juvenile chum salmon from the Columbia River. Generally, however, researchers find migration of chum salmon juveniles out of estuaries appears to closely correlate with prey availability (LCFRB 2004). For information about conditions in the CR Estuary and how chum salmon may be affected, see the Proposed CR Estuary ESA Recovery Plan Module for Salmon & Steelhead http://www.nwr.noaa.gov/Salmon-Recovery-Planning/ESA-Recovery-Plans/Estuary-Module.cfm (accessed April 11, 2012).

2.4.4 White Salmon River steelhead

Oncorhynchus mykiss, of which steelhead and rainbow trout are members, displays a wide variety of life history strategies (Busby et al. 1996). Anadromy is not obligatory in *O. mykiss*, but scientists extensively debate the heritability of anadromy (Rounsefell 1958; Mullan et al. 1992). Progeny of anadromous steelhead can spend their entire lives in freshwater (residualize), while progeny of rainbow trout can migrate seaward. The White Salmon River watershed supports both forms of *O. mykiss*. Although rainbow trout are not in the MCR steelhead DPS, genetic analysis shows that White Salmon steelhead and rainbow trout are an inland race of *O. mykiss* (Phelps et al. 1990; Phelps et al. 1994). The White Salmon population is as part of the Cascade Eastern Slope Tributaries MPG (Figure 2-10).

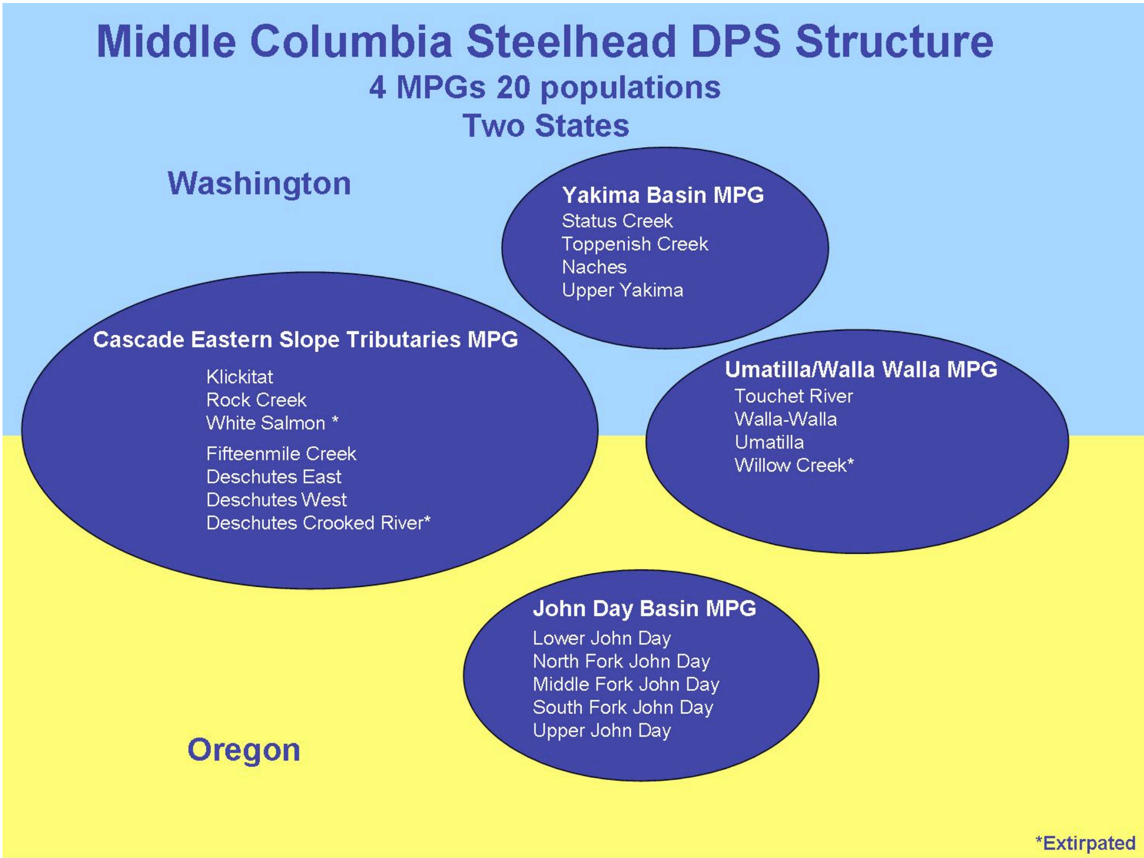

Figure 2-10. Major Population Groups (MPGs) and populations of middle Columbia steelhead. Note the White Salmon steelhead population is considered functionally extirpated (ICTRT 2007b)

Some biologists believe that residual steelhead populations in the form of resident trout may contribute to anadromy in the watershed. Phelps et al. (1990) found that introgression from hatchery rainbow plants was not evident in wild rainbow trout samples and high levels of genetic diversity still exist in this population. Seiler and Neuhauser (1985) caught more steelhead smolts than were predicted by the modeling. One hypothesis is that resident rainbow trout spawning upstream of the former Condit Dam continue to produce some steelhead smolts, indicating that anadromous *O. mykiss* has maintained genetic diversity and fitness (NPCC 2004).

Pre-removal monitoring in the White Salmon River above Condit Dam has identified *O. mykiss* juveniles displaying smolt behavior and morphology, and PIT-tagged juveniles have been detected passing Bonneville Dam with one being recovered at the tern colony on East Sand Island (B. Allen, personal communication, 2007). In addition, a juvenile *O. mykiss* PIT-tagged above Condit Dam September of 2004 at 98 mm was detected ascending Bonneville Dam in July of 2006. Genetic analysis of juvenile *O. mykiss* collected in the upper watershed above Husum Falls are different from hatchery trout released in the basin, however additional samples are needed to confirm this finding (Allen et al. 2006). This information supports the theory that even though the population is functionally extirpated there is still the potential for re-establishing anadromous steelhead in the White Salmon River Basin.

Biologists divide steelhead into two basic run types based on the salmonid species' level of sexual maturity at the time they enter fresh water and the duration of the spawning migration. The stream maturing type, or summer steelhead, enters fresh water in a sexually immature condition and requires several months in fresh water to mature and spawn. The ocean-maturing type, or winter steelhead, enters fresh water with well-developed gonads and spawns relatively shortly after river entry (Bambrick et al. 2004). Based on habitat conditions and the composition of nearby populations, it is likely that the White Salmon River population historically supported both summer and winter life history patterns (ICTRT 2008). Chapman (1981), using instream flow measurements, estimated that in pristine conditions prior to the construction of Condit Dam, the White Salmon River supported 763 adult steelhead. Young and Rybak (1987) estimated that the habitat could support 39,000 steelhead smolts, and 2,770 adults.

Key Habitat during Different Life Stages

Steelhead generally return to the White Salmon River between April and October, although some hold over in the CR throughout the year and enter the river as they approach spawning. Wild steelhead spawn from February to June with peak spawning in April. Hatchery-reared summer steelhead in the White Salmon River watershed, however, typically spawn earlier, from December to February, with peak activity in January. Steelhead spawning and rearing currently occurs in the lower White Salmon and will occur in both mainstem and tributary habitats after dam removal.

Steelhead eggs incubate in their gravel beds for four to seven weeks, depending on water temperature, before hatching. After emergence, the small fry seek shallow, slow velocity areas within the stream channel, often associated with stream margins. As young steelhead mature they move into water with increasing depth and velocities. Juvenile steelhead typically spend two to three years in freshwater before outmigrating to the ocean. They typically move to interstitial spaces between cobble and boulders for cover during the fall, and remain in this habitat until March. In April, they return to a more active rearing life stage and seek out suitable habitat types. Outmigration occurs in spring and typically peaks in early May (NPCC 2004). Table 2-3 shows key habitat for steelhead during different life stages.

Some steelhead are iteroparous (do not die after spawning). A small proportion of repeat spawners, known as kelts, may return to the ocean for a short period and repeat the spawning migration, a life history adaptation that may be fundamental to ensuring population stability. Iteroparity for Mid-Columbia steelhead ranges from reported rates of 2-4 percent above McNary Dam (at RM 292 measured from the mouth of the Columbia) (Busby et al. 1996) up to 17 percent in the unimpounded tributaries below Bonneville Dam (at RM 146.1) (Leider et al. 1986). Iteroparity rates of summer and winter steelhead in the Kalama River, a tributary to the CR below Bonneville Dam have been estimated at 15 percent and 21 percent respectively (Withler 1966; Leider et al. 1986), while repeat spawners in the Hood River, an Oregon tributary in the impounded Bonneville Pool above Bonneville Dam, make up 9 percent of the summer and 13 percent of the winter-run of steelhead (Olsen 2004). The combined sampling from 1979 to 1981 (Howell et al. 1985) and the 2005 adult trapping data from YN and WDFW reported iteroparity rates for Klickitat River steelhead at 3.2 percent. Sampling of adults at the Klickitat River's Lyle Falls Fishway in 2004 and 2005 has indicated repeat spawning rates of 2.9 percent for summer steelhead and 8.8 percent for winters. Most repeat spawners are females. Iteroparity is a life history trait that should be assessed once steelhead re-colonize the White Salmon River and taken into account when management decisions for White Salmon steelhead are made.

Table 2-3. Key habitat by life stage and time period for steelhead (NPCC 2004)

Life Stage	Relevant Months	Key Habitat Descriptions
Spawning	Mar-Jun	Riffles, tailouts, and glides containing a mixture of gravel and cobble sizes with flow of sufficient depth for spawning activity
Incubation	Mar-Jun	Riffles, tailouts, and glides as described for spawning with sufficient flow for egg and alevin development
Fry Colonization	May-Jul	Shallow, slow velocity areas within the stream channel, often associated with stream margins
Active Rearing	0-age May-Jul; 1-age, Mar-Oct; 2+-age, Mar-Oct	Gravel and cobble substrates with sufficient depth and velocity, and boulder/large cobble/wood obstruction to reduce flow and concentrate food
Inactive Rearing	0,1-age Oct-Mar	Stable cobble/boulder substrates with interstitial spaces
Migrant	1-age, Mar-Jun 2+-age, Mar-Jun	All habitat types having sufficient flow for free movement of juvenile migrants
Pre-spawning Migrant	Winter, Nov-Apr Summer, All	All habitat types having sufficient flow for free movement of sexually mature adult migrants
Pre-spawning Holding	Winter, Dec-May Summer, All	Relatively slow, deep water habitat types typically associated with (or immediately adjacent to) the main channel

2.5 Hatchery Production and Releases

Fall Chinook salmon

No hatchery fall Chinook salmon are released directly in the White Salmon River watershed; however, hatchery tule fall Chinook salmon from Spring Creek NFH do stray into the watershed, contributing to natural production. Fish technicians have also recovered hatchery-origin URB fall Chinook salmon in the White Salmon River. These URB fall Chinook salmon are primarily from the LWS NFH, Bonneville Hatchery, and Klickitat Hatchery programs and are not part of the LCR Chinook salmon ESU. Biologists and recovery planners are considering Spring Creek NFH tule fall Chinook salmon for use in the reintroduction of fall Chinook salmon after PacifiCorp completes decommissioning of Condit Dam. This program is described below.

Spring Creek NFH Tule fall Chinook salmon

Hatchery managers used fall Chinook salmon from the White Salmon River to establish the Spring Creek NFH fall Chinook salmon program; the hatchery program is part of the LCR Chinook salmon ESU. The program uses only returns to the hatchery for broodstock, but has incorporated other tule stocks in the past. Hatchery workers last released non Spring Creek NFH tule fall Chinook salmon from the hatchery in 1991; the fish were Bonneville tule fall Chinook salmon. The Spring Creek NFH tule fall Chinook salmon is the most representative of the native Chinook salmon population that was historically present in the White Salmon River.

The hatchery program mitigates for lost and degraded habitat because of the construction and operation of the CR hydrosystem by producing locally adapted broodstock for sport, commercial, tribal, and international harvest. The production goal for the current program is for an on-station release of 10,500,000 sub-yearlings annually, with 1,700,000 acclimated and released at the LWS NFH, and 2,800,000 eggs transferred downstream to the Bonneville State Hatchery. This production requires a minimum of 7,000 adults (4,000 females). As mentioned previously, recovery planners are considering fall Chinook salmon from the program for reintroduction into the watershed once decommissioning of Condit Dam is completed. Genetic analysis of naturally spawning fall Chinook salmon in the White Salmon and other Bonneville Pool tributaries determined that Spring Creek NFH fall Chinook salmon are representative of the naturally spawning population of fall Chinook salmon in the White Salmon River (Smith et al. 2007; Smith and Engle 2011).

Non ESU Little White Salmon NFH Upriver Bright fall Chinook salmon

Biologists collected the original source of this stock of URB fall Chinook salmon at the Bonneville State Fish Hatchery. The current source of URB fall Chinook salmon is fish returning to the LWS NFH. The URB fall Chinook salmon stock is not native to the LWS and is not considered part of the LCR Chinook salmon ESU.

The purpose of the hatchery program is to successfully rear and release URB fall Chinook salmon into the LWS, which will mitigate for lost and degraded habitat because of the construction and operation of the CR hydrosystem, meet *U.S. v. Oregon* court agreements, and provide a 1.7 million fry release in the Yakima River Basin. The program production goal is to release 2.0 million sub-yearling URB fall Chinook salmon at the hatchery, and 2.5 million sub-yearlings that come from the Bonneville State Hatchery and are acclimated for 4 weeks before being released on-station.

Spring Chinook salmon

Presently there are no hatchery programs associated with this population, however hatchery spring Chinook salmon have been observed spawning in the White Salmon River. In 2009, biologists examined 110 spring Chinook salmon carcasses at a weir installed at RM 1.1 at the White Salmon Ponds fish facility downstream of Condit Dam (Engle et al. 2010). All the spring Chinook salmon carcasses were hatchery-origin and post-spawn, i.e., near death or in a state of decay (Engle et al. 2010). The lack of natural-origin spring Chinook salmon examined at the weir supports the observation that spawning does occur in the lower White Salmon River but rearing habitat is lacking (Engle et al. 2010).

Coho salmon

There are no hatchery programs that directly release hatchery coho salmon into the White Salmon River. The coho salmon program at the LWS NFH released coho salmon that may have contributed to straying into the White Salmon River in the past, but stray rates were not estimated. The LWS NFH discontinued the program after releases in 2004 because of funding shortfalls. Stray coho salmon currently entering the White Salmon River may come from releases in the Klickitat and Umatilla rivers and from Bonneville Hatchery.

Chum salmon

Historical and current hatchery influences on chum salmon are minimal. Hatcheries have released chum salmon into only 4 of 10 Washington populations. Hatchery fish do not comprise a substantial fraction of any naturally spawning chum salmon population and all originate from local wild populations. Current chum salmon hatchery programs focus on reintroduction (Chinook River) and conservation (Duncan Creek, and Grays River) (LCFRB 2004).

Steelhead

Scientists and recovery planners do not consider the hatchery programs in the White Salmon River watershed to be part of the MCR steelhead DPS. From 1995 to 2010, fisheries co-managers annually released both summer and winter steelhead smolts from broodstock collected at the Skamania Hatchery on the West Fork of the Washougal River into the White Salmon River below Condit Dam. The summer steelhead broodstock derives from summer steelhead from the Washougal and Klickitat Rivers. The winter steelhead broodstock derives from returns to the Washougal River.

The Skamania Hatchery program goal was to provide fisheries for summer and winter steelhead in the White Salmon River as mitigation for losses from human development and concomitant habitat loss and to meet the obligations of the *U.S. v. Oregon* agreement. The program involved an annual release of 24,000 summer and 20,000 winter steelhead smolts, although actual releases varied from year to year. Production consisted of adipose-fin-clipped fish to allow for selective fisheries and to facilitate assessment of the ratio of hatchery adults to wild adults. Workers trucked smolts from Skamania Hatchery and stream-released them into the White Salmon River at RM 1.5. Fish managers terminated the program with the 2009 releases.

Biologists would need to develop or identify a more suitable broodstock to expedite the reintroduction of steelhead in habitats upstream of the former Condit Dam. Monitoring steelhead escapement and production, after dam decommissioning is complete, will determine whether there are impacts from these Skamania Hatchery releases.

2.6 Harvest

Primarily ocean and mainstem CR commercial, tribal, and sport intercept Chinook salmon and coho salmon. Tributary sport fisheries also harvest some Chinook salmon and coho salmon. The LCFRB recovery plan (LCFRB 2004) and the ESA section 7 Biological Opinion for fisheries managed under the *U.S. v. Oregon* Agreement (NMFS 2008c) describe in detail harvest management and harvest effects.

In 2012, the fisheries regulations in the White Salmon River prohibited the retention of unmarked Chinook salmon from April 1 to July 31, and unmarked Chinook salmon and coho salmon from August 1 to March 31, in the area from the mouth to the Northwestern Lake Road bridge (WDFW 2012).During the removal of Condit Dam the White Salmon was closed to fishing from the Northwestern Lake Road bridge downstream to the old county road bridge below the powerhouse. Regulations also prohibit the retention of chum salmon in tributary recreational fisheries.

Steelhead harvest, while locally important, was historically likely less substantial than salmon harvest because of lower abundance and spawning times that coincided with higher flows (NPCC 2004). The YN reports that tribal members fished for salmon and steelhead historically as high as Husum Falls and Rattlesnake Falls on the White Salmon River (J. Meninick, YN Cultural Resources Department, personal communication, 2006). Section 5.4, Harvest, for an expanded discussion of harvest impacts.

3 Recovery Goals and Viability Criteria

The primary goal of ESA recovery plans is for the species to reach the point that it no longer needs the protection of the Act, i.e., NMFS delists the species. Recovery plans may also contain "broad-sense goals," defined in the recovery planning process as going beyond the requirements for delisting to address, for example, other legislative mandates or social, economic, and ecological values.

NMFS applies the delisting criteria at the ESU/DPS level based on determinations of the viability of the independent populations that make up the ESU/DPS. The LCR ESA Recovery Plan describes the criteria for delisting the LCR ESUs. As noted, this Plan is an appendix of the LCR ESA Recovery Plan. The middle Columbia Steelhead ESA Recovery Plan describes the criteria for delisting the MCR Steelhead DPS. This plan is also an appendix to the middle Columbia Steelhead ESA Recovery Plan. This chapter provides recovery goals for the White Salmon River Chinook salmon, coho, chum salmon, and steelhead populations and describes the criteria NMFS will use to assess progress toward those goals and the role of the White Salmon River salmon populations in overall ESU/DPS viability.

There are two kinds of criteria that enter into a delisting decision: biological criteria defining viable populations (section 3.2, Biological Viability Criteria) and "threats" criteria related to the five listing factors detailed in the ESA (section 3.3, Threats Criteria). The threats criteria define the conditions under which NMFS can determine that responsible parties have addressed or mitigated the listing factors or threats. Together these make up the "objective, measurable criteria" required under section 4(f)(1)(B). This chapter discusses both kinds of criteria.

3.1 Recovery Goals

The primary goal of this plan is for the White Salmon River salmon and steelhead populations to contribute to the delisting of the LCR ESUs and the MCR Steelhead DPS. McElhany et al. (2000) defines a VSP as an independent population that has negligible risk of extinction over a 100-year timeframe. However, all populations within an ESU or DPS do not have to reach viable status for NMFS to delist the ESU/DPS (section 3.2.2, DPS and MPG Viability Criteria).

The visions, goals, and actions of many of the parties involved in the White Salmon recovery planning process may go beyond ESA delisting. The vision for broad-sense recovery incorporates ESA delisting goals in the sense that NMFS could delist White Salmon River salmon and steelhead during an extended and stepwise process of achieving broad-sense recovery goals. Broad-sense recovery goals incorporate many of the local and traditional uses, including those associated with rural and Native American values, which are important in the Pacific Northwest.

The proposed local, collaborative recovery board may choose to define additional, broad-sense goals for the White Salmon River watershed and other areas within the Washington Gorge Management Unit. The board's broad-sense goals for the area would likely build upon direction already adopted by various stakeholders in the area. These goals would then guide the board as it defines and implements future recovery actions for the White Salmon River watershed.

3.2 Biological Viability Criteria

One of the main tasks assigned to the TRTs was to develop biologically based criteria for determining the viability of ESA listed salmon and steelhead. Viability criteria identify characteristics and conditions that, when met, describe viable populations and a viable ESU or DPS.

The TRTs based their approaches to recovery on guidance from the NMFS Technical Memorandum *Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units* (McElhany et al. 2000). This memorandum provides general direction for setting viability objectives at the ESU/DPS and component population levels. VSP guidelines provided by McElhany et al. (2000) recommend that a viable DPS population should be large enough to:

- Have a high probability of surviving variation observed in the past and expected future
- Be resilient to environmental and anthropogenic disturbances
- Maintain genetic diversity
- Support/provide ecosystem functions

NMFS organized the viability guidelines provided by McElhany et al. (2000 around four major considerations: abundance, productivity, spatial structure, and diversity. ESU/DPS-level viability criteria consider the appropriate distribution and characteristics of component populations to maintain the ESU/DPS in the face of longer-term ecological and evolutionary processes (ICTRT 2005a). The viability criteria defined by the ICTRT and W/LC TRT have been adopted as the biological criteria for delisting of the ESUs and DPS that include the listed White Salmon populations discussed in this Plan.

3.2.1 ESU/DPS Viability Criteria

Defining ESU and DPS Structure

The TRTs applied overall ESU/DPS-level viability criteria based on smaller units of MPG and independent populations to determine paths toward viability. Central to this approach is the recognition that salmonid population structure is hierarchical. The TRT based the biological criteria for populations and ESU/DPS-level viability on the existence of a biological hierarchy that spans ESUs/DPSs, major groupings, populations, and substructure within populations (Figure 3-1). The approach recognizes that historical salmonid populations within an ESU or DPS retain some genetic similarities because they move between different habitats during their life cycle. This distribution across the landscape and the diverse genetic, life history and morphological characteristics that evolve/contribute significantly to a population's long-term persistence.

- **Evolutionarily Significant Unit:** Two criteria define an ESU or DPS listed under the ESA: 1) it must be substantially reproductively isolated from other conspecific units, 2) it must represent an important component of the evolutionary legacy of the species (Waples 1991).
- **Major Population Grouping:** A group of populations that share similar genetic, geographic (hydrographic), and/or habitat characteristics within an ESU/DPS (ICTRT 2005b). The ICTRT termed this level in the hierarchy a MPG, and the W/LC TRT called it a "stratum." The TRTs consider MPGs, strata, and the "geographic regions" described by the Puget Sound TRT to be analogous.
- **Independent Population:** McElhany et al. (2000) defined an independent population as "…a group of fish of the same species that spawns in a particular lake or stream (or portion thereof) at a particular season and which, to a substantial degree, does not interbreed with fish from any other group spawning in a different place or in the same place at a different season. Groups are considered to be independent populations if they are isolated to such an extent that exchanges of individuals among the populations do not substantially affect the population dynamics or extinction risk of the independent populations over a 100-year time frame."

Hierarchy in Salmonid Population Structure

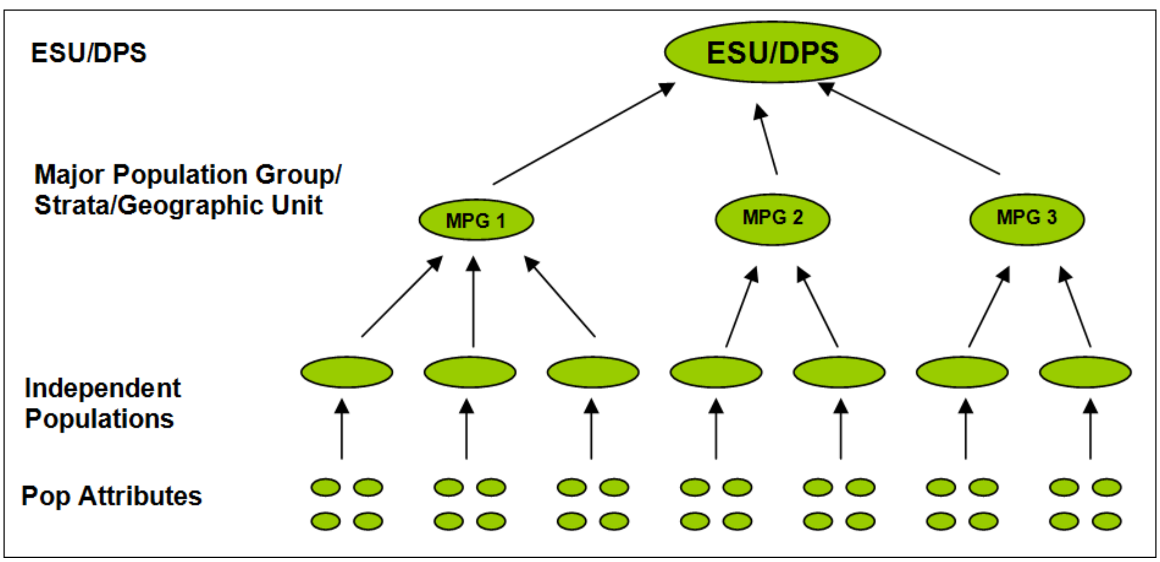

Figure 3-1. Hierarchical levels of salmonid population structure as defined by the TRTs for ESU/DPS recovery planning

The TRTs established ESU/DPS-level viability criteria based on the VSP guidelines identified by McElhany et al. (2000). The W/LC TRT identified five essential elements to address in its approach (McElhany et al. 2006). The ICTRT (2007) adapted these five elements for the middle Columbia Steelhead DPS. The five elements are:

> **Stratified Approach**: Life history and ecological complexity that historically existed should have a high probability of persistence. The W/LC TRT aggregated populations into MPG, or strata, based on each combination of life history type and ecological zone. The ICTRT stratified the MCR steelhead DPS into groups based on ecoregion characteristics (Eastern Cascades, Columbia Plateau, John Day and Yakima), life history types (summer, winter and summer/winter) and other geographic and genetic considerations.
>
> **Viable Populations**: Some individual populations within a MPG should have persistence probabilities consistent with a high probability of MPG persistence. The W/LC TRT defined high persistence probability based on the presence of at least two populations with a negligible risk of extinction and a strata average of a medium-low risk of extinction. The ICTRT defined high persistence probability based on the presence of at least two or one-half of historical populations with a negligible risk of extinction.
>
> **Representative Populations**: Representative populations must achieve criteria or maintain viability criteria, but not every historical population needs to meet viability criteria. Viable combinations of populations should include "core" populations that are highly productive, "legacy" populations that represent historical genetic diversity, and dispersed populations that minimize susceptibility to catastrophic events.
>
> **Non-deterioration**: No population should be allowed to deteriorate until ESU/DPS recovery is assured, and all extant populations should be maintained. Current populations and population segments should be preserved. Recovery measures will be needed in most areas to arrest declining status and offset the effects of future impacts.
>
> **Safety Factors**: Higher levels of recovery should be attempted in more populations than the minimum needed to achieve ESU/DPS viability because not all attempts will be successful. Recovery efforts should target more than the minimum number of populations and more than the minimum population levels thought to ensure viability. Some populations should be highly viable.

W/LC TRT Recommended Viability Criteria

The W/LC TRT document, *Interim Report on Viability Criteria for Willamette and Lower Columbia Basin Pacific Salmonids* (McElhany et al. 2003) describes recommended viability criteria for salmon ESUs in the W/LC recovery domain. The LCFRB applied these 2003 criteria to assess viability and develop the recovery direction for the listed White Salmon River Chinook salmon, coho, and chum salmon populations that NMFS and the NPCC adopted as part of the lower Columbia Salmon Recovery and Subbasin Plan (LCFRB 2004). This direction is also included in this recovery plan. Summarized below are the criteria and approach defined by the W/LC TRT in 2003. In 2006, the W/LC TRT (McElhany et al. 2006) revised the 2003 criteria by incorporating new analyses by the W/LC TRT itself, other TRTs and state agencies, among others. The LCFRB and the WAGIT which includes White

Salmon stakeholders will eventually use the new criteria to update goals and status evaluations for Washington populations through the recovery plan revision process. The 2006 revised viability criteria (McElhany et al. 2006) are available at http://www.nwfsc.noaa.gov/trt/wlc/viability_report_revised.cfm (accessed April 11, 2012).

Independent Population Viability Criteria

The W/LC TRT's 2003 viability criteria (McElhany et al. 2003) use five population-level attributes as indicators for viability: 1) adult productivity and abundance, 2) juvenile out-migrant productivity, 3) population diversity, 4) habitat, 5) spatial structure. The 2003 report also provides a set of guidelines for examining viability for each indicator (McElhany et al. 2003). Shown in Table 3-1 are the 2003 viability criteria.

Table 3-1. Population viability criteria (McElhany et al. 2003; McElhany et al. 2006)

Adult Population Productivity and Abundance

1. In general, viable populations should demonstrate a combination of population growth rate, productivity, and abundance that produces an acceptable probability of population persistence. Various approaches for evaluating population productivity and abundance combinations may be acceptable, but must meet reasonable standards of statistical rigor.
2. A population with a non negative growth rate and an average abundance approximately equivalent to estimated historical average abundance is in the highest persistence category. The estimate of historical abundance should be credible, the estimate of current abundance should be averaged over several generations, and the growth rate should be estimated with adequate statistical confidence. This criterion takes precedence over criteria 1.

Juvenile Outmigrant Production

The abundance of naturally produced juvenile migrants should be stable or increasing as measured by observing a median annual growth rate or trend with an acceptable level of confidence.

Within Population Spatial Structure

The spatial structure of a population must support the population at the desired productivity, abundance, and diversity levels through short-term environmental perturbations, longer-term environmental oscillations, and natural patterns of disturbance regimes. The metrics and benchmarks for evaluating the adequacy of a population's spatial structure should specifically address:

a. Quantity: Spatial structure should be large enough to support growth and abundance, and diversity criteria.

b. Quality: Underlying habitat spatial structure should be within specified habitat quality limits for life history activities (spawning, rearing, migration, or a combination) taking place within the patches.

c. Connectivity: Spatial structure should have permanent or appropriate seasonal connectivity to allow adequate migration between spawning, rearing, and migration patches.

d. Dynamics: The spatial structure should not deteriorate in its ability to support the population. The processes creating spatial structure are dynamic, so structure will be created and destroyed, but the rate of flux should not exceed the rate of creation over time.

e. Catastrophic Risk: The spatial structure should be geographically distributed in such a way as to minimize the probability of a significant portion of the structure being lost because of a single catastrophic event, either anthropogenic or natural.

Within Population Diversity

1. Sufficient life history diversity must exist to sustain a population through short-term environmental perturbations and to provide for long-term evolutionary processes. The metrics and benchmarks for evaluating the diversity of a population should be evaluated over multiple generations and should include:

   a. Substantial proportion of the diversity of a life-history trait(s) that existed historically,

   b. Gene flow and genetic diversity should be similar to historical (natural) levels and origins,

   c. Successful utilization of habitats throughout the range, and

   d. Resilience and adaptation to environmental fluctuations.

General Habitat

1. The spatial distribution and productive capacity of freshwater, estuarine, and marine habitats should be sufficient to maintain viable populations identified for recovery.
2. The diversity of habitats for recovered populations should resemble historical conditions given expected natural disturbance regimes (e.g., wildfire, flood, volcanic eruptions, etc.). Historical conditions represent a reasonable template for a viable population; the closer the habitat resembles the historical diversity, the greater the confidence in its ability to support viable populations.

At a large scale, habitats should be protected and restored, with a trend toward an appropriate range of attributes for salmonid viability. Freshwater, estuarine, and marine habitat attributes should be maintained in a non-deteriorating state.

The W/LC TRT's revised criteria, described in their 2006 report *Revised Viability Criteria for Salmon and Steelhead in the Willamette and Lower Columbia Basins* (McElhany et al. 2006), use three population-level attributes as indicators of viability instead of the five identified in 2003. The 2006 attributes are: 1) abundance and productivity, 2) spatial structure, 3) diversity. The revised criteria include juvenile out migrant productivity as a subset of abundance and productivity and address habitat criteria as part of the discussion of listing factors criteria (McElhany et al. 2006).

The W/LC TRT's 2003 system for integrating population attributes to assess population extinction risk used a 0-4 qualitative scale, with zero indicating a population with a low probability of persistence, and four indicating a population with high probability of persistence. The TRT's 2006 report (McElhany et al. 2006) maintains this system (Table 3-2).

Table 3-2. Population persistence*/viability categories (McElhany et al. 2003; McElhany et al. 2006)

Scale	*Viability*	*Description*	*Persistence Probability**
0	Very Low (VL)	Either extinct or very high risk of extinction	0-40%
1	Low (L)	Relatively high risk of extinction	40-74%
2	Medium (M)	Medium high risk of extinction	75-94%
3	High (H)	Low (negligible) risk of extinction (represents a "viable" level)	95-99%
4	Very High (VH)	Very low risk of extinction	>99%

** 100-year persistence probabilities*

Strata and ESU Viability Criteria

The criteria developed by the W/LC TRT for recovery planning in 2003 state that for an ESU as whole to be viable, all of the historical strata need to have a high probability of persistence (McElhany et al. 2003). The W/LC TRT used ratings of individual population's extinction risk to determine viability at the strata and ESU levels. Table 3-3 shows criteria guidelines identified by the W/LC TRT to complete these evaluations. The TRT maintained its support for the guidelines in its 2006 report (McElhany et al. 2006).

Table 3-3. Criteria guidelines for determining strata and ESU viability (McElhany et al. 2003, 2006)

ESU-Level Criteria Guidelines
1. Every Stratum (life history and ecological zone combination) that historically existed should have a high probability of persistence
Strata-Level Criteria Guidelines
1. Individual populations within a stratum should have persistence probabilities consistent with a high probability of strata persistence 2. Within a stratum, the populations restored/maintained at viable status or above should be selected to: a. Allow for normative metapopulation process, including the viability of "core" populations that are defined as the historically most productive populations b. Allow for normative evolutionary processes, including the retention of the genetic diversity represented in relatively unmodified historic gene pools c. Minimize susceptibility to catastrophic events
ESU-Level Recovery Strategy Criteria Guidelines
1. Until all ESU viability criteria have been achieved, no population should be allowed to deteriorate in its probability of persistence 2. High levels of recovery should be attempted in more populations than identified in the strata viability criteria because not all attempts will be successful

ICTRT Recommended Biological Viability Criteria

The ICTRT developed biologically based viability criteria for ESA-listed salmon and steelhead in the Interior Columbia domain. The ICTRT based its approach to recovery on guidance from the NMFS Technical Memorandum, *Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units* (McElhany et al. 2000). As stated above, this memorandum provides general direction for setting viability objectives at the ESU/DPS and component population levels.

Viability criteria at the population level address four VSP parameters (McElhany et al. 2000):

- *Abundance* - the average number of spawners in a population over a generation or more
- *Productivity* - the performance of a population over time in terms of recruits produced per spawner
- *Spatial Structure* - a population's geographic distribution and the processes that affect that distribution
- *Diversity* - the distribution of genetic, life history, and phenotypic variation within and among populations

The ICTRT grouped specific population-level criteria into two categories to assess viability at the independent population level: measures addressing abundance and productivity, and measures addressing spatial structure and diversity. The viability of an independent population is determined by integrating risks across the four parameters.

The ICTRT's objective for population abundance and productivity is that abundance should be high enough that 1) in combination with intrinsic productivity, declines to critically low levels would be unlikely assuming recent historical patterns of environmental variability; 2) compensatory processes provide resilience to the effects of short-term perturbations; 3) subpopulation structure is maintained (e.g., multiple spawning tributaries, spawning patches, life history patterns) (ICTRT 2005a).

The ICTRT developed criteria for characterizing the relative size and complexity of Interior Columbia Basin steelhead populations based on their analysis of the intrinsic or historical potential habitat available to the population (ICTRT 2005a). This analysis used available Geographic Information System (GIS) data layers showing stream characteristics (e.g. channel width, gradient, and valley confinement) and empirically derived relationships between habitat type, stream structure, landscape processes, and spawning. The ICTRT built a model that also incorporated information from local biologists and recovery planners to identify natural barriers to migration and other local variations.

Mid-Columbia steelhead spawn in a wide range of tributary drainage areas: from small creeks such as Fifteenmile or Rock Creek to very large rivers such as the lower John Day. The ICTRT categorized historical population sizes as Basic, Intermediate, Large, and Very Large, and set minimum abundance thresholds for steelhead populations of each type as follows: Basic: 500 spawners; Intermediate, 1,000 spawners; Large, 1,500 spawners; Very Large, 2,250. The abundance thresholds are associated with minimum productivity thresholds, based on modeling studies described by the ICTRT (March 2007a and November 2007b). Modeling studies link abundance and productivity, within limits: above a certain threshold, higher productivity can compensate for lower abundance and vice versa.

The ICTRT used the concept of the viability curve (ICTRT 2007a, 2007b; McElhany et al. 2006) as a framework for defining population specific abundance and productivity levels to meet the objectives (Figure 3-2). A viability curve describes combinations of abundance and productivity that yield a particular risk threshold. The viability curve links the two parameters relative to extinction risks associated with short-term environmental variability. Given a particular productivity level, larger populations are more resilient in the face of year-to-year variability in overall survival rates than are smaller populations. Populations with relatively high intrinsic productivity (expected ratio of spawners to their parent spawners at low levels of abundance) are also more robust at a given level of abundance than populations with lower intrinsic productivity.

The ICTRT generated viability curves for each population to define the combinations of abundance and productivity corresponding to a range of extinction risks over a 100-year period - less than 1 percent (very low), less than 5 percent (low), less than 25 percent (moderate), and greater than 25 percent (high), see Figure 3-2. It targeted population level recovery strategies to achieve less than a 5 percent (low) risk of extinction in a 100-year period. This is consistent with the VSP guidelines and conservation literature (McElhany et al. 2000; NRC 1995).

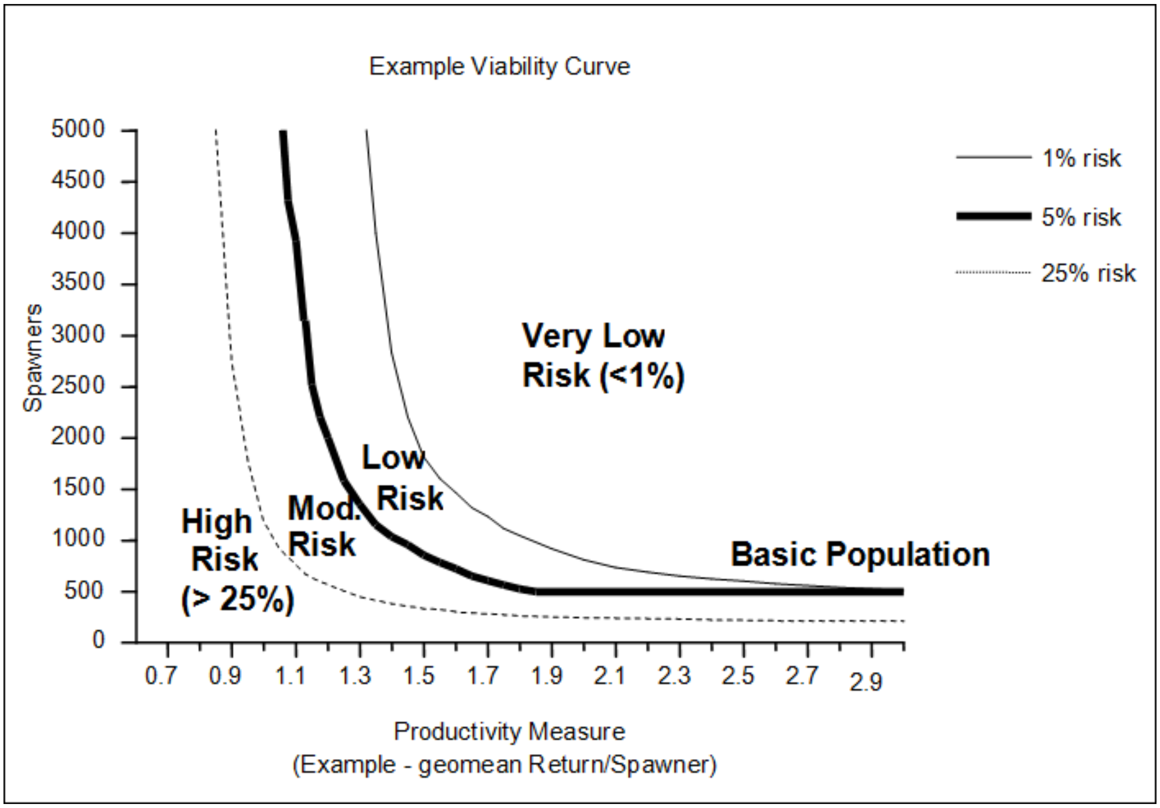

Figure 3-2. Example of an abundance/productivity viability curve (ICTRT 2007a)

3.2.2 DPS and MPG Viability Criteria

Similar to the W/LCR TRT approach to strata and ESU viability criteria (Table 3-3) the ICTRT (2007) developed criteria based on recovery of MPGs. MPGs are geographically and genetically cohesive population groups, and are critical components of ESU/DPS spatial structure and diversity (Figure 2-10). Having all MPGs within an ESU/DPS at low risk provides the greatest probability of persistence for the ESU/DPS. Thus, the ICTRT criterion for a viable ESU/DPS is that all extant MPGs and any extirpated MPGs critical for proper functioning of the ESU/DPS should be at low risk.

Further, the following five criteria should be met for an MPG to be regarded as at low risk (viable) (ICTRT 2007b):

1. At least one-half of the populations historically within the MPG (with a minimum of two populations) should meet viability standards.
2. At least one population should be classified as “Highly Viable.”
3. Viable populations within an MPG should include some populations classified (based on historical intrinsic potential) as “Very Large," "Large," or “Intermediate,” generally reflecting the proportions historically present within the MPG. In particular, Very Large and Large populations should be at or above their composite historical fraction within each MPG.

4. All major life history strategies (e.g., spring and summer-run timing) that were present historically within the MPG should be represented in populations meeting viability requirements.

5. Remaining MPG populations should be maintained with sufficient abundance, productivity, spatial structure, and diversity to provide for ecological functions and preserve options for ESU/DPS recovery.

Population Recovery Classifications

The W/LC TRT and LCFRB used the results of the 2003 Population Viability Criteria report to build a recovery scenario that describes the target status for each population. The W/LC TRT and the LCFRB classified individual populations as *primary* (targeted for restoration to high or high + probability of persistence), *contributing* (targeted for restoration to low or medium probability of persistence), or *stabilizing* (populations that are to be maintained at current levels and likely to have low probabilities of persistence). They identified the following target levels for White Salmon Chinook salmon, coho, and chum salmon. The LCFRB has updated the 2004 recovery plan and proposed to maintain the classifications for all of the White Salmon River populations except coho salmon, which has been elevated to a primary population classification (LCFRB 2010).

White Salmon River Fall Chinook salmon (Contributing, Medium)

Historically, the tule fall Chinook salmon population in the White Salmon was large. Condit Dam affected the population, although a small amount of fall Chinook salmon habitat was available downstream of the dam and upstream from Bonneville Reservoir inundation. The Spring Creek Hatchery program, which originated from White Salmon River fall Chinook salmon stock, is located three miles downstream of the river mouth and straying of returning hatchery adults to the White Salmon River is consistent with a *contributing* population designation. A tribal fishery targets Spring Creek Hatchery fish near the river mouth. The W/LC TRT and the LCFRB targeted the White Salmon population for medium viability to reflect concerns with hydro impacts (Bonneville and Condit dams) and higher harvest rates associated with combined treaty and non-treaty fisheries. Based on the TRT's findings, the Plan proposed an abundance goal for recovery of 900 fish (LCFRB 2004).

White Salmon River Spring Chinook salmon (Contributing, Low)

This population was historically significant but is currently extinct. Reintroduction would include use of an outside stock. The best source stock may be from the Klickitat, which is outside the lower Columbia ESU. The W/LC TRT would need to provide criteria for evaluating appropriate source stocks for reintroduction. The low viability target for White Salmon spring Chinook salmon recognizes the long period required to restore a locally adapted natural population from an out-of-basin stock. Based on TRT findings, the Plan proposed an abundance goal for recovery of 400 fish (LCFRB 2004).

White Salmon River coho salmon (Primary, High)

The White Salmon River coho salmon are part of the Washington upper Gorge Tributaries and White Salmon River population. Lack of access to habitats upstream of Condit Dam limits current potential for coho salmon production in the White Salmon River. There may be some coho salmon production occurring in the one-mile reach downstream of Condit Dam. Based on TRT findings, the Plan proposed an abundance goal for recovery of 150 fish (LCFRB 2004).

Upper Gorge chum salmon, including White Salmon River chum salmon (Contributing, Medium)

The LCFRB identified the entire population of upper Gorge chum salmon to have a very low viability (LCFRB 2004). Bonneville Reservoir inundates most of historical habitat for this population and passage at Bonneville Dam impacts both juvenile and adult migration. The LCFRB proposed an abundance goal for recovery of 600 fish.

White Salmon River steelhead (Low Risk)

The ICTRT did not apply the same classification system to MCR steelhead populations but did identify that to be viable, the White Salmon steelhead population needs to reach a minimum abundance threshold of 500 naturally produced spawners with a sufficient intrinsic productivity to achieve a five percent or less risk of extinction over a 100-year timeframe (ICTRT 2007b). The ICTRT recognizes that recovering this functionally extirpated population to a viable level may not be necessary to achieve viability at the MPG and DPS levels.

3.3 Threats Criteria

NMFS evaluated listing factors under section 4(a)(1) when the agency made the initial determination to list the species for protection under the ESA. In the future, when NMFS reevaluates the status of the species to determine whether these factors continue to limit recovery, the agency can decide whether the protections of the ESA are still warranted. If no longer warranted, NMFS could delist the species.

At the time of a delisting decision, NMFS will examine whether the entities responsible for recovery have addressed the section 4(a)(1) listing factors. To assist in this examination, NMFS will use the listing factors (or threats) criteria described below in addition to evaluation of biological recovery criteria and other relevant data and policy considerations.

To determine that the affected DPS has recovered to the point that it no longer requires the protections of the ESA, NMFS will review the status of the listing factors according to the specific criteria identified for each of them (see below). The threats need to have been addressed to the point that delisting is not likely to result in their re-emergence. It is possible that current perceived threats will become insignificant in the future as a result of changes in the natural environment or changes in the way threats affect the entire life cycle of salmon. Consequently, as the result of RM&E, NMFS expects that the agency will change the ranking of threats over time and identify new threats. During the 5-year status reviews, NMFS will evaluate and review the listing factor criteria under conditions at the time.

The specific criteria listed below for each of the relevant listing/delisting factors help to ensure that responsible entities address and mitigate the underlying causes of prior to considering a species for delisting. NMFS expects that if the proposed actions described in the Plan are implemented, they will make substantial progress toward meeting the following listing factor (threats) criteria:

Factor A: The present or threatened destruction, modification, or curtailment of its habitat or range

To determine that the ESU or DPS is recovered, threats to habitat should be addressed to a degree sufficient to support a viable ESU or DPS as outlined below:

1. Impaired fish passage (e.g., dams and culverts) is addressed, either through removal or modification of obstructions, to improve survival and restore access to historically accessible habitat where necessary to support recovery goals.
2. Flow conditions that support sufficient salmonid rearing, spawning, and migration of a viable ESU or DPS are achieved, where possible, through management of White Salmon River mainstem and tributary irrigation operations, and through the improvement of other water user efficiencies and conservation, including for municipal supply and other consumptive purposes.
3. Forest management practices that protect watershed and stream functions are implemented on Federal, state, tribal, and private lands.
4. Agricultural best management practices, including grazing, are implemented to protect and restore riparian areas, floodplains, and stream channels, and to protect water quality from sediment, pesticide, herbicide, and fertilizer runoff.
5. Urban and rural development, including land use conversion from agriculture and forestland to residential uses, avoids impairment of water quality or impairment of natural stream conditions.
6. The effects of toxic contaminants on salmonid fitness and survival in the White Salmon mainstem and tributaries are sufficiently limited so as not to affect recovery.
7. Channel function, including vegetated riparian areas, canopy cover, streambank stability, off-channel and side-channel habitats, natural substrate and sediment processes, and channel complexity, is restored to provide adequate rearing and spawning habitat.
8. Floodplain function and the availability of floodplain habitats for salmon are restored to a degree sufficient to support a viable ESU/DPS. This restoration should include connectivity between river and floodplain and the restoration of altered sediment routing.
9. Water operations management in the mainstem White Salmon and tributaries maximize survival of juvenile rearing, emigrating smolts, and immigrating and spawning adults.

Factor B: Over-utilization for commercial, recreational, scientific or educational purposes

To determine that the ESU or DPS is recovered, any utilization for commercial, recreational, scientific, or educational purposes should be managed as outlined below:

1. Fishery management plans for salmon are in place that (a) accurately account for total fishery mortality (i.e., both landed catch and non-landed mortalities) and constrain mortality rates to levels that are consistent with achieving population viability (i.e., provide for adequate spawning escapement given their productivity); (b) are implemented in such a way as to avoid deleterious genetic effects on populations or negatively affect the distribution of populations.
2. Federal, state, and tribal fishing rules and regulations are effectively enforced.
3. Technical tools accurately assess the effects of the harvest regimes so that harvest objectives are met but not exceeded.
4. Scientific handling of fish from adult and juvenile trapping operations is minimized to reduce indirect mortalities associated with education or scientific programs, while recognizing that monitoring, research, and education are key actions for conservation of the species.
5. To the degree sufficient to support a viable ESU or DPS, routine instream construction and maintenance practices are implemented in a manner to reduce or eliminate mortality of listed species.

Factor C: Disease or predation

To determine that the DPS is recovered, any disease or predation that threatens its continued existence should be addressed as outlined below:

1. Hatchery operations do not subject salmon populations to deleterious diseases and parasites and do not result in increased predation rates of wild salmon.
2. Predation by avian predators is managed in a way that promotes recovery of salmon populations.
3. The northern pike minnow are managed to reduce predation on salmon to a degree sufficient to meet recovery goals.
4. Populations of introduced smallmouth bass, walleye, and catfish are managed such that competition or predation does not impede salmon recovery. Predation by marine mammals on salmon runs below Bonneville Dam is managed within the framework of applicable statutes and to the degree necessary to protect upstream migration of salmon.
5. Physiological stress and physical injury that may cause disease or increase susceptibility to pathogens during rearing or migration should be reduced during critical low flow periods (e.g., low water years) or poor passage conditions (e.g., at diversion dams or bypasses).

Factor D: The inadequacy of existing regulatory mechanisms

To determine that the ESU or DPS is recovered, any inadequacy of existing regulatory mechanisms that threatens its continued existence should be addressed to the degree necessary to support a viable ESU or DPS, as outlined below:

1. Sufficient resources, priorities, regulatory frameworks, and coordination mechanisms are established and/or maintained for effective enforcement of land and water use regulations that protect and restore habitats and for the effective management of fisheries.
2. Habitat conditions and watershed functions are protected through land-use planning that guides human population growth and development.
3. Habitat conditions and watershed function are protected through regulations that govern resource extraction such as timber harvest and gravel mining.
4. Habitat conditions and watershed functions are protected through land protection agreements as appropriate and where existing policy or regulations do not provide adequate protection.
5. Regulatory, control, and education measures to prevent additional exotic plant and animal species invasions are in place.

Factor E: Other natural or human-made factors affecting its continued existence

To determine that the ESU or DPS is recovered, other natural and human-made threats to its continued existence should be addressed as outlined below:

1. Hatchery programs are being operated in a manner that is consistent with individual watershed and region-wide recovery approaches, recognizing Federal obligations; appropriate criteria should be used for the integration, where appropriate, of hatchery populations and extant natural populations inhabiting watersheds where the hatchery fish return.
2. Hatcheries operate using appropriate ecological, genetic, and demographic risk containment measures for: (1) hatchery-origin adults returning to natural spawning areas, (2) release of hatchery juveniles, (3) handling of natural-origin adults at hatchery facilities, (4) withdrawal of water for hatchery use, (5) discharge of hatchery effluent, (6) maintenance of fish health during their propagation in the hatchery.
3. Mechanisms are in place to effectively continue monitoring the proportion of hatchery and wild spawners in the watershed.
4. Mechanisms are in place to reduce the incidence of, and impacts from, introduced, invasive, or exotic plant and animal species.
5. Nutrient enrichment programs should be evaluated to determine where additional nutrient inputs can provide significant benefits.

4 Current Status Assessment

In 2004, the W/LC TRT completed a population extinction risk evaluation of salmon and steelhead populations in the Willamette and LCR Basins, including White Salmon River populations (McElhany et al. 2004). During the evaluation, biologists ranked each population for absolute extinction risk on a scale of 0 to 4, with 0 = extirpation or nearly so, and 4 = very low extinction risk (McElhany et al. 2003). Each member of the W/LC TRT, based on the information available, ranked the VSP attributes such that the score for each attribute added up to 10, and then they provided an estimate of "data quality" based on their assessment of the overall amount of information available for each attribute (McElhany et al. 2004). Discussed below are the results of this evaluation.

4.1 Risk of Extinction: Willamette/Lower Columbia TRT

White Salmon River Fall Chinook salmon

White Salmon River fall-run Chinook salmon received a weighted average score of 0.86, suggesting that the population is at a very high risk of extinction (Table 4-1). In their review, W/LC TRT members recognized the population's low total abundance, some team members commented that the population is extirpated from its historical range, except for 2 to 2.5-mile reach below Condit Dam, and that the overwhelming majority of fish observed in the river are strays from nearby hatcheries. Other members considered the observed adults as *de facto* population members (McElhany et al. 2004). Overall, most TRT members considered the in-river fall-run Chinook salmon population to be heavily influenced by hatchery strays, although some members included the Spring Creek NFH in their diversity evaluation as a potential source for re-establishing a native-run.

Table 4-1. Evaluation scores for White Salmon fall-run Chinook salmon (McElhany et al. 2004)

*Attribute**	*0.00*	*1.00*	*2.00*	*3.00*	*4.00*	*Average*	*Data quality*
Productivity	3.17	4.67	2.17	0.00	0.00	0.90	1.83
Juvenile outmigrants				NR			
Diversity	2.00	3.33	3.83	0.83	0.00	1.35	2.00
Habitat	3.50	5.00	1.50	0.00	0.00	0.80	1.50
Spatial Structure	7.17	2.83	0.00	0.00	0.00	0.28	3.00

* W/LC TRT scores rated on a 0-4 scale: 0 = extirpated or nearly so, 1 = relatively high extinction risk, 3 = low extinction risk, and 4 = very low extinction risk. NR = not relevant

White Salmon River Spring Chinook salmon

McElhany et al. (2004) gave the White Salmon spring-run Chinook salmon a weighted average extinction risk score of 0.07, indicating the population is extirpated (Table 4-2). The team concluded that the population is extirpated from construction and over 90 years of blocked passage at Condit Dam. Some members included observed spring-run-timed spawners at the base of Condit Dam, while others considered these fish as strays spawning in unsuitable habitat for spring-run Chinook salmon (McElhany et al. 2004).

Table 4-2. Evaluation scores for White Salmon spring-run Chinook salmon (McElhany et al. 2004)

*Attribute**	*0.00*	*1.00*	*2.00*	*3.00*	*4.00*	*Average*	*Data quality*
Productivity	9.33	0.67	0.00	0.00	0.00	0.07	1.33
Juvenile outmigrants	10.00	NR	NR	NR	NR	NR	4.00
Diversity	8.33	1.33	0.33	0.00	0.00	0.20	1.50
Habitat	10.00	0.00	0.00	0.00	0.00	0.00	1.50
Habitat (w/o dams)	3.75	3.50	2.75	0.00	0.00	0.90	1.50
Spatial structure	9.67	0.33	0.00	0.00	0.00	0.03	3.17

* W/LC TRT scores rated on a 0-4 scale: 0 = extirpated or nearly so, 1 = relatively high extinction risk, 3 = low extinction risk, and 4 = very low extinction risk. NR = not relevant

White Salmon River coho salmon

White Salmon coho salmon received a weighted average extinction risk score of 0.39, indicating that the population is extirpated or nearly so (Table 4-3). TRT members, however, used a default score for no data, which assumes that fish may exist but are not monitored; other members noted that the White Salmon coho salmon population was probably extirpated following construction of Condit Dam, implying the default score might not be appropriate (McElhany et al. 2004). The TRT determined that hatchery introductions, the near absence of accessible spawning habitat, and the low probability of any successful natural reproduction suggest that most genetic diversity native to the White Salmon is extirpated and was replaced by hatchery introductions. In evaluating the habitat criterion, many TRT members included historical spawning habitat above the dam in their considerations (McElhany et al. 2004).

Table 4-3. Evaluation scores for White Salmon coho salmon (McElhany et al. 2004)

Attribute*	**0.00**	**1.00**	**2.00**	**3.00**	**4.00**	**Average**	**Data quality**
Productivity	5.00	5.00	0.00	0.00	0.00	0.50	0.17
Juvenile outmigrants	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diversity	7.83	2.17	0.00	0.00	0.00	0.22	1.50
Habitat	5.33	3.67	1.00	0.00	0.00	0.57	2.00
Spatial structure	9.17	0.83	0.00	0.00	0.00	0.08	1.83

* W/LC TRT scores rated on a 0-4 scale: 0 = extirpated or nearly so, 1 = relatively high extinction risk, 3 = low extinction risk, and 4 = very low extinction risk.

Upper Gorge Tributaries chum salmon

Upper Gorge Tributaries chum salmon, including those that occupied the White Salmon historically, received a weighted average extinction risk score of 0.18, indicating that the population is extirpated or nearly so (Table 4-4). Data are limited to Bonneville Dam passage counts, although many fish that ascend fall back to spawning areas below the dam. Fish technicians have recovered only a few carcasses above Bonneville Dam; no one has reported spawning aggregations, although biologist M. Weeber, (Weeber, M. personal communication, Oregon Department of Fish and Wildlife (ODFW), 2010), observed individual spawners in Eagle Creek, Oregon. The Bonneville Pool eliminated spawning habitat in both the mainstem and lower creek reaches, creating a series of disconnected spawning sites and culverts, and, stream modifications on the transit corridor on the Washington side of the CR may limit access for a few chum salmon that may be present. Low abundance for the species as a whole may also restrict population dispersal (McElhany et al. 2004).

Table 4-4. Evaluation scores for upper Gorge chum salmon (McElhany et al. 2004).

Attribute*	0.00	1.00	2.00	3.00	4.00	Average	Data quality
Productivity	9.50	0.50	0.00	0.00	0.00	0.05	1.00
Juvenile outmigrants	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diversity	8.67	1.33	0.00	0.00	0.00	0.13	1.17
Habitat	6.67	2.67	0.50	0.17	0.00	0.42	1.83
Spatial structure	7.33	1.83	0.67	0.17	0.00	0.37	1.83

* W/LC TRT scores rated on a 0-4 scale: 0 = extirpated or nearly so, 1 = relatively high extinction risk, 3 = low extinction risk, and 4 = very low extinction risk.

4.2 Extinction Risk: Interior Columbia TRT

White Salmon River Steelhead

Scientists consider the White Salmon River steelhead population functionally extirpated. The abundance of native summer and winter steelhead in the White Salmon River before 1919, when the loss of the fish ladder at Condit Dam blocked passage to upriver spawning and rearing grounds is unknown. However, some natural steelhead production in the reach below Condit Dam continued to occur (Bambrick et al. 2004). Some biologists believe that residual steelhead populations in the form of resident trout may contribute to anadromy in the watershed. *O. mykiss* from Rattlesnake Creek have been observed showing physiological changes consistent with smoltification, and fish have been detected outmigrating during the typical smolt migration period (B. Allen, personal communication, 2007). As further evidence in support of the retention of anadromous life history traits, a PIT-tagged *O. mykiss* was detected outmigrating from lower Rattlesnake Creek in March 2005, and was detected again in July 2006 moving up through the adult fish ladder at Bonneville Dam, possibly as a one-salt steelhead (B. Allen, personal communication, 2007). Even with this observation, remnant genetic influences from the original White Salmon River steelhead population in fish spawning in the small section of the White Salmon River below Condit Dam is thought to be minor with natural production coming primarily from the large releases of out-of-basin hatchery stock.

Biologists generally believe that White Salmon River steelhead historically ranged from the mouth to RM 16.3 in the mainstem and into Buck, Spring, Indian, and Rattlesnake creeks (Figure 4-12) (ICTRT 2008). Some anecdotal historic records (WDF 1951), suggest that anadromous fish may have once ascended the White Salmon River as far as Trout Lake, RM 28.2. Most biologists, however, consider Big Brother Falls, RM 16.2, to be the upper limit of historical steelhead migration (NPCC 2004). This historical range provided approximately 33 to 40 miles of steelhead spawning and rearing habitat (NPCC 2004; Bambrick et al. 2004; Ecology 2007).

The ICTRT identified one MaSA, below Big Brother Falls, within the White Salmon watershed based on its historical intrinsic potential analysis. The ICTRT defines a MaSA as a system of one or more branches that contains sufficient habitat to support at least 500 spawners. The ICTRT does not consider any population fewer than 500 spawners to be viable, regardless of its intrinsic productivity.

Figure 4-1 shows the intrinsic habitat potential and MaSA for the White Salmon River summer/winter steelhead populations as identified by the ICTRT in their 2008 analysis (ICTRT 2008). Intrinsic potential is the estimated relative suitability of a habitat for spawning and rearing of anadromous salmonids species under historical conditions inferred from stream characteristics including channel size, gradient, and valley width.

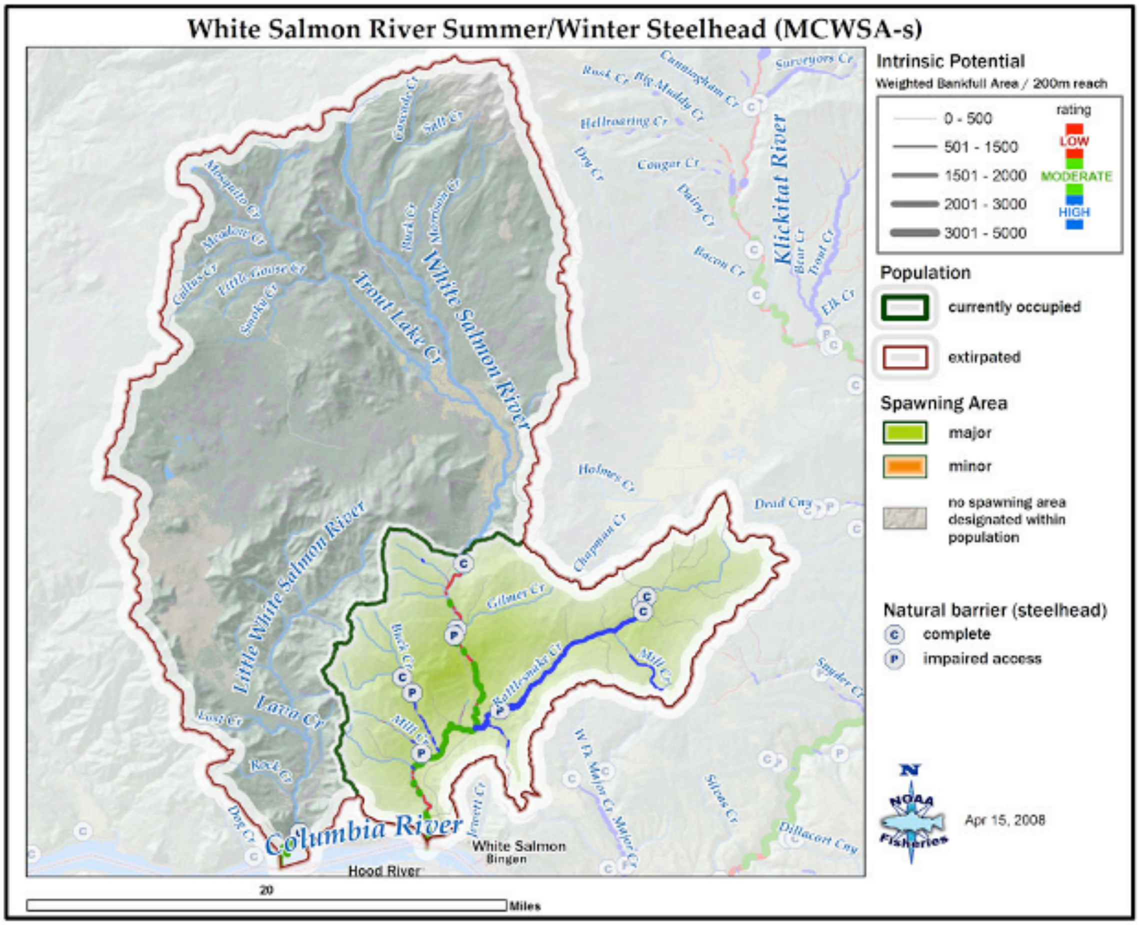

Figure 4-1. Intrinsic habitat potential and Major Spawning Area for the White Salmon River summer/winter steelhead (ICTRT 2008)

5 Limiting Factors and Threats

Scientists generally describe the reasons for a species' decline in terms of limiting factors and threats. Analysis of limiting factors and threats across the entire species' life cycle forms the basis for designing recovery strategies and actions. NMFS defines limiting factors as the biological and physical conditions limiting DPS and population status (e.g., elevated water temperature), and defines threats as those human activities or naturally induced actions that cause the limiting factors (e.g., removal of riparian vegetation for agricultural or residential purposes, which causes loss of shade and, consequently, elevated water temperature).

For salmon and steelhead, survival to reproduce depends on a complex, interacting system of environmental conditions, with different conditions needed for each life stage. Optimal water temperature, for example, varies (within limits) for adult migration versus egg incubation or juvenile rearing. Because of this complexity, in many cases, scientists have a poor understanding of the actual limiting factors.

The list of limiting factors for the White Salmon River salmon and steelhead populations, as for the other populations that make up the LCR salmon ESUs and the MCR steelhead DPS addressed in this recovery plan, is based on a substantial body of research on salmonids, local field data and field observations, and the considered opinions of regional experts. These are implicitly hypothetical statements, made with the expectation that by taking action in the face of some degree of scientific uncertainty, then monitoring the results, continuing to conduct research as a high priority, and adapting our management actions in response, the state of our knowledge will improve and so will fish survival, although not necessarily in a directly parallel process.

Until recently, the primary factor limiting production of all White Salmon species was the presence of Condit Dam. PacifiCorp breached the dam in October 2011, and has removed the structure. Now that the dam no longer serves as a barrier to upstream migration, the primary factor affecting recovery in the White Salmon River watershed is the lack of native stocks. Spring Chinook salmon, coho, chum salmon, and steelhead populations are either extirpated or functionally extirpated (Good et al. 2005, ICTRT 2007b, Ford et al. 2011). The development of local populations will necessitate natural re-colonization or require the introduction of stocks from other basins, but may be limited by the quality of habitat within the watershed.

Salmon and steelhead have not occupied the habitat upstream of the dam for decades. An abundance of unoccupied habitat is present in the basin. Therefore, habitat quality upstream of the former dam is not currently limiting the populations. Fall Chinook salmon and some strays of other species utilize the lower river below the former Condit Dam. The numbers of fall Chinook salmon spawners increased from low levels in the early 2000s (WDFW 2002) to an average of 2,750 for the 2007-08 period (Roler 2009). The majority of the fall Chinook salmon, spawning in the lower river, were assumed to be strays from Spring Creek NFH. The marking of all of the production at Spring Creek NFH has shown that the escapement in recent years has been overwhelmingly from natural-origin fall Chinook salmon (Roler 2011). Prior to breaching of the dam, the habitat in the lower river may have been limiting Chinook salmon production in the years of high abundance.

In the future, some of the species that historically occupied the watershed may slowly begin to occupy upstream habitat through natural re-colonization/straying. More direct stocking may also occur to facilitate the rate of population growth. As the populations recover, some factor related to in-river habitat, quality may eventually become the factor limiting salmonid production. To a certain degree, this will depend upon the species that come to occupy that habitat and also on the degree that the various natural waterfalls in the basin end up restricting dispersion of the species.

When the dam was breached, the reservoir drained quickly. Biologists have not yet had the opportunity to evaluate the current condition of habitat downstream of the dam, but they anticipate large amounts of sediment entering the lower river and moving into the Columbia River. They cannot predict, with any certainty, other habitat conditions after removal; however, the reduction of habitat carrying capacity of the habitat is likely to persist for some unknown period of time. Habitat downstream of the dam may limit population production in the lower river until that habitat recovers from the effects of the removal of the dam, though redds were observed in the lower river in 2012 (R. Engle, USFWS, personnel communication December 2012).

The discussion below further describes what biologists currently know about the condition of the basin's habitat. Numerous studies completed since 2002, including the applicable results of the EDT run completed in 2004 (Allen and Connolly 2005), form the basis of this habitat discussion. In that spirit, this chapter describes potential factors that may limit future anadromous salmon and steelhead populations in the White Salmon River watershed. Chapter 5 is organized as follows:

- Section 5.1 addresses the migration barrier at Condit Dam.
- Section 5.2 identifies freshwater life cycle factors.
- Section 5.3 describes effects on the populations from hatchery production and releases.
- Section 5.4 discusses impacts from harvest.
- Section 5.5 identifies effects from the CR hydrosystem.
- Section 5.6 discusses effects of predation.
- Section 5.7 discusses ocean effects.
- Section 5.8 discusses climate change.
- Section 5.9 discusses other large-scale threats.

5.1 Blocked Migration and Impaired Passage

The single greatest factor limiting salmon and steelhead populations in the White Salmon River watershed was the migration barrier at Condit Dam. Only a small percentage of the historical anadromous spawning and rearing areas was accessible. Table 5-1 presents the current or pre-Condit Dam removal and historical distribution (post Bonneville Dam) within the White Salmon River watershed based on the assumptions built into the EDT model. Note that as an artifact of the EDT model, it defined fall and spring Chinook salmon spawning habitat with no overlap. As a result, the fall Chinook salmon habitat was reduced to cover an area less than what biologists generally believe to be historically accessible. Biologists have considered fall Chinook salmon habitat to have historically extended up to Husum Falls at RM 7.6, which may overlap with possible spring Chinook salmon spawning habitat between Condit Dam and Husum Falls. Chum salmon is the only species that would have access to all of its remaining historical range with the dam in place.

Table 5-2 summarizes primary limiting factors for LCR fall Chinook salmon. Table 5-3 summarizes additional limiting factors affecting anadromous fish in the White Salmon River Basin. Described below are these limiting factors.

Table 5-1. River miles of salmon and steelhead habitat above and below Condit Dam (NPCC 2004).

Species	*Historical Distribution*	*Current Distribution*	*% of Historical Access*	*Comments*
Chum salmon	1.2 miles	1.2 miles	20%	80 percent of spawning area flooded by Bonneville Dam
Fall Chinook salmon	3.6 miles	3.4 miles	94%	6 percent of spawning area above Condit Dam
Spring Chinook salmon	12.8 miles	0 miles	0%	All of spawning area above Condit Dam
Coho salmon	21.1 miles	3.4 miles	16%	Majority of spawning area above Condit Dam
Steelhead	32.9 miles	3.4 miles	10%	Majority of spawning area above Condit Dam

5.2 Freshwater Habitat

5.2.1 Lower White Salmon River Habitat Below Condit Dam

Prior to removal, operations at Condit Dam had reduced the rearing potential in the bypass reach downstream of the dam because minimum flows were 15 cfs, which was only a small percentage of the natural low flows of approximately 626 cfs (United States Geographic Survey (USGS) 2010). Power peaking associated with dam operation caused further diel flow variation, which has led to dewatering, stranding, and an increase in bioenergetic losses because of movements associated with daily flow changes.

The transport of rock and sediment, as well as nutrients, cold water and large wood down the White Salmon River stopped at Northwestern Lake. As a result, coarse material tends to dominate the reach downstream of the dam. Historically, this reach likely had more gravel, cobble, and large wood which salmon and steelhead used as spawning habitat, than is currently present.

The removal of Condit Dam has restored normative flows in the reach. Sediment and woody material transport is also being re-established. During the years after dam removal, flows will transport fine sediment out of the previous reservoir area downstream to the CR. These sediments are likely to affect the quality of spawning habitat in the reach downstream of the dam until the river re-establishes a stable channel and the banks of the new channel also become relatively stable. The reduced habitat quality may decrease the numbers of fall Chinook salmon (and other species that stray into the lower river) that the river can support for an unknown number of years.

Steelheads use the lower reach of the White Salmon River and the area at the mouth of the White Salmon River. Other species migrating to rivers upstream of the White Salmon River use the river as a cool water refuge in the summer and also as temporary overwintering habitat (High et al. 2006; Keefer et al. 2008). By filling in rearing area and holding pools, the sediment released from behind the dam may alter this cool water refuge area for upstream migrants. The return of downstream wood transport may help to eventually deposit wood that helps to scour pools, sort sediments and create holding habitat.

5.2.2 Habitat Upstream of Condit Dam

Flow Regimes

A watershed analysis conducted by the USFS in the upper White Salmon River indicated that, based on past management activities, portions of the upper White Salmon River may be subject to increased peak flow events (USFS 1998). Tributary reaches of the White Salmon generally have more volatile flows than the mainstem White Salmon. Road building, removal of trees from riparian areas, clearing of forests and agricultural lands, loss of wetlands, and other impacts on ecosystem function may have modified the intensity of flows in some tributary reaches.

Channel Structure, Riparian Condition, and Floodplain Connectivity

Some stream reaches in the tributaries have few deep pools and little instream wood (Allen et al 2006a, 2006b; Morris 2004). Substrate in Rattlesnake Creek has a low percentage of ‘fines’ and abundance of spawning sized material (Morris 2003). No additional data representing habitat quality in the mainstem White Salmon River are available to date.

Both timber harvest and fires have impacted forested lands within the lower reaches of the watershed. Biologists consider 72 percent of riparian areas within the upper White Salmon to be late successional, as compared with 38 percent for the entire basin (USFS 2002). Small red alder tends to dominate riparian areas along Rattlesnake and Buck Creeks; conifers in the riparian area are sparse (Allen et al. 2006a, 2006b).

Roads can affect salmonid habitat by reducing natural infiltration and increasing hydro-confinement, leading to altered flow regimes, peak flows, and increased delivery of fine sediment to streams. The magnitude of effect as measured by road density is dependent upon the number of roads, the locations of roads, the surfacing used, traffic levels, and mid-slope engineering of the road (Dubé et al. 2004).

Researchers calculated road densities (road miles/square-mile) in the upper, middle, and lower White Salmon River at 3.7 miles per square mile (2.3 kilometers per square km), 3.1 miles per square mile (1.9 kilometers per square kilometer), and 4.0 miles per square mile (2.5 km per square km), respectively. Tributary road density in the upper White Salmon ranged from 0.2 to 4.4 miles per square mile (0.1 to 2.7 km per square km) (USFWS 2002). Rattlesnake Creek has a density of 3.54 miles per square mile (2.2 km per square km) and Buck Creek a density of 5.05 miles per square mile (3.1 km per square km) (Allen and Connolly 2005). Analyses of the effects of roads on sediment inputs or stream flow have been limited to the headwaters of the mainstem (USFS 2002) and the headwaters of Rattlesnake Creek (Panakanic Watershed Analysis, http://fortress.wa.gov/dnr/forestpractices/wsasmt.cgi?wsaval=acme (accessed April 11, 2012). The Forest Service assessment identified roads that needed addressing. The upper Rattlesnake assessment found that roads were not contributing high amounts of sediment.

After the dam decommissioning efforts are completed, fine sediment will likely dominate habitat in the area previously occupied by the reservoir until such time as the fine materials deposited behind the dam are transported out of the reach, a new channel becomes established, and banks stabilize. Riparian seeding and tree planting, described in PacifiCorp's Re-vegetation and Wetlands Management Plan (PacifiCorp Energy 2010), will address the lack of riparian vegetation in the inundated area. Wood abundance may be high because the reservoir stopped downstream transport of woody debris since 1919; actual abundance will depend on the amount of wood transported into the reservoir and the decay rate of that wood.

Water Quality

Water temperature and dissolved oxygen levels in the mainstem White Salmon River are at or near optimum levels for salmonids (White and Plumb 2004). Maximum temperature within the expected anadromous range meets Washington state water quality standards with the exception of Rattlesnake Creek which approaches lethal temperatures in some locations in some years (White and Plumb 2004; White and Plumb 2005; White and Cochrane 2005, Connolly 2003; Morris 2005). Phosphorus and nitrate/nitrite in the basin (mainstem and tributaries) is very high. Phosphorus levels tend to be roughly twice the recommended EPA standard for creeks and streams and nitrate/nitrite is as much as two orders of magnitude higher that the EPA recommended standard (White and Plumb2004, 2005; White and Cochrane 2005, EPA 2000).

There are currently several segments of the mainstem White Salmon and tributaries listed as impaired waterways, 303(d) listings, by the Washington State Department of Ecology, although some of the data on which the listings are based needs updating. Ecology lists individual reaches on Gilmer Creek, Rattlesnake Creek, the mainstem White Salmon, and Trout Lake Ditch as Category 5 (water quality impaired) for fecal coliform. Temperature impairments have led to the Category 5 listing of reaches on Indian and Rattlesnake creeks http://www.ecy.wa.gov/programs/wq/303d/2008/index.html (accessed April 11, 2012).

5.3 Hatchery Production and Releases

Discussed below are effects of hatchery production and releases on White Salmon River salmon and steelhead populations.

Chinook salmon

Tule fall Chinook salmon from Spring Creek NFH contribute to natural production of fall Chinook salmon in the White Salmon River. Most of the fish spawning naturally in the White Salmon River were assumed to be hatchery-origin tule fall Chinook salmon based on CWT recoveries. Spring Creek NFH began marking all of its hatchery production and as a result, recent spawning ground surveys have shown that the majority of the tule fall Chinook salmon returning to the White Salmon River are of natural origin (Roler 2011). Spring Creek NFH tule fall Chinook salmon originally derive from White Salmon tule fall Chinook salmon and biologists and recovery planners anticipate that Spring Creek NFH tule fall Chinook salmon may be used to supplement natural production in the future. Smith and Engle (2011) collected genetic samples from juvenile salmon emigrated from the White Salmon River and determined that the naturally produced fall Chinook salmon juveniles grouped with Spring Creek NFH tules when compared to other LCR tule fall Chinook salmon populations and stray URB fall Chinook salmon.

Stray URB hatchery fall Chinook salmon may be affecting the productivity of the tule fall Chinook salmon in the White Salmon River. These URB fall Chinook salmon are strays from releases at the LWS NFH and other releases in the Bonneville Pool. Through redd superimposition, URB fall Chinook salmon can adversely affect tule fall Chinook salmon: Peak spawning time for URB fall Chinook salmon is in late October and into November after tule fall Chinook salmon spawning has been completed. Since habitat has been very limited in the White Salmon River, URB fall Chinook salmon that spawn on top of tule fall Chinook salmon redds can decrease the productivity of the White Salmon River population. The LWS NFH is taking measures to decrease the number of stray URB fall Chinook salmon. Recent escapement data for the White Salmon River has shown a decrease in the abundance of URB fall Chinook salmon spawners, but in some years, their abundance exceeds that of tule fall Chinook salmon (Roler 2011). If these measures are unsuccessful in reducing the number of stray URB fall Chinook salmon to acceptable levels, the hatchery will implement other actions.

Biologists do not know the actual stray rate of Spring Creek NFH tule fall Chinook salmon into local tributaries, but these Spring Creek hatchery fish do contribute to naturally spawning tule fall Chinook salmon in upper gorge tributaries, including the White Salmon River. The exact proportion of these hatchery fish on the spawning grounds could not be determined because only a small number of the hatchery's fish were marked. The estimated number of tule fall Chinook salmon spawners has increased in recent years peaking in 2003 with 1,575 being observed in the Wind River, 12,471 in the White Salmon River, and 10,686 in the Klickitat River (Jenkins, 2006; Roler 2009). All recent production at Spring Creek NFH fall Chinook salmon have been externally marked allowing for differentiation between natural-origin and hatchery fall Chinook salmon in the White Salmon River. All age-classes of the hatchery tule fall Chinook salmon returning to Spring Creek NFH were marked in 2010, and escapement to the White Salmon River was estimated to be composed of 1,142 natural-origin and 558 hatchery-origin tule fall Chinook salmon adults (Roler 2011). Smolt-to-adult survival rates averaged 0.136 percent for the 1991-95 brood years (Spring Creek NFH Hatchery Genetic Management Plan (HGMP) 2002). The total exploitation rate for the hatchery program was as high as 75.3 percent for the 1982-89 brood years. An estimate for brood years 1990-93 has the total exploitation rate at 67 percent, with nearly half of the impacts occurring in the CR, primarily in the Zone 6 area above Bonneville Dam (Spring Creek NFH HGMP 2002).

Hatchery-produced spring Chinook salmon are not released into the White Salmon River Basin though strays from the LWS NFH and other programs were recovered at a weir on the White Salmon River in 2009 (Engle et al. 2010).

Coho salmon

Hatchery biologists found that coho salmon from the LWS NFH had strayed into the White Salmon watershed prior to the closure of the program in 2004. Biologists consider these strays and others from releases further upstream in the CR to be the likely source of naturally spawning coho salmon in the White Salmon River.

Steelhead

Until 2010, fisheries managers released summer and winter steelhead from Skamania broodstock into the White Salmon River below Condit Dam to support tribal and recreational fisheries. Technicians marked all hatchery fish to allow for selective fisheries. These releases may limit the diversity of any naturally produced winter steelhead in the basin. However, the primary constraint on summer and winter steelhead in the White Salmon River has been the limited spawning and rearing habitat. Further, biologists do not believe Skamania stock steelhead are reproductively successful when spawning naturally; thus, adverse effects on natural populations may be limited. The hatchery terminated releases of these hatchery fish as of 2010 and biologists expect any potential impacts associated with these releases within the White Salmon will diminish after 2011. There may also be significant straying of migrating hatchery fish from other basins into the White Salmon seeking a cold water refugia (High et al. 2006, Keefer et al. 2008). These strays may originate from different DPSs including the Snake River Basin. While some may contribute to rebuilding the population, other strays may have a negative impact.

5.4 Harvest

Harvest currently does not limit the abundance or the diversity of White Salmon River steelhead, and spring Chinook salmon, coho salmon, and chum salmon, populations. NMFS considers all of these populations extirpated or functionally extirpated (Good et al. 2005; ICTRT 2007b; Ford et al. 2011). Any coho, chum, spring Chinook salmon, and most steelhead found in the White Salmon River are strays from other basins. In the White Salmon River, non-tribal coho salmon and steelhead fisheries are selective for marked hatchery fish, requiring the release of unmarked salmon and steelhead. Regulations prohibit retention of fall Chinook salmon in the White Salmon River from October 1 to December 31.

Fall Chinook salmon

Ocean fisheries off the coasts of Oregon, Washington, and British Columbia catch LCR fall-run (tule) Chinook salmon populations (NMFS 2008c). Total exploitation rates were generally higher through 1993 (averaging 69 percent), lower from 1994 to 1999 (averaging 34 percent), then increasing since 2000 (averaging 49 percent). From 2002 to 2006, regulators limited fisheries to a 49 percent exploitation rate. Total exploitation rates have been higher in some years but have averaged 49 percent from 2002 to 2006. The average exploitation rates for non-treaty fisheries in the CR for these same periods were 16 percent, 8 percent and 9 percent respectively. Tribal fisheries have a higher harvest rate on the Bonneville Pool tule populations, including the White Salmon River population (NPCC 2004; NMFS 2000).

For the last several years, NOAA Fisheries has limited Pacific Fisheries Management Council (Council) and in-river fisheries by specifying a total exploitation rate limit. From 2002 to 2006, the limit was 49 percent. The Council reduced the exploitation rate to 42 percent in 2007. NOAA Fisheries' guidance to the Council for 2008 was that Council fisheries should be managed such that the total exploitation rate on LCR Chinook salmon tule populations, from all fisheries does not exceed 41 percent. For 2009 and thereafter, NOAA Fisheries has set a total exploitation rate limit for tule Chinook salmon through their annual guidance letter to the Council. The Council's Salmon Forest Management Plan (FMP) requires NOAA Fisheries to provide such guidance. Fisheries subject to the 2008 *U.S. v. Oregon* Agreement that are part of the set of Prospective Actions must be managed subject to the overall exploitation rate limit as proposed in 2008 and have been since 1999 (NMFS 2008c). Biologists believe that tribal fisheries do not have a significant impact on the entire LCR tule fall Chinook salmon run, but do have a higher harvest rate on the Bonneville Pool tule populations, including the White Salmon River (NPCC 2004; NMFS 2000). Under the *U.S. v. Oregon* Agreement, there are a number of escapement and management objectives that limit the harvest of fall Chinook salmon in fisheries that would impact White Salmon River fall Chinook salmon, for example, a minimum escapement goal of 7,000 adults (4,000 females) to meet broodstock needs at Spring Creek NFH can restrain ocean, lower river mainstem, and above Bonneville Dam treaty fisheries (NMFS 2008c).

Tributary fisheries minimally impact tule fall Chinook salmon. The White Salmon River tributary fishery accounts for less than one percent of the total run-size of LCR fall Chinook salmon and less than 4 percent of the White Salmon River tule fall Chinook salmon (NMFS 2008c). Currently, Washington fisheries regulations allow fall Chinook salmon retention in the lower White Salmon River from July 1 to March 31 annually, but close the river to the retention of Chinook salmon ½ mile upstream from the Highway 14 bridge from October 1 to December 31 to protect spawning salmon (WDFW 2009). Catch record cards are the basis for the estimated total recreational Chinook salmon catch in the White Salmon River. These data can contain recording errors and fish misidentification, along with dip-in fish destined for upriver systems. The exploitation rate of White Salmon River tule fall Chinook salmon during WDFW-regulated fisheries in the White Salmon River is less than 5 percent of the terminal run. Biologists estimate the terminal run-size based on the annual catch rate and spawning escapement estimate data collected since 1995 (NPCC 2004). The average annual catch of wild tule fall Chinook salmon is approximately 30 fish and the average annual escapement estimate is 461, therefore, the average annual terminal run of White Salmon

River tule fall Chinook salmon is approximately 491 fish. Biologists extrapolate total run-size of the White Salmon River tule fall Chinook salmon and total fisheries impact from these data. Using the estimated annual terminal run-size and estimated annual exploitation from ocean and CR mainstem fisheries, the estimated average total run-size of White Salmon River tule fall Chinook salmon is 784 fish (NPCC 2004). The total number of fall Chinook salmon spawners (natural-origin and hatchery) has increased from low levels in the early 2000s (USFWS 2004) to an average of 2,750 for the 1998-2007 period (Roler 2009). The sport harvest has remained at roughly 30 adult fall Chinook salmon (Kraig and Smith 2008). Therefore, in recent years the proportion of the total escapement caught in the fishery has remained small.

Spring Chinook salmon

If the White Salmon River produced spring Chinook salmon, they would contribute to lower Columbia mainstem fisheries and treaty fisheries in the Bonneville Pool. Spring Chinook salmon originating from above Bonneville Dam do not contribute to ocean fisheries compared to other LCR spring Chinook salmon populations (NMFS 2008c). Fishery managers would deal with spring Chinook salmon originating from the White Salmon River as part of the upriver spring and Snake River summer Chinook salmon group. This group includes all natural and hatchery produced spring Chinook salmon originating from the CR and its tributaries above Bonneville Dam (NMFS 2008c). The abundance of this group and the status of natural-origin spring Chinook salmon from the Snake River and upper CR is the basis for establishing harvest rates for both lower river commercial and recreational fisheries and tribal treaty fisheries above Bonneville Dam. The harvest rate for this group averaged 14.5 percent from 1999 to 2008, but the actual harvest rate for prospective White Salmon spring Chinook salmon would be less because they are not exposed to the full Zone 6 (above Bonneville) treaty fishery (ODFW and WDFW 2009). Tributary sport regulations for the White Salmon River require the release of unmarked Chinook salmon from April 1 to June 30 protecting natural-origin spring Chinook salmon that may enter the White Salmon River (WDFW 2009).

Coho salmon

NMFS considers White Salmon coho salmon extinct and therefore allows no fisheries targeting coho salmon in the White Salmon River (Good et al. 2005). Stray hatchery coho salmon can be retained and all wild coho salmon must be released in fisheries downstream of the location of Condit Dam from July 1 to March 31 (WDFW 2009) LCR coho salmon are caught in both ocean and in-river fisheries. Until 1993 the exploitation rates of LCR coho salmon have been very high, contributing to their decline (NMFS 2008c). The combined ocean and in-river exploitation rates for LCR coho salmon averaged 91 percent through 1983, averaged 69 percent from 1984-1993, and decreased to an average of 16.7 percent from 1994-2007 (NMFS 2008c). The exploitation of hatchery coho salmon has remained approximately 50 percent through the use of selective fisheries.

The Pacific Fishery Management Council in accordance with the 2008 *U.S. v. Oregon* Agreement and related biological opinions regulates LCR coho salmon harvest, which is subject to a total exploitation rate limit for the combined ocean and in-river fisheries. Previously, ocean regulators used Oregon Coast natural coho salmon as a surrogate for estimating ocean fisheries impacts to LCR coho salmon. In 2006, largely as a consequence of increased attention resulting from its listing, the methods for assessing harvest in ocean fisheries changed so that they were more specific to LCR coho salmon (NMFS 2008c).

Each year, harvest managers in the CR will set coho salmon fishing regulations, after accounting for anticipated ocean harvest, so as not to exceed the total exploitation rate limit. In 2008, the total exploitation rate limit was 8 percent based on the year specific circumstances. For 2009 and thereafter, NOAA Fisheries will set a total exploitation rate limit for LCR coho salmon through their annual guidance letter to the Council. Fisheries subject to the 2008 *U.S. v. Oregon* Agreement that are part of the set of Prospective Actions must be managed subject to the overall exploitation rate limit as proposed in 2008 and as they have been since 1999. Under the *U.S. v. Oregon* Management Agreement (NMFS 2008c) these non-treaty fisheries do not exceed the 50 percent catch sharing objective for coho salmon destined for above Bonneville Dam.

Chum salmon

In the first half of the 20th century there was a substantial commercial chum salmon fishery with a harvest rate of more than 500,000 chum salmons in some years (Myers et al. 2006). Harvest of chum salmon in the CR is limited to indirect fishery mortality. Regulators closed or drastically minimized commercial chum salmon fisheries in the 1950s due to severe population declines. Currently, there are no recreational or commercial fisheries in the CR. The number of chum salmon landed as take incidental to lower river commercial gill net fisheries has been fewer than 50 fish in each of the last five years. Harvest impacts to chum salmon from CR commercial and recreational fisheries are constantly below 5 percent and since 1998 have averaged 1.6 percent. Biologists assume ocean fishing mortality on CR chum salmon to be zero. Regulations prohibit retention of chum salmon in the White Salmon River.

Middle Columbia River steelhead

NMFS considers White Salmon River steelhead functionally extirpated (ICTRT 2007b). Any future White Salmon River produced steelhead would have similar fishery impacts as biologists have observed for steelhead destined for the other MCR Basins in Bonneville Pool. Various fisheries can catch these steelhead as they migrate through the CR and Pacific Ocean. These fisheries are discussed briefly below.

Ocean Fisheries

Ocean fisheries rarely catch steelhead; therefore, biologists do not consider these fisheries a significant source of mortality to MCR steelhead (NMFS 2000). Biologists assume ocean fishing mortality on MCR steelhead to be zero.

Columbia River Mainstem Non-Tribal Fisheries

There has been no direct freshwater non-tribal harvest on wild steelhead from the MCR steelhead DPS since 1992, when the last wild fish catch-and-release regulations on these populations became effective. Therefore, all current non-tribal harvest impacts on Mid-Columbia DPS steelhead are due to incidental by-catch in commercial or recreational fisheries that target hatchery steelhead or other species. Monitoring these impacts is complex. Released fish experience a mortality rate, possibly delayed and difficult to measure, that is highly variable and depends on what gear is used, how the fish are caught by the gear, how the fish are handled during capture and release, and environmental conditions. Biologists estimate release mortality to be very low (below one percent of encounters (NMFS 2008c)), with an unknown range of error. Fish technicians monitor recreational fisheries by conducting creel surveys, interviewing anglers about their catch, gear, and wild steelhead releases. Biologists estimate the total recreational impact on winter and summer steelhead as they move through the mainstem to the tributaries to be less than 2.5 percent (ODFW 2008).

There are three stocks of summer steelhead used for management of treaty and non-treaty mainstem fisheries, including the LCR Skamania stock, upriver A-run stock, and upriver B-run stock. All MCR steelhead populations are designated A-run, with two populations being winter-run. In NOAA's Biological Opinion for the 2008-2017 *U.S. v. Oregon* Fisheries Agreement, the wild MCR Steelhead DPS in the non-treaty winter, spring, and summer mainstem fisheries are subject to a 2 percent harvest rate limit (NMFS 2008c). Non-treaty fall fisheries are also limited to a 2 percent harvest rate limit for A-run summer steelhead. The total annual harvest rate limit for A-run steelhead in non-treaty fisheries is 4 percent and 2 percent for the summer-run and winter-run of the MCR steelhead DPS, respectively. The expected harvest impacts from non-treaty fisheries are less than the limits proposed in the *U.S. v. Oregon* Fisheries Agreement. The yearly incidental catch of A-run steelhead in non-treaty fisheries has averaged 1.6 percent since 1999; co-managers do not expect to the incidental catch rate to change over the course of the Agreement (NMFS 2008c).

Treaty Indian Fisheries

Tribal fishers in Zone 6 of the Columbia mainstem (between Bonneville Dam and McNary Dam) continue to retain wild steelhead for commercial sale or for personal use. The *U.S. v. Oregon* Fisheries Agreement does not establish specific harvest rate limits for tribal fisheries on steelhead during the spring or summer seasons that extend through July 31. Reported steelhead catch in Zone 6 winter and spring fisheries for 2003 to 2005 ranged from 0.7 percent to 7.9 percent of the winter steelhead run over Bonneville Dam. In 2004, reported and estimated non-reported steelhead catch together amounted to 4.8 percent of the run at Bonneville, with an unknown range of error (ODFW 2008).

Harvest restrictions for B-run steelhead and upper CR bright fall Chinook salmon limit tribal fishery impacts on MCR steelhead (NMFS 2008b). The harvest rate on MCR summer-run steelhead in spring, summer, and fall Zone 6 tribal fisheries combined averaged 11.7 percent since 1985 and 6.64 percent since 1998 (NMFS 2008b, Table 8.8.5.5-1). Co-managers expect the impacts resulting from the tribal fisheries to be similar to the 1998-2006 average of 6.64 percent. The harvest rate is mostly for populations that pass more dams in Zone 6 than the White Salmon steelhead population, which passes only one Zone 6 dam. White Salmon steelheads are therefore subject to fewer non-Native American and tribal treaty fisheries and experience a harvest rate estimated to be less than 10 percent.

White Salmon River Fisheries

The White Salmon River was open year-round for marked hatchery steelhead up to the Powerhouse outfall. After dam breaching, the area open to steelhead fisheries is the lower three miles of the mainstem river, and also upriver as far as Husum. This fishery harvests marked Skamania hatchery steelhead released in the basin as juveniles and out-of-basin steelhead that dip-in to the White Salmon River when seeking cooler water temperatures in the summer. According to catch card data available for the 2002-03 return year, fisheries harvested 3,135 marked summer steelhead and 133-marked winter steelhead (WDFW 2008). Non-tribal fisheries for Chinook salmon and coho salmon are open in the lower White Salmon River all year and require the release of unmarked Chinook salmon and coho salmon by non-tribal fishers.

5.5 Federal Columbia River Hydrosystem

Hydropower system construction and operation (flow regulation) in the CR Basin has been a major cause of changes in the CR and estuary from historical conditions.

Within the White Salmon watershed, creation of the Bonneville Dam pool on the mainstem CR affected steelhead and salmon by effectively inundating the lower 0.96 miles of the habitat. This resulted in the loss of riparian, spawning, and rearing habitat and increased predation by native and non-native fish in the lower river. The effects are greatest on White Salmon chum salmon, since the dam inundated all but 0.24 miles of their original habitat. A lack of historical data inhibits quantitative evaluation of the impacts of Bonneville pool inundation on native fish, plant, and wildlife species.

Dams altered conditions within much of the mainstem Columbia and Snake Rivers compared to historic conditions. The development of hydropower and water storage projects within the CR Basin resulted in the inundation of many mainstem spawning and shallow-water rearing areas (e.g., loss of spawning gravels and access to spawning and rearing areas); altered water quality (e.g., reduced spring turbidity levels), water quantity (e.g., seasonal changes in flows and consumptive losses resulting from use of stored water for agricultural, industrial, or municipal purposes), water temperature (e.g., including generally warmer minimum winter temperatures and cooler maximum summer temperatures), water velocity (e.g., reduced spring flows and increased cross-sectional areas of the river channel), food (e.g., alteration of food webs, including the type and availability of prey species), and safe passage (e.g., increased mortality rates of migrating juveniles) (Williams et. al 2005; Ferguson et. al 2005).

Model studies indicate that the hydrosystem and reduced river flows caused by climate change together have decreased the delivery of suspended particulate matter to the lower river and estuary by about 40 percent (as measured at Vancouver, Washington) and have reduced fine sediment transport by 50 percent or more (Bottom et al. 2005). Overbank flow events, important to habitat diversity, have become rare, in part because flow management and irrigation withdrawals prevent high flows and in part because diking and revetments have increased the "bankfull" flow level (from about 18,000 to 24,000 m3/s). The dynamics of estuarine habitat have changed in other ways relative to flow. The availability of shallow (between 10 cm and 2 m depth), low-velocity (less than 30 cm/s) habitat now appears to decrease at a steeper rate with increasing flow than during the 1880s, and the absorption capacity of the estuary appears to have declined.

The CR Estuary Module, at http://www.nwr.noaa.gov/Salmon-Recovery-Planning/ESA-Recovery-Plans/Estuary-Module.cfm (accessed April 11, 2012), provides more information on factors that limit viability of LCR Chinook salmon and coho salmon, CR chum salmon, and MCR steelhead in the CR Estuary.

5.5.1 Hydro Project Impacts on Outmigrating Smolts

As anadromous juvenile salmonids migrate from freshwater rearing habitats to the ocean, they are vulnerable to a host of factors that affect their survival. Scientists have conducted many studies in recent years to determine both the direct effects associated with project passage (e.g., instantaneous mortality, injury, loss of equilibrium, reservoir and tailrace predation) and indirect effects (e.g., vulnerability to predation in the estuary or plume, disease, and physiological stress), which contribute to the total mortality of seaward migrating salmonids (Counihan et al. 2005).

White Salmon River salmonids must pass only Bonneville Dam on their way to and from the Pacific Ocean. The 2008 Federal Columbia River Power System (FCRPS) Biological Opinion's Reasonable and Prudent Alternative (RPA) requires a 10-year program of configuration improvements at the dam including the installation of turbines with minimum gap runners at Powerhouse 1 and increased guidance into the juvenile bypass systems at both powerhouses (NMFS 2008b). BPA will continue and further increase the pike minnow sport fishery incentive program, removing more of these predators from Bonneville pool. Upon implementation of these changes, juvenile survival from the mouth of the White Salmon to below Bonneville Dam is expected to be 95.5 percent for Chinook salmon, coho and chum salmon and 90.8 percent for steelhead (NMFS 2008b, Table 14.3 of the Incidental Take Statement).

5.5.2 Hydro Project Impacts on Migrating Adults

Passage Survival

Fish returning to the White Salmon watershed must pass Bonneville Dam and Reservoir. Prospective actions under the 2008 FCRPS Biological Opinion's RPA are expected to maintain the current high survival rates of 98.6 percent for spring-run Chinook salmon, 98.5 percent for steelhead, and 96.9 percent for fall-run Chinook salmon, coho, and chum salmon (NMFS 2008b, Table 14.1 of the Incidental Take Statement). Sea lions take about 22 percent of adult winter steelhead and 8.5 percent of adult spring Chinook salmon in the tailrace of Bonneville Dam (NMFS 2008b).

The 2008 FCRPS Biological Opinion RPA requires that the USACE install, and improve as needed, sea lion excluder gates at all main adult fish ladder entrances and must continue to support land and water based harassment efforts by NOAA Fisheries, ODFW, WDFW and the Tribes to keep sea lions away from the area immediately downstream of Bonneville Dam.

5.6 Predation, Competition and Disease

There has been an increase in abundance of predatory native and exotic fishes below Condit Dam within the reservoir created by Bonneville Dam. Primary predators of juvenile salmonids in the CR include northern pike minnow, smallmouth bass, channel catfish, walleye, terns, cormorants, and sea lions. Northern pike minnow are native cyprinids that are widely distributed throughout the CR Basin. Because these predators consume millions of salmonid smolts per year in the LCR, they are the subjects of an extensive predator control effort.

Hatchery steelhead juvenile releases into the White Salmon have probably led to competition with any natural-origin smolts produced below Condit Dam; these releases were discontinued in 2010. Hatchery adults that stray into the White Salmon River may compete for spawning and rearing habitat. Spawning of later returning URB fall Chinook salmon can reduce the productivity of naturally spawning tule fall Chinook salmon through redd superimposition.

Hatchery managers have reported Bacterial Kidney and Black Spot diseases throughout the White Salmon Basin (Allen et al. 2006a, 2006b). Now that PacifiCorp has breached Condit Dam, diseased fish moving into waters upstream of the former dam site may introduce other pathogens and/or diseases into the basin. The effects of disease on current or any potential future populations are unknown.

5.7 Ocean Conditions

The effects of ocean conditions on abundance of Pacific salmon and steelhead vary among species and populations within species. Migration patterns in the ocean may differ dramatically and expose different stocks to different conditions in different parts of the ocean. Some species have broad, offshore migration patterns that may extend as far as the Gulf of Alaska (steelhead, chum, and some Chinook salmon). Others have migration patterns along the Washington, British Columbia, Oregon, and California coasts (Chinook salmon, coho, and cutthroat salmon). Thus, ocean conditions do not have coincident effects on survival across species or populations.

Widespread changes in ocean conditions have dramatically affected ocean survival of steelhead. Cooper and Johnson (1992) showed that variation in steelhead run sizes and smolt-to-adult survival was highly correlated between runs up and down the West Coast. Smolt-to-adult survival rates generally varied 10-fold between good and bad years. Scientists know little about the early ocean life history of CR chum salmon.

5.8 Climate Change

Climate change represents a potentially significant threat to recovery of listed salmon and steelhead populations. The Independent Scientific Advisory Board (ISAB) for the NPCC, CR Basin Indian Tribes, and NMFS reviewed the potential effects of climate change on salmonids in the CR Basin (ISAB 2007). The ISAB report shows that changes in climate may adversely affect steelhead in freshwater habitats across the MCR DPS by exacerbating existing problems with water quantity (lower summer stream flows) and water quality (higher summer water temperatures). Impacts on snow pack, stream flow, and water quality in the Columbia Basin include the following (ISAB 2007):

- Warmer temperatures will result in more precipitation falling as rain rather than snow.
- Snow pack will diminish, and the timing of stream flow will be altered.
- Peak river flows will likely increase.
- Water temperatures will continue to rise.

These changes may affect steelhead more than other salmonids because of their long rearing period in freshwater.

Changing conditions could also affect salmonid health and survival in the ocean through a variety of mechanisms, including increased ocean temperatures, increased stratification of some waters, changes in the upwelling season, shifts in the distribution of salmonids, long-term variability in winds and ocean temperatures, increased acidity, and increased atmospheric and oceanic variability (NMFS 2007, 2008a; ISAB 2007).

All other threats and conditions remaining equal, future deterioration of water quality, water quantity, and/or physical habitat can be expected to cause a reduction in the number of naturally produced adult steelhead returning to these populations across the DPS. This possibility further reinforces the importance of achieving survival improvements throughout the entire steelhead life cycle. Recent research also indicates that neighboring populations with differences in habitat may show different responses to climate changes (Crozier and Zabel 2006; Crozier et al. 2008). This research reinforces the importance of maintaining habitat diversity.

5.9 Other Large-Scale Threats

Other large-scale threats that may affect salmon and steelhead populations in the White Salmon watershed in the future include the following:

- Human population growth. Pressures may increase for conversion of forestry and agricultural land uses to residential uses and residential water development, with potential impacts on habitat and water conditions.
- Increase in exotic invasive species that potentially compete with native flora and fauna. Such invasive species could provide food and/or cover to species that potentially compete with, prey on, or carry diseases that could affect native species.
- New diseases and/or pathogens. Migrating steelhead can introduce them through exposure to marine aquaculture operations or illegal stocking of out-of-watershed species, among other means.
- Natural catastrophic events.(e.g., earthquakes, volcanic eruptions, and large-scale forest fires).

Table 5-2 lists the primary factors limiting the production of fall Chinook salmon, the only extant population in the White Salmon River drainage. Table 5-3 lists the combined factors limiting the production of the extirpated or functionally extirpated spring Chinook salmon, coho, and chum salmon, and steelhead populations within the White Salmon watershed. Also listed are the potential impacts on population VSP parameters, sites where these impacts may be observed, the underlying anthropogenic threats, life stage affected, significance, and actions that would address the limiting factors.

Table 5-2. Primary limiting factors for lower Columbia River fall Chinook salmon in the White Salmon River drainage

Limiting Factor	VSP Parameter Impacted	Sites Affected	Threats	Life Stages Affected	Significance (Scope/Severity)	Actions
Lack of spawning gravel and spawning area	Abundance, productivity	Lower 3.3 RM of mainstem White Salmon River	High fine sediment loads delivered from the former Northwestern Lake	Spawning and incubation	Fine sediments accumulated in the bottom of the former Northwestern Lake will be transported into the lower 3.3 miles of the river for potentially many years. These fine sediments will tend to settle out in lower gradient areas and will also tend to build up during lower flow periods. The net effect on habitat remains unknown.	Restoration of habitat in the reaches formerly occupied by Northwestern Lake and downstream of the former dam site. Natural processes will eventually come to an equilibrium.
Harvest	Abundance, productivity	All, but especially ocean and Columbia River fisheries	Commercial, recreational, and tribal fisheries	Upstream migration, ocean survival	Significant harvest of fall Chinook salmon is allowed annually. While the specified allowed harvest is expected to result in gradual population growth, the allowable rate of harvest may slow recovery	Modify fisheries
Genetic changes and/or competition with hatchery fish	Genetic diversity, abundance and productivity	All spawning areas	Strays from other areas	Spawning and rearing	Unknown	Monitor

Table 5-3. Additional factors potentially limiting anadromous fish (lower Columbia River spring Chinook salmon and coho salmon, Columbia River chum salmon, and middle Columbia River steelhead in the White Salmon River drainage). The primary limiting factors are highlighted in light yellow; factors that may become limiting in the future are highlighted in light gray.

Limiting Factor	VSP Impacted Parameter	Sites Affected	Threats	Life Stages Affected	Significance (Scope/Severity)	Actions
Lack of an extant viable population	Abundance and Productivity	All	Populations of steelhead, spring Chinook salmon, coho salmon, and chum salmon are considered extirpated or functionally extirpated	All stages	Re-colonization by the extirpated species will be limited to natural repopulation of the basin through straying	The preferred approach for reintroduction of species into the basin is to allow natural straying into the river. Hatchery alternatives may be implemented if population recovery is determined to be too slow.
Harvest	All	All	Now that the dam has been removed, an abundance of unoccupied habitat has become available. Harvest will directly affect the rate of species re-colonization and population growth.	All	Will delay the rate of recovery in direct proportion to the numbers of fish potentially spawning in the basin that are caught	Manage fisheries to increase the potential for escapement into the White Salmon River.
High sediment loads in the reaches formerly occupied by Northwestern Lake and the reaches downstream of the former lake and a lack of suitable spawning habitat downstream of Buck Creek	Abundance and Productivity, spatial structure and diversity	All	The high sediment loads mobilized out of the area of the former lake may eradicate suitable spawning habitat downstream of Buck Creek for many years. The absence of quality spawning habitat in the lower reaches may deter stray fish from moving into the upper basin where	All	May delay re-colonization of the basin	Implementation of PacifiCorp's Dam Decommissioning Plans. Additional analysis of both habitat and re-colonization rates will be required to determine if additional actions are needed.

Limiting Factor	VSP Impacted Parameter	Sites Affected	Threats	Life Stages Affected	Significance (Scope/Severity)	Actions
			good spawning habitat is available.			
Factors that may become limiting as the populations grow						
Stream flow	Primarily abundance and productivity	Buck Creek	Water diversions.	Fry colonization, inactive age-0 and 1, juvenile rearing, migration	Diversion withdraws 70 percent of flow from Buck Cr., while unused portion returns to White Salmon via gully	Address Buck Creek water diversion
Large Woody Debris abundance	Primarily abundance and productivity	Mainstem White Salmon upstream of Buck Creek and lower White Salmon River mainstem.	Removal of wood for recreation; land use practices that reduce riparian forests	Fry colonization, juvenile rearing, overwintering, pre-spawners, spawners	Lack of LWD reduces pool habitat, sediment sorting and habitat complexity	Place LWD as appropriate and feasible. Address wood removal by boaters. Add structure to form pools
Stream temperatures	Abundance, productivity, spatial structure and diversity	Indian and Rattlesnake Creeks, lower Buck Creek, and possibly the reaches formerly occupied by Northwestern Lake	Land use practices that reduce riparian function; lack of riparian vegetation within the footprint of the former Northwestern Lake	Juvenile rearing, active age-0, spawning, migration	Currently the problem exists primarily in Rattlesnake and Indian Creeks, but may become a problem in the reaches previously occupied by the reservoir.	Increase shading along temperature limited reaches.
Harassment, predation and competition	Primarily abundance, productivity	Bonneville Pool	Inundation by Bonneville Pool	Adult migrants, pre-spawners, holding	Increase in exotic species and recreational activity in lower river	Improve programs that target exotic piscivorous fish in the mainstem Columbia

6 Recovery Strategy and Actions

The preceding chapters summarize recovery goals, biological and threats criteria, current status assessment, and the major limiting factors and threats identified for the White Salmon River salmon populations. How will we reach recovery? The White Salmon recovery strategy contains two key parts: 1) a plan for reintroducing naturally produced salmon and steelhead into historical habitat after the removal of Condit Dam, 2) improving and increasing freshwater habitat for salmon and steelhead production in key reaches of the watershed. The Plan also recommends ensuring that harvest or hatchery actions do not impede efforts to improve salmon and steelhead viability.

Blocked passage at Condit Dam was the primary limiting factor for both salmon and steelhead until the dam was breached in October 2011, and completely removed in October 2012. The methods considered to reintroduce salmonids to their historical habitat, included natural re-colonization, artificial propagation, or some combination of the two. Section 6.1 and Appendix I describe reintroduction plans.

Sections 6.2 through 6.5 also propose additional actions regarding freshwater habitat, hatcheries, harvest, and hydrosystem operations.

6.1 Salmon and Steelhead Reintroduction Plans

The White Salmon Working Group, made up of Federal, state, and tribal fisheries managers, as well as representatives of PacifiCorp (Condit Dam operators), developed several options to consider for the reintroduction of salmon and steelhead into the White Salmon River. The group fleshed out each option with a description of the biological basis for the approach, operational and maintenance needs, and monitoring and evaluation needs. For more details about the options and considerations, see Appendix I.

Some members of the White Salmon Working Group proposed that after Condit Dam removal or passage restoration, the reintroduced/re-colonized populations in the White Salmon River be experimental populations pursuant to section 10(j) of the ESA. However, these fish would not meet the ESA's definition for an experimental population, which is defined, in part, as one that is "wholly separate geographically from non-experimental populations of the same species."

After the removal of Condit Dam, populations of Chinook salmon, coho salmon, and steelhead cannot remain "wholly separate geographically" from other populations within the listed ESU/DPS. Keeping the populations "wholly separate" from the other populations within the listed species is also not consistent with the recovery strategy where the goal is for listed species from neighboring populations to re-colonize the habitat above Condit Dam after its removal. Furthermore, as Sections 2.4.4 and 6.1.5 (MCR steelhead) describe, the steelhead population in the White Salmon River still evidence some of its ability for anadromy and is not wholly extirpated.

6.1.1 Fall Chinook salmon

The White Salmon Working Group agreed on a salvage plan for tule fall Chinook salmon to maintain natural production assuming Condit Dam removal. Beginning in 2008, biologists tested a salvage plan to see if technicians could capture enough adult tule fall Chinook salmon below Condit Dam and safely transport them to spawning habitat above the dam. Biologists monitored the transported tule fall Chinook salmon to determine post-release survival, movement, and spawning habitat preferences (Engle and Skalicky 2009). In 2009, technicians installed a weir at the White Salmon Ponds site and tested increasing adult salmon collection and estimating escapement above the White Salmon Ponds site (Engle et al. 2010).

The White Salmon Working Group evaluated the following options for tule fall Chinook salmon (see Appendix I for detailed descriptions).

1. Salvage adipose present CWT-negative tule fall Chinook salmon from the White Salmon River in the fall of 2010 to start tule fall Chinook salmon restoration.
2. Spring Creek NFH would spawn adults and rear eggs. The hatchery would acclimate and release the resulting juveniles at White Salmon Ponds.
3. Salvage adipose present CWT-negative tule fall Chinook salmon returning to Spring Creek NFH to start tule fall Chinook salmon restoration.
4. Outplant adults, adipose present, in 2011 above Condit Dam prior to removal.
5. No salvage effort in the White Salmon River or at Spring Creek NFH. Salvage adipose present CWT-negative tule fall Chinook salmon returning to the White Salmon River and outplant above Condit Dam prior to removal.

The White Salmon Working Group selected the outplant option (Option 4) for tule fall Chinook salmon because they believed that the habitat currently available above Condit Dam that can support natural spawning tule fall Chinook salmon and because this option would minimize the potential impacts of hatchery rearing. Biologists tested a number of collection alternatives 2008 to ensure that technicians could collect unmarked tule fall Chinook salmon in adequate numbers and safely transport them above Condit Dam (Engle and Skalicky 2009). In 2008, the goal was to transport up to 500 adults made up of marked hatchery fall Chinook salmon collected in the lower White Salmon River and fall Chinook salmon from Spring Creek NFH. Hatchery fall Chinook salmon were used for this test because Condit Dam did not have a system to safely pass juvenile salmon during their outmigration. In 2008, technicians collected 90 adults in the White Salmon River and transported 333 adults from Spring Creek NFH to habitat above Condit Dam (Engle and Skalicky 2009).

Monitoring of the transported adults determined the movement of adults after release, where spawning occurred, and determined that spawning was successful. The White Salmon Working Group is finalizing an operating plan for collection and transportation of adult tule fall Chinook salmon in 2010 (see Engle and Skalicky 2009). In 2009, technicians installed a weir and tested it adjacent to the White Salmon Ponds, using the historic weir location to collect more tule fall Chinook salmon adults (Engle et al. 2010). In 2011, prior to Condit Dam breaching, a total of 679 tule fall Chinook salmon were collected from the lower White

Salmon River and transported and released between Husum Falls and Northwestern Lake, of these 552 were determined to be natural-origin. Furthermore, spawning ground surveys determined that spawning was successful below Husum Falls (R. Engle, USFWS, November 2012, personal communication).

6.1.2 Spring Chinook salmon

The White Salmon Working Group reviewed the following options for reintroducing spring Chinook salmon into White Salmon River (see Appendix I for detailed descriptions).

1. Natural colonization, i.e., no active reintroduction efforts from outside sources.
2. Wild Klickitat spring Chinook salmon as brood source for juvenile release into the White Salmon River. Eggs collected and reared at Klickitat Hatchery, juveniles acclimated and released at White Salmon Ponds.
3. Klickitat Hatchery spring Chinook salmon as brood source for juvenile release into upper White Salmon River, starting in the spring of 2010 (from Klickitat Hatchery thinning release or other surplus juveniles).
4. Klickitat Hatchery integrated stock spring Chinook salmon as brood source for juvenile release into White Salmon River, in future years (broodstock source would be hatchery-reared offspring of wild fish).
5. Transport surplus Klickitat Hatchery adults to White Salmon starting in the fall of the year of removal.
6. Trap and transport Klickitat wild adults to White Salmon starting in the fall of the year of removal.
7. Monitor natural escapement and production for 4-5 years then evaluate need and suitability of Option 4.

The White Salmon Working Group decided on Option 7 for spring Chinook salmon. Under this option Working Group members propose to monitor escapement of spring Chinook salmon into the upper White Salmon River, including the proportion of Carson stock hatchery spring Chinook salmon on the spawning grounds. The Working Group also will monitor spring Chinook salmon smolt production in the upper White Salmon River. The 4-5 year monitoring period will determine if natural production is occurring and the source of that production. The monitoring period will also allow time for the development of the Klickitat Hatchery integrated spring Chinook salmon program and determine whether production capacity at this facility is available. The White Salmon Working Group considered the Klickitat Hatchery spring Chinook salmon program the best source of broodstock for reintroduction, even though it is not part of the LCR Chinook salmon ESU because it is within the transition zone between LCR and interior CR populations (Ford et al. 2011). The two nearest populations of spring Chinook salmon within the LCR ESU are in the Lewis River in Washington and the Sandy River in Oregon. Each of these basins have spring Chinook salmon hatchery programs but reintroduction efforts in the Lewis River Basin require current local production, while broodstock collection and funding shortfalls constrain production in the Sandy River. The result is the unavailability of a suitable source of spring Chinook salmon stock to support the reintroduction efforts in the White Salmon River. NMFS is currently reviewing whether a population re-established in historic habitat using a non-ESU spring Chinook salmon stock can be part of the listed ESU for recovery and delisting purposes. The Hood River spring Chinook salmon recovery efforts are using a non-ESU spring Chinook salmon stock for reintroduction.

6.1.3 Coho salmon

The White Salmon Working Group reviewed the following options for reintroducing coho salmon into White Salmon River (see Appendix I for detailed descriptions).

1. Natural re-colonization, i.e., no reintroduction efforts from outside sources.
2. Juveniles from Washougal and/or Bonneville/Cascade hatcheries released into White Salmon River.
3. Collection of wild adult broodstock in Klickitat River with spawning and rearing at hatchery facility and juvenile release in White Salmon River.
4. Collection of wild adult broodstock in White Salmon River with spawning and rearing at hatchery facility and juvenile release in White Salmon River.
5. Monitor natural escapement and production for 4-5 years then evaluate need and suitability of Options 2, 3 or 4.

The White Salmon Working Group decided on Option 5 for coho salmon. As described for spring Chinook salmon, the Working Group members propose to monitor escapement, hatchery- and natural-origin coho salmon on the spawning grounds, and juvenile production in the White Salmon River Basin. Sources of stray hatchery coho salmon include releases from Bonneville Hatchery and releases into the Klickitat and Umatilla River basins. All of these releases derive from hatchery programs that are part of the LCR coho salmon ESU. A recovery team will use the results of the monitoring efforts to determine future reintroduction activities.

6.1.4 Chum salmon

The White Salmon Working Group reviewed the following options for reintroducing chum salmon into White Salmon River (see Appendix I for detailed descriptions).

1. Natural re-colonization, i.e., no reintroduction efforts from outside sources.
2. Active adult outplanting in years after Condit Dam removal.
3. Active stocking of juvenile chum salmon or outplanting of eggs in egg baskets and hatch boxes via WDFW's Washougal Hatchery or Willard NFH.
4. Initiate temporary hatchery program for chum salmon using existing USFWS hatcheries for subsequent outplanting of chum salmon captured at Bonneville Dam.

The White Salmon Working Group decided on Option 1 for chum salmon. The group chose this option because of the uncertainty regarding the status of chum salmon above Bonneville

Dam. This option calls for expanded spawning ground surveys in the Bonneville Pool using the mainstem chum salmon spawning habitat criteria developed for the population below Bonneville Dam. Those conducting surveys should focus in the lower reaches of suitable tributaries and include habitat suitability assessments for the reservoir and the tributaries.

6.1.5 Steelhead

The White Salmon Working Group reviewed the following options for reintroducing steelhead into White Salmon River (see Appendix I for detailed descriptions).

1. Natural re-colonization, i.e., no reintroduction efforts from outside sources.
2. Wild donor from local watershed as brood source for juvenile release into the White Salmon River. Eggs collected and reared at suitable hatchery and juveniles acclimated and released at White Salmon Ponds.
3. White Salmon resident *O. mykiss* as brood source, with locally suitable anadromous wild donor stock spawned for juvenile release into upper White Salmon River.
4. White Salmon steelhead captive brood program using captured outmigrating juveniles.
5. White Salmon steelhead kelt reconditioning. Recondition local spawners to enhance survival.

Based on the potential to re-establish natural production of steelhead in the basin, the White Salmon Working Group decided that Option 1, natural re-colonization, was the best approach. Indications that the (resident) population of *O. mykiss* in the White Salmon River above Condit Dam still produces smolts, even though the construction of Condit Dam and the end of passage in 1913 eliminated anadromy, was the basis of the group's decision. Recent monitoring in the White Salmon River above Condit Dam has identified *O. mykiss* juveniles displaying smolt behavior and morphology. Biologists detected juveniles PIT-tagged in Rattlesnake Creek passing Bonneville Dam, with one recovered at the tern colony on East Sand Island (B. Allen, personal communication, 2007). In addition, biologists detected a juvenile *O. mykiss* PIT-tagged above Condit Dam in September 2004 at 98 mm ascending Bonneville Dam in July 2006. Genetic analysis of juvenile *O. mykiss* collected in the upper watershed above Husum Falls found differences from hatchery trout released in the basin; additional samples are needed, however, to confirm this finding (Allen et al. 2006).

Additional research by Carmichael (Ruzycki 2003) in the Grande Ronde and by Thrower et al. (2004) in Alaska has identified a potential strategy for steelhead in the White Salmon. Research conducted by Thrower et al. (2004) indicated that:

> after 70 years of freshwater residency, a formerly anadromous, wild, freely breeding population of *O. mykiss* has retained large amounts of genetic variability associated with growth, precocious maturation and smolting despite complete selection against the phenotypic expression of at least one of the fitness related characters (smolting migration) critical for the re-establishment of an anadromous population…. Genetic potential for smolting can lie dormant or be maintained through a dynamic

> interaction between smolting and early maturation for decades despite complete selection against the phenotype. The results have significant implications for the preservation of threatened anadromous stocks in fresh water and the inclusion of resident fish of formerly anadromous populations, currently trapped behind longstanding barriers to migration, as one component of the same population.

This information supports the theory that even though the population is functionally extirpated, there is some the potential for re-establishing anadromous steelhead in the White Salmon River Basin. Using resident *O. mykiss* above Condit Dam will provide a genetic link to historical anadromous *O. mykiss*.

6.1.6 Monitoring and Evaluation

The key to the success of all of these options is to implement all of the proposed monitoring and evaluation activities, including development and implementation of an approach to monitor adult escapement, adult movement, presence/absence of stray hatchery-origin salmon and steelhead, and population productivity. In the future, if the need arises, and after careful evaluation and consensus among the co-managers, biologists could use a weir to exclude hatchery-origin adults, thus creating a refuge for naturally produced salmon and steelhead. Another reason that the White Salmon Working Group supported these options was that the removal of Condit Dam provides a rare opportunity to study the natural re-colonization of newly available habitat without using hatchery intervention. The proposed White Salmon Recovery Board and NMFS will evaluate the proposed options and make an assessment after 5 years to determine the next steps for reintroduction of salmon and steelhead in the White Salmon River.

Much remains unknown about the current status of the historical salmon and steelhead populations in the White Salmon and the capability of the habitat to support increased production. This Plan proposes the following actions to establish a baseline of current population status and habitat conditions and to help ensure that efforts to reintroduce salmon and steelhead in the White Salmon are efficient and successful. The YN, USGS, WDFW, USFWS, and UCD identified these actions. Chapter 8 offers further discussion of basin-wide monitoring and evaluation activities.

Biologists need to gather data and analyze information needs upstream and downstream of Condit Dam now that PacifiCorp has removed the dam. This information will inform project selection and implementation and improve the rate and success of reintroduction.

Below is a description of a multi-agency cooperative process for planning reintroduction. Table 6-1 summarizes the biological objectives, actions, and existing strategies for data gathering and analysis; it also outlines some needed habitat restoration. The YN, USGS, WDFW, USFWS, and UCD agreed to these general biological objectives and provided the detailed actions for which they would accept responsibility. In 2012, the White Salmon Working Group will work to refine the monitoring and evaluation plan to reflect the removal of Condit Dam in 2011.

Various management entities have implemented some of these monitoring and evaluation activities starting in 2006 and continued these activities through the removal of Condit Dam (e.g., Allen et al. 2006; Smith et al. 2007). Recovery planners are seeking funding to continue the monitoring post-dam removal.

Table 6-1. Biological objectives, management strategies, and actions to enhance/reintroduce anadromous salmonid populations and acquire baseline habitat information in the White Salmon River Basin

Biological Objective	Full Description	Actions and Existing Strategies
Implement reintroduction plan	Salmon and steelhead will be allowed to naturally re-colonize habitat above the former Condit Dam. Intensive monitoring activities will be implemented, including implementation of a program designed to monitor adult and juvenile abundance	Continue monitoring activities already occurring in the basin and expand to include population monitoring in the White Salmon River and Rattlesnake Creek
Complete gathering of information on existing salmonid stocks	Determine the status, life histories, and genetic composition of fish populations in the White Salmon River and its tributaries that are now accessible to anadromous salmonids.	Finalize adult and juvenile monitoring program for existing stocks in the White Salmon River. Assess interaction of bright and tule Chinook salmon populations and rainbow and steelhead
Hatchery status monitoring	Monitor the proportion and origin of hatchery salmon and steelhead on the spawning grounds	Continue to count adipose marked and unmarked carcasses and tagged adults
Maintain genetic diversity of listed salmonids	Continue to monitor current salmonid species composition and viability to determine effects of reintroduction actions	To maintain the genetic diversity of salmonid species in the White Salmon River complete analysis of information that describes the stocks and genetic diversity that currently exists
Population status monitoring	Monitor salmon and steelhead spawning escapement to estimate viable salmonid population parameters	Estimate population abundance using statistically robust methodologies
Assess effect of anadromous fish on resident fish	Assess the resident fish population prior to the reintroduction of anadromous salmonids	Assess resident trout contribution to smolts. Establish comprehensive monitoring program (of trout population). Assess change in resident population after steelhead re-colonization/reintroduction begins

6.2 Freshwater Habitat Strategies and Actions

This plan proposes a number of freshwater habitat strategies and actions to rebuild the salmon and steelhead populations in the White Salmon River drainage to the desired levels of viability. The Plan recognizes that anadromous salmonids did not occupy the habitat upstream of the former Condit Dam; therefore habitat upstream of the dam was not limiting the population. However, now that the river upstream of the dam is becoming accessible, and anadromous salmonids are beginning to use this habitat, factors such as head cutting at the head of the old reservoir and the practice of removing large woody debris could limit the carrying capacity of the existing habitat. The factors limiting the populations during the process of rebuilding will be habitat affected by dam removal, or an out-of-basin factor such as harvest, predation, or ocean conditions which affects the rate of population growth.

Habitat downstream of the dam currently affects salmon production. With the removal of Condit Dam, the habitat downstream of the dam has changed dramatically and the habitat within the footprint of the existing reservoir may be of very low quality. Restoration of the habitat in those areas will be a priority.

Restoration of upstream habitats is also included in this Plan. Salmonids will eventually fully occupy the upstream habitats. Immediate initiation of restoration activities in the upstream habitats will ensure that quality habitat is available as the populations grow.

Maintenance and protection of existing high quality habitats to ensure no net loss in quantity or quality of existing available habitat can also be an important element in providing for the development of salmonid populations in the basin. Land use planning, implementation of BMPs, acquisitions, easements, cooperative agreements, protective land designations, and voluntary commitments are potential tools for protecting and maintaining high quality habitat.

The Plan defines four freshwater habitat strategies: 1) gain information needed to identify and prioritize habitat actions that will provide the greatest opportunity to contribute to recovery, 2) restore mainstem habitat downstream of Buck Creek, 3) protect and conserve existing natural ecological processes, 4) improve habitat in upriver reaches. The fourth strategy addresses habitat improvement in upriver reaches that anadromous populations have recently begun to occupy. Because the fourth strategy does not address a known limiting factor, it is therefore a broad-sense strategy. The White Salmon Working Group defined the strategies and actions through review and analysis of currently available information. Many reaches in the White Salmon watershed have quality habitat and functional ecological processes that are currently capable of supporting anadromous fish populations or have moderate habitat quality and quantity and the potential to become high quality habitat (White and Cochrane 2005; Morris 2003, 2004, 2005; Allen et al. 2006a, 2006b; White and Plumb 2004, 2005). The strategies and actions address risks that the TRT identified in viability assessments for the populations.

This Plan designed the strategies and actions together to protect and improve freshwater habitat in the drainage and, thus, improve the potential productivity of White Salmon salmonid populations. The Plan's actions to restore passage and habitat also expect to benefit other anadromous and resident species, including cutthroat trout and Pacific lamprey

(*Lampetra tridentata*), a candidate for ESA listing and an important food source for members of the YN. Table 6-2 summarizes the strategies and actions related to improvement of freshwater habitat. Table 6-3 summarizes proposed habitat related actions associated with the fourth strategy: improve habitat that anadromous populations may eventually occupy.

Table 6-2. Primary biological objectives, management strategies, and actions to improve habitat in the White Salmon River watershed

Biological Objective	Species	Full Description	VSP Parameter Addressed	Actions and Existing Strategies
Gain information needed to identify and prioritize habitat actions that will provide the greatest opportunity to contribute to recovery	All species	Complete habitat surveys to help prioritize restoration needs and measure select habitat attributes above and below Condit Dam to document changes associated with removal of the dam as well as documenting time to recovery	All	An assessment of existing conditions is needed to prioritize recovery efforts
Restore mainstem habitat downstream of Buck Creek	All species	The effects of dam removal can only be estimated. With the dam removed, surveys will need to be conducted to a) document the habitat conditions immediately after removal, b) document changes in habitat over time, and c) identify and prioritize habitat restoration projects	All	Restore habitat through the implementation of PacifiCorp's Decommission Management Plans Complete surveys following dam removal. Identify and implement priority actions for habitat restoration such as bank stabilization of restoration of native vegetation.
Protect and conserve existing natural ecological processes.	All species	Protection and conservation of existing habitat will ensure that quality habitat is available as populations grow and will help to avoid additional impacts to habitats currently in use	All	• Land use planning to minimize anthropogenic effects • Land acquisition and conservation • Adoption and management of conservation agreements • Application of BM P BMPs • Public outreach to educate river uses and others

Biological Objective	Species	Full Description	VSP Parameter Addressed	Actions and Existing Strategies
Restore riparian vegetation along stream sections that exceed state standards for temperature	All species	Some stream segments within the expected range of anadromous salmonid distribution are known to be excessively warm. Since it takes time to grow trees that will eventually provide shade, planting of trees and implementing other programs to restore and protect riparian conditions is desirable in the near term	All	• Identify stream segments that are excessively warm within the expected anadromous salmonid distribution • Where riparian trees are sparse, implement programs to increase the density of the riparian vegetation • Implement programs to protect existing riparian vegetation

Table 6-3. Biological objectives, management strategies, and actions to improve habitat in the upper White Salmon River watershed

Biological Objective	Species	Full Description	VSP Parameters Addressed	Actions and Strategies
Additional Freshwater Habitat Strategies and Actions Addressing Likely Future Limiting Habitat Factors and Habitat Quality				
Improve habitat in upriver reaches	All populations	Protect and conserve natural ecological processes that support the viability of populations and their primary life history strategies throughout their life cycle Priority locations: Rattlesnake Creek, Indian Creek, Buck Creek, White Salmon River (Buck Creek to Husum Falls),	All Parameters	• Protect highest quality habitats through acquisition and conservation • Adopt and manage conservation agreements • Consistently apply BMP BMPs and existing laws to protect and conserve natural ecological processes • Provide public outreach to educate river uses and others

Biological Objective	Species	Full Description	VSP Parameters Addressed	Actions and Strategies
		Spring Creek		
	All populations	Gain information needed to identify and prioritize habitat actions that will provide the greatest opportunity to contribute to recovery Priority locations: Watershed areas above Buck Creek, with emphasis on the mainstem	All	• Conduct habitat surveys to help prioritize restoration needs • Implement projects to improve habitat
	All populations	Restore passage and connectivity to habitats blocked or impaired by artificial barriers Priority locations: Buck Creek	Abundance Productivity Spatial Structure	• Remove or replace barriers blocking or impairing passage including dams, dikes, road culverts, and irrigation structures • Provide screening at 100 percent of irrigation diversions • Replace screens that do not meet criteria
	All populations	Reduce nutrient loads; Nutrient levels in the White Salmon Basin are high (White and Plumb 2005; White and Cochrane 2005). The nutrient enrichment may decrease juvenile or adult fish survival. A rehabilitation strategy is recommended. Monitoring will help determine if actions taken have improved the situation	Abundance Productivity Spatial Structure	• Reduce runoff from septic tanks • Reduce nutrient runoff from dairies and agricultural lands
	All populations	Improve floodplain connectivity and function and channel migration processes	Abundance Productivity	• Reconnect side channels and off-channel habitats to stream channels • Restore wet meadows • Reconnect floodplain to channel

Biological Objective	Species	Full Description	VSP Parameters Addressed	Actions and Strategies
		Priority locations: Rattlesnake Creek, Indian Creek, Buck Creek, White Salmon River (Buck Creek to Husum Falls), Spring Creek	Spatial Structure	• Relocate or improve floodplain infrastructure and roads • Conduct public awareness and education about restoration efforts
	All populations	Improve channel structure and complexity Priority locations: Rattlesnake Creek, Indian Creek, Buck Creek, White Salmon River (Buck Creek to Husum Falls), Spring Creek	Abundance Productivity	• Place stable wood and other large organic debris in streambeds • Stabilize streambanks • Restore natural channel form
	All populations	Improve riparian condition and LWD recruitment Priority locations: Rattlesnake Creek, Indian Creek, Buck Creek, White Salmon River (Buck Creek to Husum Falls), Spring Creek	Abundance Productivity	• Restore natural riparian vegetative communities • Develop grazing strategies that promote riparian recovery • Eradicate invasive plants species from riparian areas
	Steelhead Spring Chinook salmon Coho salmon	Reduce anthropogenic effects on hydrograph to provide appropriate flows during critical periods Priority locations: Rattlesnake Creek, Indian Creek, Buck Creek	Abundance Productivity	• Implement agricultural water conservation measures • Improve irrigation conveyance and efficiency • Restore natural functions and processes through actions identified in strategies above • Employ BMPs to forest, agriculture, and grazing practices and to road management • Protect and/or rehabilitate springs • Increase pool habitat • Restore wetlands and other water holding capacity on plateau

Biological Objective	Species	Full Description	VSP Parameters Addressed	Actions and Strategies
	All populations	Reduce summer water temperatures Priority locations: Rattlesnake Creek, Indian Creek, Buck Creek	Abundance Productivity	• Improve riparian vegetation • Reduce sediment inputs to streams

6.2.1 High Priority Reaches for Habitat Protection/Restoration and Proposed Actions

The White Salmon Subbasin Plan (NPCC 2004) identifies the following areas as high priority reaches for protection and restoration (based on anticipated potential distribution):

- Steelhead habitats are likely concentrated in the White Salmon River mainstem upstream to Husum Falls and in Rattlesnake Creek. The reach between Husum Falls and Big Brother Falls, RM 16.2, may also contain potential habitat. Rattlesnake Creek has an abundance of rainbow trout as well as numerous restoration opportunities.
- Spring Chinook salmon will likely concentrate in habitats in the mainstem reaches downstream of BZ Falls, RM 12.4. This habitat area would include the reaches downstream of the former Condit Dam, the footprint of the reservoir, and reaches between Buck Creek and BZ Falls. With the dam's removal, significant, high priority restoration opportunities exist.
- Coho salmon would likely utilize both the lower river and the upper river habitats, including the tributaries (Rattlesnake, Spring, and Buck creeks).
- Fall Chinook salmon are likely to concentrate in areas downstream of Condit Dam, and upstream as far as Husum Falls after passage resumes.
- Chum salmon are likely to concentrate near the mouth of the White Salmon River.

The following areas rank as the highest priorities for habitat restoration. Reasons for their ranking and actions proposed to address limiting factors and threats are summarized below based on information provided in White and Cochrane (2005), Morris (2003, 2004, 2005), Allen et al. (2006a, 2006b), White and Plumb (2004, 2005), EDT modeling results (Allen and Connolly 2005), the White Salmon Subbasin Plan (NPCC 2004), and Klickitat Lead Entity Region Salmon Recovery Strategy (Klickitat Lead Entity 2005).

White Salmon River Mainstem - Site of Condit Dam, RM 3.3

Achieving multiple DPS/ESU population recovery goals depends largely on the success of efforts to restore passage to upriver spawning and rearing habitats and improve flow and habitat conditions in the lower river.

<u>Actions</u>:

- The complete removal of Condit Dam to provide unimpeded upstream passage by adult and juvenile salmonids.
- Improve flow and habitat conditions in the lower White Salmon River.

White Salmon River Mainstem - Mouth to Condit Dam

After breaching, sediment loads below the dam site have increased, directly impacting fall Chinook salmon present in the reach at the time of dam removal. Sediment loads will impact potential spawning and rearing habitat for Chinook salmon, chum and coho salmon in the lower White Salmon River, and will impact the migration corridors for all anadromous species. An assessment of conditions after dam removal will determine the best approach to restoration.

Actions:

- Restore habitat through the implementation of PacifiCorp's Decommissioning Management Plan.
- Assess limiting habitat features due to dam removal and restore habitat as needed to provide for spawning, rearing, and adult holding and migration.
- Place LWD and gravel as appropriate.

White Salmon River Mainstem - Condit Dam to Buck Creek

This reach currently contains the section under the former Northwestern Reservoir. It should provide important habitat for salmon and steelhead spawning, rearing, migration, and adult holding after the effects of the Condit Dam removal are addressed. Large quantities of sediment have accumulated in the reservoir since the original owners built the dam in 1913. With the dam's removal, it may require years for the river to establish a stable channel. The banks of the river will tend to slough and erode until they reach a stable angle of repose and attain sufficient vegetation to reduce erosion and stabilize slopes. The time needed to re-establish a stable channel with clean gravels is unknown. Recovery planners and fish managers could take actions to hasten restoration. Biologists cannot identify the precise set of actions with any confidence until they evaluate the habitat conditions post-dam removal.

Actions:

- Restore habitat through the implementation of PacifiCorp's Decommissioning Management Plan.
  - Assess habitat-limiting features and identify restoration needs.
  - Implement projects to restore habitats, including planting of native vegetation.

White Salmon River Mainstem - Buck Creek to Husum Falls

This reach extends from the headwaters of the former Northwestern Lake to Husum Falls. The reach has high potential for salmon and steelhead spawning, rearing, and adult holding. USFWS also listed the mainstem White Salmon River up to Husum Falls as proposed critical habitat for bull trout; that same habitat is important for coastal cutthroat trout. Habitat in the reach generally remains in good condition. Therefore, recovery planners proposed no actions, though as use by anadromous fish increases, an assessment of the habitat in this section should be completed.

White Salmon River Husum to BZ Falls

There is little data available regarding habitat conditions between Husum and BZ Falls. This reach would likely support coho salmon and steelhead and possible spring Chinook salmon. Biologists generally think the reach is in good condition, making restoration in this reach a lower priority. The primary action for this section would be to assess habitat features and restore habitat as needed to provide for spawning, rearing, and adult holding and migration.

Rattlesnake Creek

Rattlesnake Creek and its tributaries provide significant spawning and rearing habitat for rainbow trout and likely highly productive habitat for coho salmon and steelhead once fish can pass to these upstream areas. The reach has low quality pools, excessive fine sediment in some spawning gravels, limited instream cover, and high summer stream temperatures in some areas (Morris 2003, 2004, 2005, White and Plumb; 2004, 2005, White and Cochrane 2005, Allen et al. 2006a, 2006b). Alders dominate riparian areas and limit long-term wood recruitment potential (Allen et al. 2006a; 2006b).

<u>Actions</u>:

- Protect functional riparian areas.
- Place LWD and other instream structure as appropriate to create pools, increase cover, and retain spawning gravels.
- Restore floodplain connectivity.
- Restore wetlands and other water holding capacity on the plateau through use of check dams and other methods.
- Establish conifers in riparian areas.
- Plant trees to reduce sediment input from banks.
- Implement measures to reduce cattle impacts to stream.

Buck Creek

Buck Creek provides potential spawning and rearing habitat for coho salmon and steelhead. Biologists believe that habitat quality is currently limited because of insufficient pools and spawning gravels, low summer flows, and unscreened agricultural diversion. No data currently supports these suppositions, except for that relating to temperature. Available data indicate that temperatures in Buck Creek meet WA state standards (White and Plumb 2004; White and Cochrane 2005).

<u>Actions</u>:

- Conduct habitat studies to identify limiting factors within Buck Creek.
- Place LWD and other instream structure, as appropriate, to create pools and retain spawning gravels.

- Assess instream flows and initiate actions to improve base flow.
- Screen agricultural diversion and improve passage at irrigation diversion.

Spring Creek

Spring Creek may provide productive habitat for reintroduced anadromous coho salmon and steelhead runs. Production potential is currently limited because of decreased habitat diversity and increased sediment. Biologists have not evaluated the factors limiting habitat in Spring Creek.

Actions:

- Conduct assessments to identify factors
- Protect or improve instream wood and functional riparian areas as necessary.
- Place LWD as appropriate.

6.3 Hatcheries

Artificial production may play a role in the recovery of salmon and steelhead populations in the White Salmon. The White Salmon Working Group has proposed a strategy to allow for the natural re-colonization of the White Salmon River after Condit Dam removal. As described above in section 6.1, biologists will evaluate the natural re-colonization of the newly accessible habitat and, if escapement and productivity goals are not being achieved, then the White Salmon Working Group or a new recovery planning body will consider additional strategies using artificial propagation. Innovative programs, such as those employed by the Yakima/Klickitat Fisheries Project, as described in the Klickitat Anadromous Fisheries Master Plan (YN 2008), would be consulted and appropriate methodologies adopted (Table 6-4).

6.4 Harvest-Related Strategies and Actions

WDFW will continue to manage non-tribal fisheries for selective fisheries that target marked hatchery salmon and steelhead, requiring the release of unmarked (wild) fish. Overall impacts are very low for these tributary fisheries, with impacts generally less than 5 percent of the naturally produced fish (NPCC 2004).

In 2009, the recreational fishing regulations in the White Salmon River prohibited the retention of unmarked Chinook salmon from April 1 to June 30 and closed the river to retention of all Chinook salmon ½ mile above the Hwy 14 Bridge from October 1 to December 31. Fishing regulations prohibit retention of wild (unmarked) coho salmon and unmarked Chinook jack salmon (Chinook salmon less than 24 inches) in the White Salmon River annually from July 1 to March 31. Fishing regulations also prohibit retention of chum salmon in tributary recreational fisheries.

Mainstem harvest will continue to be managed through the *U.S. v. Oregon* process, and will be subject to consultation with NMFS. Co-managers will incorporate enhanced public education and non-tribal fisheries along with new selective fisheries regulations to ensure understanding and compliance.

Treaty Indian fishing rights in the Columbia basin are under the continuing jurisdiction of the U.S. District Court for the District of Oregon in the case of *U.S. v. Oregon*, No. 68-513 (filed in 1968). The parties to *U.S. v. Oregon* are the United States acting through the Department of Interior (USFWS) and BIA and Department of Commerce (NMFS), the Warm Springs, Umatilla, Nez Perce, Yakama, and Shoshone-Bannock Tribes, and the states of Oregon, Washington, and Idaho. In *U.S. v. Oregon*, the Court affirmed that the treaties reserved for the tribes 50 percent of the harvestable surplus of fish destined to pass through their usual and accustomed fishing areas.

A new *U.S. v. Oregon* Management Agreement has been completed, and NMFS has completed a section 7 Biological Opinion addressing the impacts of the fisheries management action and hatchery production in the new agreement (NMFS 2008c). The new management agreement will cover CR fisheries management and hatchery production actions from 2008 to 2017.

During the last 10-15 years, *U.S. v. Oregon*, the CR Fish Management Plan and successor agreements that contain restraints on the fisheries necessitated by ESA listings have managed harvest regulations. The agreements quantify and allocate between tribal and non-tribal fishing subject to ESA-imposed constraints for listed species (Table 6-4).

6.5 Hydro-Related Strategies and Actions

Actions to address out-of-watershed hydro-related limiting factors and threats are included in the recently released 2008 FCRPS Biological Opinion (NMFS 2008b). (Available at https://pcts.nmfs.noaa.gov/pls/pcts-pub/pcts_upload.summary_list_biop?p_id=27149) (accessed April 11, 2012).

Within the White Salmon River watershed, removal of Condit Dam will achieve the goals of restoring flows to the 1.1-mile bypass reach; recruiting gravel to the lower 3 miles of river; and, in the long-term, restoring MCR steelhead spawning habitat. Removal will also provide unimpeded movement of adult and juvenile lower Columbia salmonids (fall Chinook salmon, coho, and chum salmon) in the White Salmon River (Table 6-4).

Table 6-4. Summary table addressing hatchery, harvest and hydrosystem-related recovery strategies and actions

Priority Strategies	Populations Affected and Addressed	Key Types of Actions	VSP Parameters Addressed	Potential Limiting Factors Addressed
Hatchery				
Restore natural production into historically utilized habitats, including blocked areas above the former Condit Dam	All populations	• Monitor escapement and natural re-colonization of historical habitat • Develop preferred option from reintroduction plan based on monitoring of natural re-colonization	All parameters	Lack of native stock
Harvest				
Manage harvest for low impact fisheries and reduce harvest-related adverse effects in those fisheries that have significant impacts	All populations	• Manage harvest for low impact fisheries • Adjust tributary harvest regulations in areas where harvest significantly impacts salmon and steelhead population growth	Abundance Productivity	Commercial, recreational, and tribal fisheries in ocean, mainstem CR and tributaries
Hydrosystem Issues and Mainstem Predation				
Maintain or improve hydropower operations and facilities at Bonneville Dam to enhance salmon and steelhead survival	All populations	• Maintain surface passage routes to improve juvenile passage at Bonneville Dam • Decrease water travel time during smolt outmigration • Improve operation of adult passage • Maintain high standards for adult fish passage at Bonneville Dam	All parameters	Hydrosystem development and operations in mainstem CR alter steelhead migration conditions and delay passage.
Reduce predation on, and competition between, salmonids	All populations	• Reduce predation by pinnipeds • Reduce predation by piscivores • Reduce predation by cormorants • Reduce predation by and relocate Caspian terns	Abundance Productivity	Hydrosystem development and operations in mainstem CR increase predation on, and competition between, salmonids.

7 Implementation and Cost Estimates

NMFS recognizes that there are significant uncertainties regarding expected future habitat conditions, that actions will need to restore habitat, and that actions require successful recolonization of salmonid populations in the White Salmon River watershed. NMFS is committed to an ongoing effort to address these uncertainties. This will require rigorous application of an adaptive management process that identifies key uncertainties, proposes competing hypotheses, and uses recovery actions and appropriate research and monitoring to test these hypotheses and adjust management accordingly.

Recovery is achievable only through the combined and coordinated actions of Federal and state agencies, tribes, and local governments, and with the participation of non-profit organizations, the business sector, and citizens. Collectively, NMFS refers to these parties as implementing partners. It will be essential that a collaborative implementation structure be set up to improve communication and work on a shared sense of priorities.

7.1 Implementation

The Washington Gorge Implementation Team (WAGIT) will coordinate implementation of the recovery plan for the White Salmon River watershed. The WAGIT is comprised of Klickitat County, the Yakama Nation, Washington Department of Ecology, Washington Department of Fish and Wildlife, the United States Geological Service, NMFS, the Central Klickitat and Underwood Conservation Districts, and various other stakeholders such as the Middle Columbia Regional Fisheries Enhancement Group. Representatives of the White Salmon Working Group are also participating on the WAGIT.

Implementation is being facilitated through the various existing programs in the area, including harvest management programs, the Yakama Nation Fisheries Program, Washington's Lead Entity Process, watershed planning and implementation processes initiated under state regulations and coordinated through the Klickitat County, various state and local habitat and watershed programs, and the various programs administered by the conservation districts. The WAGIT chose to draw upon and work within the many ongoing programs rather than developing a parallel, potentially duplicative process.

A balance between the biological benefit of a recovery action, its cost, and feasibility of implementation provides the basis for the WAGIT prioritization framework. Projects that address primary limiting factors, have high biological benefit to listed fish, are relatively inexpensive, and are feasible, receive highest funding priority. Projects with high cost, low biological benefit to listed fish species, and relatively low feasibility receive lowest funding priority.

Funding sources for salmon and steelhead recovery actions in the Columbia basin vary. They include:

- Pacific Coastal Salmon Recovery Fund (PCSRF) (states and tribes)
- Salmon Recovery Funding Board (SRFB) (a combination of PCSRF and Washington State funds)
- Columbia Basin Fish Accords
- Congressional appropriations (Federal agencies)

- State appropriations (state agencies)
- NPCC Fish and Wildlife program (states and tribes)
- Federal/state grants
- Non-profit organization programs and grants

7.2 Costs

NMFS, in coordination with the WAGIT and the White Salmon Working Group, provided cost estimates for implementing the White Salmon River Recovery Plan. The team developed cost estimates for a range of actions necessary to successfully reestablish anadromous fish populations in the White Salmon River watershed. There are numerous research, monitoring, and evaluation actions, specified in this Plan. Completed RM&E studies will help identify priority projects. In the absence of needed information, NMFS developed interim cost estimates for all potential recovery actions. NMFS and the area biologists estimated that RM&E actions will cost roughly $1,540,000 over a 5-year period. Chapter 8 provides further discussion of monitoring. Implementing PacifiCorp's decommissioning plans for Condit Dam is estimated at $0.9 to $1.1 million. Habitat actions related to the dam decommissioning could cost up to $15,100.000. The total cost over a 5-year period for restoring anadromous populations in the White Salmon River is estimated to be $16,781,000 (Table 7-1). More detailed information regarding these costs is provided in Appendix IV, White Salmon River Implementation Schedule: Summary of Actions and Potential Costs to Restore White Salmon River Anadromous Fish Populations and Their Habitat.

Table 7-1. Summary of potential costs to restore the White Salmon River fish populations and their habitat

ACTION CATEGORY	COST
Implementation of PacifiCorp's decommissioning plans	**$900,000 to 1,100,000**
RM&E	**$1,540,000**
Habitat Restoration and other actions	**15,100,000**
Hydrosystem and Mainstem Predation	**Not Estimated**
TOTAL	**$16,781,000**

The action categories listed in Appendix IV are derived from Chapter 6 Recovery Strategy and Actions. In many cases the specific actions provided in Appendix IV offer more detail than that described in Chapter 6. This is particularly true with regard to data collection and population monitoring. As discussed in Chapter 6, there is uncertainty regarding the primary factors that will limit the White Salmon populations in the long-term. Proposed data collection will fill those data gaps and provide direction for specific habitat restoration actions.

8 Monitoring, Research, and Evaluation for Adaptive Management

The various research and monitoring efforts proposed and underway in the White Salmon watershed regarding salmon and steelhead reintroduction, habitat restoration, and other activities require comprehensive empirical monitoring data on fish populations and habitat to identify appropriate project actions and strategies, select suitable sites and priority locations for actions, populate habitat/production capacity modeling efforts (such as EDT and All H's Analyzer [AHA]), and inform adaptive management for the salmonid recovery plan. Needed is additional information on fish distribution, abundance, productivity, habitat conditions, genetic diversity, pathogen levels, and other population parameters, as well as on population limiting factors. White Salmon recovery also requires a coordinated monitoring program to meet these various needs, as well as to help direct and evaluate the recovery effort.

8.1 Designing a Monitoring and Evaluation Program to Support Adaptive Management

Because of the length and complexity of the salmonid life cycle, there are many uncertainties involved in improving salmonid survival. To simply identify cause-and-effect relationships between any given management action and the characteristics of salmon populations can be a scientific challenge. It is essential to design a monitoring and evaluation program that will answer these basic questions: How will we know we are making progress? How will we get the information we need? How will we use the information in decision-making?

Designing an effective monitoring program for salmon recovery involves the following initial steps:

1. Clarify the questions regarding policy and management decision-making. Include the full ESU and the full salmonid life cycle.
2. Identify entity or entities responsible for coordinating development of this program.
3. Identify:
    - Which populations and associated limiting factors to monitor.
    - Metrics and indicators.
    - Frequency, distribution, and intensity of monitoring.
    - Tradeoffs and consequences of these choices.
4. Assess the degree to which existing monitoring programs are consistent with NMFS guidance.
5. Identify needed adjustments in existing programs, additional monitoring needs, and strategy for filling those needs.
6. Develop a data management plan (See Appendix B of *Adaptive Management for ESA-Listed Salmon and Steelhead Recovery: Decision Framework and Monitoring*

Guidance (May 1, 2007) http://www.nwr.noaa.gov/Salmon-Recovery-Planning/ESA-Recovery-Plans/upload/Adaptive_Mngmnt.pdf (accessed April 11, 2012).

7. Prioritize research needs for critical uncertainties, testing assumptions, etc.

8. Identify entities responsible for implementation.

8.2 Adaptive Management

Adaptive management means taking an experimental approach to a complex task, making one's assumptions clear, and continuously evaluating them in the light of new information. Adaptive management works best when the design of performance data collection and evaluation methods helps the information managers make sound decisions. As outlined in the NMFS *Adaptive Management* guidance document, several types of monitoring are needed: 1) implementation and compliance monitoring, which is used to evaluate whether the recovery plan is being implemented; 2) status and trend monitoring, which assesses changes in the status of an ESU (or a DPS) and its component populations, as well as changes in status or significance of the threats to the ESU (or the DPS); 3) effectiveness monitoring, which tests hypotheses and determines (via research) whether an action is effective and should be continued. In addition, it's important to build research to illuminate the many unknowns in salmon recovery - the "critical uncertainties" - that make management decisions all the more difficult.

NMFS' guidance document presents a decision framework (Figure 8-1) that can guide the design of a RM&E plan. The framework contains: 1) questions regarding ESU/DPS status (biological viability criteria); 2) questions regarding statutory listing factors and factors limiting recovery (limiting factor and threats criteria). Evaluating a species for potential delisting requires an explicit analysis of both types of criteria.

The guidance document contains a more detailed discussion of the framework and identifies the specific questions necessary to evaluate ESU/DPS status. These specific questions take the form of a series of decision-question sets that address the status and change in status of a salmonid DPS and the risks posed by threats to the DPS. NMFS designed the decision-question sets to elicit the information it needs to make delisting decisions. For recovery planners, the framework can guide future decisions about management strategies and actions aimed at achieving recovery goals.

The White Salmon monitoring and evaluation program will build on existing programs designed for monitoring tributary habitat in the White Salmon. The White Salmon monitoring and evaluation program will provide 1) a clear statement of the metrics and indicators by which progress toward achieving goals can be assessed; 2) a plan for tracking such metrics and indicators; 3) a decision framework through which new information from monitoring and evaluation can be used to adjust strategies or actions aimed at achieving the Plan's goals.

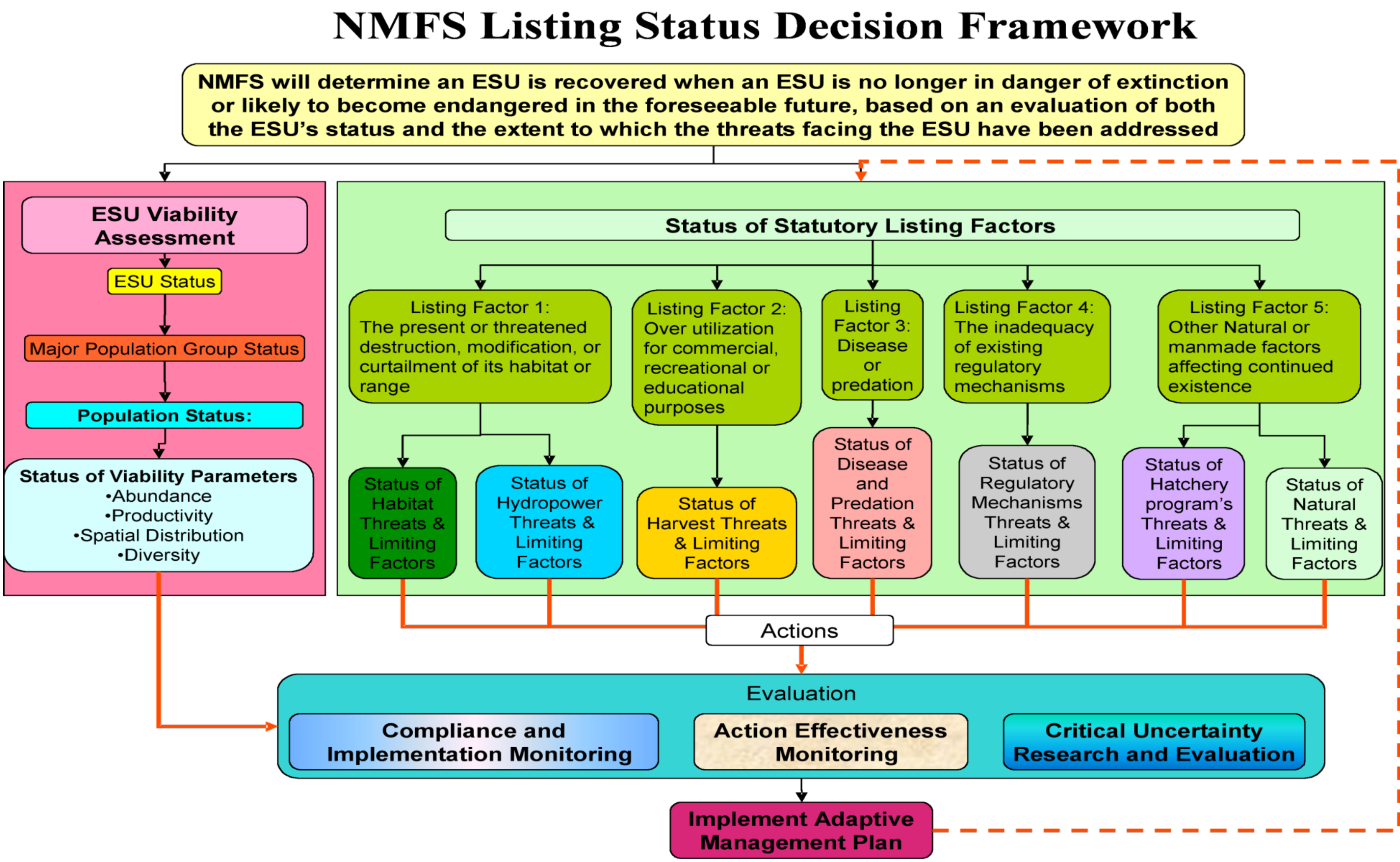

Figure 8-1. NMFS Listing Status Decision Framework

8.3 Critical Uncertainties

Data gaps important to recovery can be divided into two major categories: 1) those that deal with critical uncertainties; 2) gaps in knowledge about the linkages between specific actions and their effects on habitat factors and VSP parameters. Monitoring and evaluation will fill some of the data gaps; research will fill others.

Critical uncertainties, the unknown aspects of environmental conditions vital to salmonid survival, are a major focus of the RM&E program. To establish linkages between specific actions and resultant environmental effects will require monitoring. Those linkages are complex and often not well understood. Understanding them requires input from experts from various fields. It is important that the actions recommended in the Plan to benefit listed fish species in the White Salmon watershed be reviewed by fish ecologists, geologists, hydrologists, and other experts familiar with the recovery region.

The Plan expects that specific benchmark values for the VSP parameters will be refined during Plan implementation based on new information that addresses current uncertainties.

There are numerous out-of-basin uncertainties. The geographic areas that constitute the multiple ESU/DPSs encompass a large part of northern Oregon and a large part of southern Washington draining into the Columbia River. There are multiple populations across species. This context is significant in terms of uncertainties:

- Under the ESA, successful recovery of listed species as defined by NMFS requires achieving specific levels of productivity for populations within the entire ESU/DPS, not only acceptable productivity within any single basin that is a part of the ESU/DPS. Local communities in different watersheds/basins across local and state boundaries are dependent upon each other for successful delisting of these species.
- Of the seven necessary components of an ESA recovery plan, only three are the responsibility of in-basin parties - for which there is currently no collaborative governing board. The other components (e.g., hydropower operations, harvest, hatcheries, macro-economics, estuarine conditions), though significant to impacts on overall mortality, involve factors that are outside of the White Salmon watershed and actions taken within the watershed do not directly these factors. To measure the increases/decreases in productivity of the target populations before they migrate out of the watershed will require monitoring.

8.3.1 Research

As noted earlier, unknown aspects of environmental conditions vital to salmonid survival are termed "critical uncertainties." Critical uncertainty research targets specific issues that constrain effective recovery plan implementation. This includes evaluations of cause-and-effect relationships between fish, limiting factors and actions that address specific threats related to limiting factors. Listed below are research actions to assess the effects of the uncertainties on recovery of listed fish species in the White Salmon watershed. Research actions address both in-basin and out-of-basin factors and are not all-inclusive. The following lists in-watershed and out-of-watershed research needs. This list derives from a longer list identifying potential research needs for other basins within the ESUs and DPS.

8.3.2 In-Watershed Research Needs

- Determine fish abundance, origin, and production data after decommissioning of Condit Dam.
- Determine mainstem restoration needs after PacifiCorp's decommissioning plans have been implemented.
- Conduct habitat/population assessment work in Buck Creek.
- Track sediment downstream of Buck Creek through time.
- Monitor water quality after dam decommissioning.
- Assess impacts of dam removal on mainstem and tributary mouths above project area.
- Address potential issues at in-lieu fishing site after dam decommissioning.
- The White Salmon River is a thermal refuge. How important is this? What impact will this have on salmon and steelhead? Steelhead move into the White Salmon River to seek cold water refuge when mainstem Columbia River temperatures increase. What impact has dam-removal had on this condition?
- Increase understanding of linkages between physical and biological processes so that managers can predict changes in survival and productivity in response to selected recovery actions.
- Test assumptions and sensitivity of EDT and other model runs.
- Determine relative performance (survival and productivity) and reproductive success of naturally producing species.
- Assess population structure.
- Determine the effects of exotic species on recovery and the feasibility of actions to eradicate or control numbers of exotic species.
- Improve the understanding of the range of interactions between resident and anadromous forms of *O. mykiss*. The nature of the relationship is inherently complex and needs further evaluation, especially as recolonization begins to occur.
- Investigate instream flow needs for the mainstem White Salmon and tributaries that will support anadromous fish.

8.3.3 Out-of-Watershed Research Needs

- Monitor harvest levels.
- Develop better methods to estimate harvest of naturally produced salmon and steelhead and indirect harvest mortalities in freshwater and ocean fisheries.

- Assess the interactions between hatchery and naturally produced salmon and steelhead.
- Assess if hatchery programs increase the incidence of disease and predation on naturally produced fish.
- Evaluate increased predation risks from native and non-native fish, birds, and mammals.

These should be coordinated with NOAA's CR Estuary Recovery Plan Module (NMFS 2007) and the 2008 FCRPS Biological Opinion (NMFS 2008c).

8.4 Monitoring

The Plan includes direction for RM&E to: define unknown population characteristics, contribute to regional monitoring efforts, better direct efforts within the watershed, and assess the effectiveness of future actions.

Research and monitoring are designed to test implementation, validation, status/trend, and effectiveness. Implementation monitoring determines if the appropriate entities implemented the planned actions as intended and whether all implementation objectives are on schedule (section 8.1, Designing a Monitoring and Evaluation program to Support Adaptive Management). Status/trend monitoring determines the current conditions (status) of the populations and their habitats and their changes over time (section 8.2, Adaptive Management). Effectiveness monitoring focuses on whether the recovery actions changed the environment and/or the VSP parameters (section 8.3, Critical Uncertainties). Validation monitoring determines whether the fundamental ecological assumptions underlying the recovery plans are true. Prominent among these assumptions are the effects of specific environmental conditions on survival and abundance of listed fish species embodied in the EDT model. Researchers will determine which assumptions need testing once recovery planners fill the critical data gaps (section 8.3, Critical Uncertainties).

Conditions outside the watershed will affect and inform actions, research, and monitoring within the watershed. Out-of-basin conditions do and will have a significant effect on the success of recovery of species within the watershed. These factors include commercial harvest, sport and tribal harvest, conditions in the mainstem CR (including hydroelectric operations), and conditions in the estuary and ocean including short and longer term cycles in ocean conditions. The regional RM&E program developed under the FCRPS Biological Opinion will measure status, trends, and effectiveness of actions in this area.

A recently formed multi-agency Condit Technical Working Group (now White Salmon Working Group) met in early 2007 to discuss RM&E issues (and actions to resolve them) in light of the proposed removal of Condit Dam. The section "In-Watershed Research Needs" (below) the RM&E questions drafted during this meeting are detailed further.

Key Question #1: What is the source of colonizing salmon and steelhead?

Collect genetic samples after dam decommissioning and compare with samples collected prior to dam removal using genetic analysis.

Key Question #2: Has the abundance and origin of salmon, steelhead, and bull trout spawners changed between pre- and post- dam removal?

Compare pre-removal abundance of spring Chinook salmon, fall Chinook salmon, steelhead, and coho salmon with abundance post dam removal.

Key Question #3: Has smolt production increased after dam removal?

Compare smolt estimates pre-dam removal for Chinook salmon fry, and coho, Chinook salmon, and steelhead smolts (USGS) with smolt population estimates after dam removal.

Key Question #4: Has the habitat changed after dam removal?

Compare bathymetric surveys below Condit in the early 1990s with post-removal surveys. Conduct cross-sectional profiles just above reservoir and near mouth to document down-cutting and sediment transport.

Described below is a general framework for monitoring within the White Salmon watershed.

8.4.1 Implementation Monitoring

Effective RM&E requires implementation and compliance monitoring checks to determine whether action entities carried out the activities as planned and whether action entities met specified criteria as a direct result of an implemented action. Scientists will monitor recovery actions within the White Salmon watershed to assess whether action entities implemented the actions as planned. This monitoring will consist of an administrative review and will not require environmental or biological measurements.

Implementation monitoring will address the types, numbers, and locations of actions implemented and how much area or stream length each action affected. Indicators for implementation monitoring will include visual inspections, photographs, and field notes on numbers, location, quality, and area affected by an action. For example, if fencing is planned for 20 miles of stream corridor to keep livestock off the stream banks so that riparian vegetation will rebound, implementation monitoring would verify the presence of the fence. Compliance monitoring would take note of the presence or absence of livestock in the fenced-off area.

Comparing field notes with the specifications in the plans or proposals (detailed descriptions of engineering and design criteria) will determine success. Thus, design plans and/or proposals will serve as the benchmark for implementation monitoring. Evaluations will describe in detail any deviations from specified engineering and design criteria.

8.4.2 Status/Trend Monitoring

Status and trend monitoring is a compilation of data based descriptions of existing conditions. To be useful in decision-making, a scientist reduces the raw data, or metrics, to a more directly applicable form or indicator. For example, if the question is "What is the annual spawning population-size of steelhead in the White Salmon River?" The indicator would be total spawning numbers of steelhead over one season for the entire river basin. The metric, or directly measured thing, however, would be something quite different, perhaps steelhead redds sighted on weekly passes over known spawning grounds. Thus, a scientist would process the metric to translate it from the metric data type (e.g., redds) into the indicator data type (e.g., spawners) and then summarize to generate the indicator required (e.g., from a list of weekly counts on spawning grounds to an annual total for the watershed).

A future collaborative board directing implementation will develop a program to monitor the status and trend of salmon and steelhead and their habitats throughout the White Salmon watershed. The program will utilize guidelines developed in the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) and the Collaborative System-wide Monitoring and Evaluation Project (CSMEP).

8.4.3 Effectiveness Monitoring

Effectiveness monitoring specifically addresses cause-and-effect questions. Demonstrating the direct and indirect impact of management actions requires supporting all steps in a logical chain that connects the action to its expected impact. This chain is rarely short and usually contains several hypotheses. For this reason, it's better to build the effectiveness monitoring into the recovery action strategies with, for example, pilot-scale tests or other methods carefully thought out beforehand.

Not all recovery actions the Plan recommends need monitoring to determine effectiveness. However, it is important that scientists assess a sufficient number of replicates of each "type" of action to assess effectiveness. To the extent possible, monitoring for recovery action effectiveness will use the Before-After-Control-Impact design with stratified random sampling, as described in the Comprehensive Statewide Monitoring Strategy (Monitoring Oversight Committee 2002). This strategy describes in detail the approach, indicators, and protocols needed to assess effectiveness of habitat restoration classes. It is critically important to coordinate the effectiveness monitoring programs with status/trend monitoring and effectiveness monitoring within the hydro sector.

Monitoring and evaluation will only provide the answers to the questions the RM&E designs intended to address. They do not provide the framework for revising questions that are ill posed. Evaluating the assumptions upon which the recovery planners built their strategy or incorporated learning into future action and strategy decisions is the role of adaptive management.

8.5 Consistency with Other Monitoring Programs

This recovery plan will utilize existing monitoring programs to evaluate the status/trend and effectiveness of recovery actions within the White Salmon watershed. Specifically, this approach will incorporate strategies, indicators, and protocols described in the Yakima/Klickitat Fisheries Project, the upper Columbia Monitoring Strategy, the Comprehensive Statewide Monitoring Strategy, and CSMEP. The development of other regional monitoring programs may result in modifications to the monitoring programs used in the White Salmon watershed. These other programs, in various states of development, include such approaches as PNAMP. As these programs develop more fully, they will provide guidance on valid sampling and statistical designs, measuring protocols, and data management. Scientists may use this information to refine and improve the existing monitoring and evaluation programs in the White Salmon watershed. The intent is to make monitoring and evaluation programs in the White Salmon watershed consistent with programs throughout the Columbia basin as well as the ESUs and DPS.

8.6 Coordination

Many entities have been or will be implementing recovery actions within and downstream of the White Salmon watershed. Monitoring programs to coordinate with include:

- Yakima/Klickitat Fisheries project
- YN Monitoring
- NOAA Fisheries RM&E program
- Washington SRFB program
- PACFISH/INFISH Monitoring program
- Pacific Northwest Interagency Regional Monitoring program
- USFWS, USGS, and Bureau of Reclamation (BOR), monitoring programs
- WDFW and Washington Department of Ecology monitoring programs
- Washington Department of Ecology Watershed Assessment and Management Process (Revised Code of Washington (RCW) 90.82)
- Local UCD monitoring

It is critical that recovery planners consult with these programs to emphasize utility, reduce redundancy, increase efficiency, and minimize costs.

8.7 Evaluation Schedule

While the White Salmon watershed currently has no collaborative regional board guiding work, a regional board for the Washington Gorge Management Unit could develop as a follow-up to recovery planning. An appropriate first check-in for the watershed is 3 years from the adoption of the Plan. At this time, the board or co-managers should review efforts within the watershed - whether or not they have obtained funding and initiated actions. At years 5, 8, and 12 further evaluations should occur in order to coordinate with other watersheds in the ESUs and the middle Columbia Steelhead DPS. Reviews at this time should start with funding and implementation effectiveness. If funding and implementation have taken place previously, the RM&E program should review their effectiveness and measure progress toward the overall implementation of projects within White Salmon. The evaluation should place progress, or the lack thereof, within context of all the ESUs and the DPS.

The first major step in the adaptive management program is to obtain 5-year implementation schedules from each of the partners that describe the tasks, schedules, priorities, and estimated cost to implement the recovery actions. The RM&E program will request that each of the Federal and state agencies, tribal and local governments, and non-governmental partners prepare an implementation schedule for their recovery actions. A regional implementation schedule covering the entire White Salmon Management Unit will combine these individual schedules. The recovery partners will complete their initial schedules in the summer of 2010; they will prepare new schedules annually incorporating changes or modifications based on implementation and effectiveness evaluations. NOAA Fisheries 5-year ESA status reviews should coordinated with additional evaluations of the status of viability attributes limiting factors and new information critical uncertainties. The White Salmon Recovery Plan should incorporate the results of these programs into adaptive management and coordinate with other middle Columbia steelhead recovery plans, the recovery plan estuary, and harvest modules for the CR, as well as the 2008 FCRPS Biological Opinion.

8.8 Monitoring and Evaluation Plan

The information in this chapter provides a framework for the development of a salmonid RM&E and adaptive management plan for the White Salmon Basin. When NMFS finalizes the recovery plan's goals and objectives, a process will begin to fully develop a RM&E plan with the White Salmon Working Group and append it to the recovery plan when the recovery plan is completed. A multi-agency salmonid reintroduction plan for the White Salmon River will rely heavily on results of research guided by ongoing monitoring and evaluation.

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Appendix I. Options for Salmon and Steelhead Reintroduction

The following are reintroduction plans for salmon and steelhead in the White Salmon River that were developed by the White Salmon Working Group, made up of Federal, state, and tribal fisheries managers, as well as representatives of the PacifiCorp (Condit Dam operators). The White Salmon Working Group developed a number of options for the reintroduction of salmon and steelhead into the White Salmon River in anticipation of the removal of Condit Dam in the fall of 2009. Each option developed for the various salmon and steelhead populations includes a description of the biological basis for the approach, operational and maintenance needs, and the monitoring and evaluation needs to support the approach. Each of the Plans and assorted options that were developed are listed below, with the preferred option highlighted in gray.

Tule Fall Chinook salmon

Salvage Effort Options within the White Salmon River in Preparation of Removal of Condit Dam.

1. Salvage adipose present CWT-negative tule fall Chinook salmon from White Salmon River in fall 2010 to start tule fall Chinook salmon restoration. Eggs collected and reared at Spring Creek NFH, juveniles acclimated and released at White Salmon Ponds.

a. Biological Basis

    i. Would emphasize collection of adult returns that presumably are natural progeny from previous spawning populations in the White Salmon.

    ii. The mass marking protocol used at Spring Creek NFH would allow for identification of “wild” fish on the spawning grounds.

        1. Hatchery fish would be either adipose-fin clipped or have a CWT present.

        2. Wild fish would have adipose-fins present and no CWT.

b. O&M (Operation and Maintenance) Needs

    i. Temporary weir construction at White Salmon Ponds.

        1. A salvage effort with fish wheel or active adult seining in Lower River to capture adipose present tule fall Chinook salmon could also be used in lieu of or in addition to weir.

            (a) Several options should be discussed for what efforts might be fiscally and logistically possible.

        2. New screens would be needed at the intake structure to comply with NOAA Fisheries or a waiver would be required to operate the ponds and weir during adult collections.

3. Potential need to coordinate with Condit Dam operations should flow manipulation need to occur for selected capture method.

ii. Eggs reared at Spring Creek NFH and transferred for acclimation at White Salmon Ponds for release in April or May per rotary trap timing of tule fall Chinook salmon.

1. Ponds need to be watered up and ready by spring following dam removal to be used for acclimation.
2. Potential upriver or alternative acclimation strategies could be used if White Salmon Ponds are not a viable option.

iii. Program Size

1. 1996 Columbia Basin Fish and Wildlife Authority (CBFWA) Document states 32,000 0+ juveniles for production and release. This translates into about 58 adults that will return based on SCNFH escapement estimates.
2. NMFS Draft White Salmon Recovery Plan states abundance recovery goal of 900 adults (TRT recommendations, pg 105).
3. White Salmon Subbasin Plan (using EDT analysis) estimates 792-995 for abundance estimation from historical through removal with PFC.
4. Based on adult escapement estimates for White Salmon, 500 to 600 adults might "fill out" escapement. The production goals would correlate to annual releases of 275,000 to 330,000.
5. Capacity at White Salmon ponds would be 300,000 for release.

iv. Need to revise HGMP from Spring Creek NFH

1. Would encompass tules and other stocks that may be acclimated at ponds (pending workgroup decisions).

c. RM&E Needs

i. Specific juvenile tagging of these fish is also needed to determine survival rates and evaluate the salvage action.

ii. Genetic analysis of adults collected for salvage effort in 2010.

1. Needed to properly assess success of salvage effort and also act as a baseline for monitoring hatchery/wild fish interactions on the spawning grounds for future years.

iii. Continuation of rotary trapping and genetic analysis to determine production of juveniles.

iv. Expansion of WDFW carcass surveys into areas above Condit dam in 2010 and beyond.

   v. Some decision process to end production based on rotary trapping results of successful spawning abundance or on wild adult escapement estimates (might be easier to estimate).

2. Salvage adipose present tule fall Chinook salmon returning to Spring Creek NFH in fall 2009 to start restoration. Eggs collected and reared at Spring Creek NFH, with juveniles acclimated and released at White Salmon Ponds.

   a. Biological Basis

      i. Would emphasize collection of adult returns that presumably are natural progeny from previous spawning populations in the White Salmon.

      ii. Annual returns to Spring Creek NFH have some components that are presumed to be naturally produced fish.

         1. Fish that have their adipose fin and do not have a CWT.

         2. This would need to be verified by analysis of CWT return data in combination with scale analysis between CWT/adipose fin clipped fish and "wild" interceptions at the hatchery.

   b. O&M Needs

      i. Eggs reared at SCNFH and transferred for acclimation at White Salmon Ponds for release in April or May per rotary trap timing of tule fall Chinook salmon

         1. Ponds need to be watered up and ready by spring 2011, this should be 2010 if we are collecting in 2009, if going to be used for acclimation.

         2. Would need to modify screens or get a waiver from NOAA Fisheries.

         3. Potential upriver or alternative acclimation strategies could be used if White Salmon Ponds are not a viable option.

      ii. Program Size

         1. 1996 CBFWA Document states 32,000 0 + juveniles for production and release. This translates into about 58 adults that will return based on SCNFH escapement estimates.

         2. NMFS Draft White Salmon Recovery Plan states abundance recovery goal of 900 adults (TRT recommendations, pg 105).

         3. White Salmon Subbasin Plan (using EDT analysis) estimates 792-995 for abundance estimation from historical through removal with properly functioning conditions.

         4. Based on adult escapement estimates for White Salmon, 500 to 600 adults might "fill out" escapement. The production goals would correlate to annual releases of 275,000 to 330,000.

5. Capacity at White Salmon ponds would be 300,000 for release.

iii. Need to revise HGMP from Spring Creek NFH.

1. Would encompass tules and other stocks that may be acclimated at ponds (pending workgroup decisions).

c. RM&E Needs

i. Specific juvenile tagging of these fish is also needed to determine survival rates and evaluate the salvage action.

ii. Genetic analysis of adults collected for salvage effort in 2009.

1. Needed to properly assess success of salvage effort and also act as a baseline for monitoring hatchery/wild fish interactions on the spawning grounds for future years.

iii. Expansion of WDFW carcass surveys into areas above Condit dam in 2010 and beyond.

iv. Continuation of rotary trapping and genetic analysis to determine natural production of juveniles.

v. Some decision process to end production based on rotary trapping results of successful spawning abundance or on wild adult escapement estimates (might be easier to estimate).

3. No salvage effort in the White Salmon or at SCNFH

a. Biological Basis

i. Assumes natural colonization in the future.

ii. Would assume that sediment movement after dam removal would be large and allow for successful natural colonization immediately.

b. O&M Needs

i. None at SCNFH

c. RM&E Needs

i. Continuation of rotary trapping and genetic analysis to determine natural production of juveniles.

ii. Expansion of WDFW carcass surveys into areas above Condit dam in 2010 and beyond.

4. Outplant adults, adipose present, in 2010 above Condit Dam prior to removal.

a. Biological Basis

i. Assumes natural colonization and allows some spawning to occur above Condit Dam prior to removal.

ii. Would assume that sediment movement after dam removal would be large and allow for successful natural colonization in later years.

iii. Could be done in conjunction with any of the previous actions or for a number of years to allow for natural colonization.

b. O&M Needs

i. Radio-tagging and Peterson disc tagging of adults to determine movement to White Salmon.

c. RM&E Needs

i. Continuation of rotary trapping and genetic analysis to determine production of juveniles.

ii. Expansion of existing carcass surveys conducted by WDFW to monitor spawning above Condit Dam during 2009 and in 2010.

Spring Chinook salmon

1. Natural re-colonization - no active reintroduction efforts from outside sources.

a. Biological Basis

i. Probably very small number of returning native adults - may not be sufficient number to restart population.

ii. Concerns about Carson fish on spawning grounds?

b. O&M Needs - little to none

c. RM&E Needs

i. Monitor any natural spawner escapement.

ii. Monitor Carson fish on spawning grounds.

iii. Monitor smolt production.

2. Wild Klickitat spring Chinook salmon as brood source for juvenile release into the White Salmon River. Eggs collected and reared at Klickitat Hatchery, juveniles acclimated and released at White Salmon Ponds.

a. Biological Basis

i. Would emphasize collection of wild Chinook salmon from locally adjacent watershed, with similar geomorphologic characteristics and flow regime.

ii. No mass marking to minimize harvest to return as many spawners to White Salmon River as possible.

1. Hatchery fish would have unique CWT if determined that carcasses survey would be productive. More important to CWT after natural production is established.

2. Use PIT-tagging. Limited Wild fish would have adipose fins present and no CWT.

b. O&M Needs

i. New improved broodstock collection facility at Lyle Falls Fishway (~3 years out).

ii. Isolated spawning and rearing at Klickitat Hatchery - several options should be discussed for what efforts might be fiscally and logistically possible.

iii. White Salmon Pond rehabilitation and O&M.

iv. Juvenile transport at fry or smolt stage.

c. RM&E Needs

i. Monitor natural and hatchery escapement to spawning grounds.

ii. Monitoring natural escapement in Klickitat River (relatively low in recent years) and any impacts to natural population from broodstock collection.

3. Klickitat Hatchery spring Chinook salmon as brood source for juvenile release into upper White Salmon River, starting in spring 2010 (from Klickitat Hatchery thinning release or other surplus juveniles).

a. Biological Basis

i. Would emphasize use of hatchery Chinook salmon from locally adjacent watershed.

ii. Possible concerns about genetic mixing in Klickitat Hatchery stock of stream- and ocean-type Chinook salmon (see c.ii. below).

b. O&M Needs

i. Isolated spawning and rearing at Klickitat Hatchery - several options should be discussed for what efforts might be fiscally and logistically possible.

ii. Upper White Salmon release site identified/developed and O&M.

iii. Direct stream release locations identified/developed.

c. RM&E Needs

i. Fish Health monitoring (BKD concerns).

ii. Assessment of possible effects of use of genetically mixed Klickitat Hatchery stock (evidence of possible broodstock mixing of stream-type [spring-run] and ocean-type [summer-run] in Klickitat Hatchery stock).

4. Klickitat Hatchery integrated stock spring Chinook salmon as brood source for juvenile release into White Salmon River, in future years (broodstock source would be hatchery-reared offspring of wild fish).
    a. Biological Basis
        i. Would emphasize use of integrated stock Chinook salmon from locally adjacent watershed.
        ii. May alleviate concerns of broodstock mining effects on Klickitat wild population (pending success of program at Klickitat Hatchery).
        iii. Would likely alleviate concerns regarding use of current Klickitat Hatchery stock due to possible mixing of stream- and ocean-type Chinook salmon (see 3.c.ii above).
    b. O&M Needs - similar to Option 3 above.
    c. RM&E Needs - similar to Option 3 above (except for 3.c.ii).
5. Transport surplus Klickitat Hatchery adults to White Salmon starting in fall 2010.
    a. Biological Basis
        i. May be precluded by disease concerns resulting from out-of-basin transfer of adult fish.
        ii. Possible concerns about genetic mixing in Klickitat Hatchery stock of stream- and ocean-type Chinook salmon (see 3.c.ii. above).
    b. O&M Needs
        i. Trucking O&M.
        ii. Racking in of transported broodstock.
    c. RM&E Needs
        i. Radio-telemetry study.
        ii. Assessment of possible genetic effects (see 3.c.ii. above).
6. Trap and transport Klickitat wild adults to White Salmon.
    a. Biological Basis
        i. May be precluded by disease concerns resulting from out-of-basin transfer of adult fish.
    b. O&M Needs
        i. Trucking O&M.
        ii. Racking in of transported broodstock.

   c. RM&E Needs

      i. Monitor any natural re-colonization in interim (concerns about Carson fish?)

      ii. Radio-telemetry study.

      iii. Monitoring natural escapement in Klickitat River (relatively low in recent years) and any impacts to natural population from adult trap and transport.

7. Monitor natural escapement and production for 4-5 years then evaluate need and suitability of Option 4.

   a. Biological Basis

      i. Would determine if sufficient number of returning adults to restart population.

      ii. Concerns about Carson fish on spawning grounds?

   b. O&M Needs - little to none (unless Option 4 initiated).

   c. RM&E Needs

      i. Monitor any natural spawner escapement.

      ii. Monitor Carson fish on spawning grounds.

      iii. Monitor smolt production.

Coho salmon

1. Natural re-colonization - no reintroduction efforts from outside sources.

   a. Biological Basis

      i. Sufficient number of returning adults to restart population?

      ii. Identification of coho benefits from EDT modeling efforts.

   b. O&M Needs - little to none

   c. RM&E Needs

      i. Monitor natural spawner escapement.

      ii. Monitor smolt production.

2. Juveniles from Washougal and/or Bonneville/Cascade hatcheries released into White Salmon River.

   a. Biological Basis

      i. Would use LCR coho stock for brood source (Washougal Hatchery, Lewis River, Type N, and/or Tanner Creek).

   b. O&M Needs

        i. Existing facilities at Washougal, Bonneville and Cascade hatcheries.
        ii. For possible acclimation - White Salmon Pond rehabilitation and O&M.
        iii. Juvenile transport at fry or smolt stage.
    c. RM&E Needs
        i. Monitor natural and hatchery escapement to spawning grounds.
        ii. Monitor natural production.
        iii. Fish health monitoring.

3. Collection of wild adult broodstock in Klickitat River with spawning and rearing at hatchery facility and juvenile release in White Salmon River.
    a. Biological Basis
        i. Would use nearby wild broodstock source.
    b. O&M Needs
        i. Identify suitable hatchery facilities for spawning and rearing.
        ii. Adult capture facility at Lyle Falls Fishway on Klickitat River.
        iii. For possible acclimation - White Salmon Pond rehabilitation and O&M.
        iv. Juvenile transport at fry or smolt stage.
    c. RM&E Needs
        i. Monitor natural and hatchery escapement to spawning grounds.
        ii. Monitor natural production.
        iii. Fish health monitoring.

4. Collection of wild adult broodstock in White Salmon River with spawning and rearing at hatchery facility and juvenile release in White Salmon River.
    a. Biological Basis
        i. Would use local wild broodstock source.
    b. O&M Needs
        i. Identify suitable hatchery facilities for spawning and rearing.
        ii. Adult capture facility - Weir or White Salmon Ponds rehabilitation.
        iii. For possible acclimation - White Salmon Pond rehabilitation and O&M.
        iv. Juvenile transport at fry or smolt stage.
    c. RM&E Needs

i. Monitor natural and hatchery escapement to spawning grounds.

ii. Monitor natural production.

iii. Fish health monitoring.

5. Monitor natural escapement and production for 4-5 years then evaluate need and suitability of Options 2, 3 or 4.
   a. Biological Basis
      i. Would determine if sufficient number of returning adults to restart population.
      ii. Identification of coho benefits from EDT modeling efforts.
   b. O&M Needs - little to none (unless Options 2, 3, or 4 initiated).
   c. RM&E Needs
      i. Monitor natural spawner escapement.
      ii. Monitor smolt production.

Chum salmon

1. Natural re-colonization - no reintroduction efforts from outside sources.
   a. Biological Basis
      i. Allows for natural colonization from populations within or below Bonneville pool.
   b. O&M Needs
   c. RM&E Needs
      i. Continuation of either annual or every nth year chum surveys using revised chum specific “Patch” analysis or remote sensing techniques to monitor re-colonization efforts.
2. Active adult outplanting in years after Condit Dam Removal.
   a. Biological Basis
      i. Decreases timeframe of re-colonization and potentially provides better opportunity for multiple pairs of chum salmon to spawn in White Salmon.
      ii. Most likely chum salmon are extirpated from White Salmon and chances for spawning to be occurring presently seem very unlikely.
      iii. Accelerates building of chum population in White Salmon.
   b. O&M Needs

i. Adults would have to be trapped in Bonneville Dam fishways or below Bonneville Dam (Ives Island, Duncan, Hardy and/or Multnomah Creek deltas) and trucked to release point in White Salmon River.

ii. Appropriate chum spawning channels could be constructed in suitable habitat within lower White Salmon River and adults transported into these channels.

c. RM&E Needs

i. Begin annual or every nth year surveys using chum specific “Patch analysis to monitor population dynamics.

ii. Identification of donor populations and determine both genetic and population fitness of these populations. (Below Bonneville stocks appear to be genetically best suited, and most easily obtained.)

iii. Identification of suitable spawning/outplanting locations and juvenile rearing habitat within White Salmon and lower tributaries.

iv. Potential PIT-tagging or Radio-tracking to determine spawning ground distribution and success or utilize remote sensing techniques.

3. Active stocking of juvenile chum salmon or outplanting of eggs in egg baskets and hatch boxes via WDFW’s Washougal Hatchery or Willard NFH.

a. Biological Basis

i. Decreases timeframe of re-colonization and potentially provides better opportunity than natural re-colonization.

ii. O&M needs - yet to be determined but could involve infrastructure needs to Willard or Washougal hatcheries in addition to fish culture needs.

b. RM&E Needs

i. Continuation of either annual or every nth year surveys using chum specific “Patch analysis to monitor population dynamics.

ii. Identification of donor populations and determine both genetic and population fitness of these populations. (Bonneville fishway and or below Bonneville stocks appear most suitable and most easily obtained).

iii. Identification of suitable stocking locations and juvenile rearing habitat within the White Salmon River and lower tributaries.

iv. Potential PIT-tagging or Radio-tracking to determine distribution, timing and movement of chum salmon juveniles.

4. Initiate temporary hatchery program for chum salmon using existing USFWS hatcheries for subsequent outplanting using only chum captured at Bonneville Dam.

a. Biological Basis

i. Decrease risk to downstream donor stocks whose numbers are annually declining.

ii. Uses parent stock of chum salmon with fidelity to the Bonneville Reservoir and possible the White Salmon River.

iii. Decreases timeframe of re-colonization.

b. O&M Needs

i. Adults would have to be trapped in Bonneville Dam fishways.

ii. Adults would be held and spawned in Service Hatcheries.

iii. Eggs or juveniles would be outplanted in suitable habitat.

c. RM&E Needs

i. Survey and identify suitable habitats prior to outplanting.

ii. Evaluate success of any outplanted eggs.

iii. Continuation of either annual or every nth year surveys using chum specific "Patch analysis to monitor population dynamics.

iv. Potential PIT-tagging or Radio-tracking to determine distribution, timing and movement of returning adult chum salmon passing Bonneville Dam.

Steelhead

There are indications that the population of *O. mykiss* in the White Salmon River above Condit Dam is still producing smolts even though anadromy has been eliminated since the construction of Condit Dam and the end of passage in 1913. Pre-removal monitoring in the White Salmon River above Condit Dam has identified *O. mykiss* juveniles displaying smolt behavior and morphology, and PIT-tagged juveniles have been detected passing Bonneville Dam with one being recovered at the tern colony on East Sand Island (B. Allen, personal communication, 2007). In addition, a juvenile *O. mykiss* PIT-tagged above Condit Dam September of 2004 at 98 mm was detected ascending Bonneville Dam in July of 2006. Genetic analysis of juvenile *O. mykiss* collected in the upper watershed above Husum Falls are different from hatchery trout released in the basin, however additional samples are needed to confirm this finding (Allen et al. 2006). This information supports the theory that even though the population is functionally extirpated there is still the potential for re-establishing anadromous steelhead in the White Salmon River Basin.

Based on the potential to re-establish natural production of steelhead in the basin, the White Salmon Working Group decided that Option 1, the natural re-colonization approach, was the best suited for the status of *O. mykiss* in the basin. The key to the success of this option is to implement all of the proposed monitoring and evaluation activities, including screw trap operations and the installation of a weir on Rattlesnake Creek to monitor adult escapement, adult movement, and presence/absence of stray hatchery-origin steelhead. In the future, if the need arises, the weir could be used to exclude hatchery-origin adults creating a refuge for naturally produced steelhead. Another reason that the White Salmon Working Group supported Option 1 was that the removal of Condit Dam provides a rare opportunity to study the natural re-colonization of newly available habitat without using hatchery intervention. Option 1 will be evaluated and an assessment made after 5 years to determine if the approach should continue or if the other proposed options should be considered.

1. Natural re-colonization - no reintroduction efforts from outside sources
    a. Biological Basis.
        i. Potentially a small number of returning native adults but may not be sufficient number to restart population.
        ii. Recent USGS studies identify PIT-tagged resident *O. mykiss* migrating from the White Salmon above Condit Dam. One PIT-tag collected at East Sand Island, and one detected passing back upriver through the Bonneville Dam fishway (steelhead life history may still be present in upper watershed).
    b. O&M Needs
        i. Maintenance of weir(s) in tributary stream(s).
    c. RM&E Needs
        i. Monitor all natural spawner escapements.
        ii. Monitor hatchery stray steelhead on the spawning grounds.
        iii. Juvenile fish surveys for abundance and growth (via PIT-tagging).
        iv. Rotary Screw Trap (both in lower river and above current reservoir site) to collect out migrants for DNA (deoxyribonucleic acid) analysis, and juvenile production.
        v. Adult and juvenile weir trap and/or instream PIT-tag detector for monitoring in Rattlesnake Creek.
        vi. Redd capping to conduct DNA analysis.
2. Wild donor from local watershed as brood source for juvenile release into the White Salmon River. Eggs collected and reared at suitable hatchery, juveniles acclimated and released at White Salmon Ponds.
    a. Biological Basis
        i. Would emphasize collection of wild steelhead from locally adjacent watershed, with similar geomorphologic characteristics and flow regime.
        ii. Marking to minimize harvest and still provide monitoring information on returning adults.
    b. O&M Needs
        i. White Salmon Pond rehabilitation and O&M.
        ii. Juvenile transport at fry or smolt stage.

iii. Possible identification and development of upriver acclimation site.

c. RM&E Needs

i. Monitor natural and hatchery escapement to spawning grounds.

ii. Monitoring natural escapement in brood source river and any impacts to natural population from broodstock collection.

3. White Salmon resident *O. mykiss* as brood source with locally suitable anadromous wild donor stock spawned for juvenile release into upper White Salmon River.

a. Biological Basis

i. Would emphasize both local (resident) and from locally adjacent watershed.

ii. Possible concerns of ESA status of new population.

b. O&M Needs

i. Upper White Salmon release site identified/developed and O&M.

ii. Possible identification and development of upriver acclimation site.

c. RM&E Needs

i. Fish Health monitoring (BKD/IHN concerns).

ii. Assessment of possible effects of use of genetically mixed local donor stock.

4. Develop White Salmon captive brood program using captured outmigrating juveniles.

a. Biological Basis

i. Capture genetically unique White Salmon steelhead for captive brood program development.

b. O&M Needs

i. Transport equipment.

ii. Spawning, incubation, rearing and adult holding facilities.

iii. Possible identification and development of upriver acclimation site.

c. RM&E Needs

i. DNA analysis to ensure White Salmon population.

5. White Salmon Steelhead Kelt Reconditioning. Recondition local spawners to enhance survival to repeat spawning stage.

a. Biological Basis

i. Maximize survival of White Salmon steelhead to bolster early stages of White Salmon re-colonization effort.

b. O&M Needs

  i. Adult downstream weir trap to collect females.
  ii. Holding area and feed.
  iii. Direct stream release locations identified/developed (for release of reconditioned adults).

c. RM&E Needs

  i. Monitoring holding/release methods (i.e. release below Bonneville, or release into White Salmon, hold and release into White Salmon just prior to spawning).
  ii. PIT-tag adults for Bonneville Dam detection.
  iii. Rotary Screw Trap (both in lower river and above current reservoir site) to collect out migrants for DNA analysis.
  iv. Acoustic tag monitoring in White Salmon and Columbia plume to track kelt movement.

Appendix II. Current Efforts and Regulations Addressing and Protecting Population Productivity in the White Salmon Watershed

Population Enhancement and Habitat Restoration Actions

Positive change is underway to address limiting factors and threats to improve steelhead habitat conditions. A number of actions are proposed, being planned, or are already being implemented in the watershed to address these conditions and the affected populations.

Recent actions include:

- Planning for population introduction/reintroduction upstream of the former Condit Dam
- Plantings of trees in riparian zones to provide for future shade and LWD recruitment
- Assessment of habitat condition in Rattlesnake Creek to identify opportunities for future restoration actions
- Klickitat County expects to initiate the development of a White Salmon Watershed (WRIA 29b) Management Plan in the near future, pending the availability of funding

Regulatory Protection

Federal, state, county, and tribal regulatory mechanisms are in place to protect habitat from current and future threats posed to listed species through habitat loss and degradation caused by human land uses and development. Numerous voluntary programs are also available to address habitat conservation. In addition, some areas receive special protection through designation, such as Wild and Scenic River reaches, primitive areas, and wildlife refuges.

NOAA Fisheries and/or U.S. Fish and Wildlife Section 7 Consultations

Section 7 of the ESA directs all Federal action agencies to consult with NOAA's NMFS and the USFWS to ensure that all Federal actions/projects will not jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat. Actions include not only direct Federal actions, but also actions funded with Federal dollars. A Biological Assessment or Biological Evaluation is usually developed and submitted to NMFS for review prior to implementation of any project. The reader can find additional information regarding the consultation process at: http://www.nwr.noaa.gov/Salmon-Harvest-Hatcheries/Hatcheries/Sec-7-USFWS-Columbia.cfm (accessed April 19, 2012).

Clean Water Act

The Federal Clean Water Act addresses the development and implementation of water quality standards, the development of Total Maximum Daily Loads (TMDL), filling of wetlands, point source permitting, the regulation of stormwater, and other provisions related to protection of U.S. waters. The Clean Water Act is administered in the State of Washington by the WDOE with oversight by the EPA. State water quality standards are set to protect beneficial uses, which include several categories of salmonid use. Ecology has a water quality certification program under which it reviews projects that will discharge dredged or fill materials into waters of the U.S. and issues certifications that the proposed action meets State water quality standards and other aquatic protection regulations, if appropriate. Ecology also issues National Pollution Discharge Elimination System (NPDES) permits, and develops water quality cleanup plans TMDL to address water quality limited streams.

National Environmental Policy Act (NEPA) Review

NEPA requires Federal agencies to consider the probable impacts of their proposed activities, programs, and projects (including funding of state, local, and private actions) on the quality of the human environment. NEPA reviews help agencies decide whether to undertake a proposed action. In most cases, the NEPA review requires the development of an Environmental Assessment or Environmental Impact Statement (EIS) that addresses the probable effects of a project and its alternatives on various elements of the environment, including soils, geology, landscapes, atmospheric conditions, vegetation, fish and wildlife, and cultural resources. Many Federal funding programs are covered under a general NEPA review completed when the funding program was developed.

Watershed Planning Act

In 1998 chapter 90.82 Revised Code of Washington (RCW) was amended with the passage of Engrossed Substitute House Bill (ESHB) 2514. This law is also known as the Watershed Planning Act. The Watershed Planning Act was established to address the diminishing water availability and quality, and the loss of habitat for fish in the State of Washington. The Watershed Planning Act provides a framework for local citizens, tribes, and state and local agencies to work together to develop and implement Watershed Management Plans for entire watersheds.

As part of the planning process, a watershed assessment is completed for each Water Resource Inventory Area (WRIA) to evaluate water supply and use. Once the watershed assessment is complete, a management plan, followed by a detailed implementation plan, is developed to address water quantity, water quality, and fish habitat issues identified in the assessment. The White Salmon River lies within WRIA 29b. Watershed planning activities are currently on hold due to the state's current budget shortfall.

State Environmental Policy Act (SEPA)

SEPA regulations require an environmental review of actions taken by the state and local agencies, including funding and permitting. Some actions, such as the construction of single-family dwellings, minor road repair, and issuance of business licenses, are exempt. A SEPA review evaluates the probable environmental effects of a proposed project. This information is used to determine if the action should be taken as proposed, if mitigation is necessary, or if the proposal should be rejected.

Forest & Fish Regulations (Washington State)

The Washington Forests & Fish Law, ESHB 2091, was signed into law in 1999 as part of The Washington State Forest Practices Act (Title 76.09 RCW), passed in 1974. The Forests

& Fish Law, based on the Forests & Fish Report, resulted in changes to forest practices rules to protect riparian and aquatic resources on more than eight million acres of private forestland. It is intended to meet the provisions of the Federal Clean Water Act concerning non-point source silvicultural practices. Changes to the law included:

- Updates of the stream typing system in the state to improve mapping of fish-bearing waters
- Increases in buffer widths along fish bearing and non-fish bearing streams,
- Changes in forest practices to protect against landslides
- Mandatory requirements to update the forest road system to hydrologically disconnect roads from streams and minimize sediment delivered to streams
- New regulations on pesticide applications to prevent or avoid drift of chemicals into streams
- Increased protection of wetlands
- Changes in enforcement
- Establishment of a scientifically based adaptive management and monitoring process for evaluating the impact of forest practices on aquatic resources
- Establishment of a process for amending the forest practices rules to incorporate new information as it becomes available
- Establishment of a small landowner office to assist non-industrial landowners

Additional information regarding the Forest Practices rules can be found at: http://www.dnr.wa.gov/BusinessPermits/ForestPractices/Pages/Home.aspx (accessed April 19, 2012).

The Washington Department of Natural Resources, on behalf of the State of Washington, submitted applications to NMFS and the USFWS for incidental take permits under section 10 of the ESA. Issuance of these permits would provide assurances that all forest practices activities in compliance with the state forest practices rules and administrative program will satisfy ESA requirements for aquatic species. The two services released the final HCP (habitat conservation plan), the final EIS, and implementing agreement in a ***Federal Register Notice*** on Jan. 27, 2006. This notice provides an opportunity for the public to review the final documents and the responses to public comments on the draft documents.

Klickitat County Shorelines Master Plan

In 1971 the Washington State Legislature passed the Washington Shoreline Management Act, adopted by public referendum in 1972. The purpose of the Act is "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines" by requiring every county and many cities to develop a Shoreline Master Plan to govern development in shoreline area http://www.ecy.wa.gov/programs/sea/sma/st_guide/intro.html (accessed April 19, 2012). Klickitat County's Shorelines Master Plan (SMP) was first adopted in 1975 and has been updated periodically since then. The SMP and brochure on the shorelines permit program can be accessed from the Klickitat County Planning Department's website: http://klickitatcounty.org/Planning/default.asp?fCategoryIDSelected=301427788 (accessed April 19, 2012).

The Klickitat County's SMP regulates "development" within the "shorelines" of the White Salmon River and other water bodies in Klickitat County's jurisdiction. "Development" is broadly defined as: construction or exterior alteration of existing structures; dredging; drilling; dumping; filling; removal of any sand, gravel or minerals; bulkheading; driving of piling; placing of obstructions; or any project of a permanent or temporary nature which interferes with the normal public use of the surface of the waters overlying lands subject to the SMP regulations at any state of water level. "Shorelines" are those lands extending landward for 200 feet in all directions as measured from the ordinary high water mark, floodways and contiguous floodplain areas landward 200 feet from such floodways; all wetlands and river deltas associated with the streams and lakes. The SMP applies to the shorelines of the mainstem of the White Salmon River as well as the shorelines of all tributaries with a mean annual flow of 20 cfs or more.

The SMP designates various shorelines of the White Salmon River and its tributaries as "environments", which determine the level of protection that is warranted. Much of the White Salmon River is designated either "Natural Environment" which prohibits most development within its shorelines or "Conservancy Environment", which allows a limited scope of development, subject to conditions (i.e., shoreline conditional use permit). Each development proposal is subject to review pursuant to the shoreline environment within which it is to be located. One or more shoreline permits must be secured prior to implementation: Substantial Development Permits are required for any development for which the total cost or fair market value exceeds $5,000, or any development which materially interferes with the normal public use of the water or shorelines; Shoreline Conditional Use Permits (CUP) are required for development types that warrant conditions to ensure consistency with the SMP; and Variances are issued to grant relief from specific bulk, dimensional, or performance standards of the SMP in order to avoid unnecessary hardship, provided that extraordinary circumstances are shown to exist and the public interest shall suffer no substantial detrimental effect. Some types of development, such as a single-family residence, normal maintenance and repair, or construction of a normal protective bulkhead for a single family residence, are exempt from the requirement of a substantial development permit, but are still subject to all other provisions of the SMP.

Existing structures and developments that were established prior to adoption of the SMP are considered legally established "non-conforming" uses. Since adoption of the SMP, the County and WDOE have reviewed all developments within shorelines, including modifications to non-conforming uses, to ensure compliance with the goals and requirements of the SMP.

The WDOE reviews the County's permit decisions and has final authority to approve or deny CUPs and Variances. Persons may appeal the final decision to the Shorelines Hearings Board.

Klickitat County Critical Areas Ordinance

Klickitat County adopted a Critical Areas Ordinance (CAO) in 2001 and, with the concurrence of WDFW, Community Trade and Economic Development, and Ecology, amended it in 2004. The CAO extends beyond the geographical scope of the County's SMP to protect wetlands, critical fish/wildlife habitat, geologically hazardous areas, aquifer recharge areas, and frequently flooded areas. The CAO is, in effect, an overlay on existing land use regulations. The CAO provides for standard setbacks of 300' from Category I wetlands, 200' from Category II, and 75' from Category III and IV. The CAO provides for standard buffers of 200' from Type 1 & 2 waters; 150' from Type 3 waters; 50' from Type 4 waters; and 25' from Type 5 waters. A wildlife habitat management plan is required for new development that will likely impair salmonid habitat functions and values. As with the SMP, developments and uses that existed prior to the adoption of the CAO are considered legally established "non-conforming" uses. The CAO and brochures land use permit programs can be accessed from the Klickitat County Planning Department's website: http://klickitatcounty.org/Planning/default.asp?fCategoryIDSelected=301427788 (accessed April 19, 2012)

Klickitat County Floodplain Management Ordinance

The Klickitat County Floodplain Management Ordinance (FPO) regulates all development and activities that may increase flood hazards. A permit is required for development within areas of special flood hazard (with at least one percent chance of flooding). The applicant for a non-residential structure must include a certification and flood analysis conducted by a professional engineer. In general, development that does not meet the specific criteria in the ordinance for development in these areas, to protect public health and safety, will be denied. The FPO and brochures land use permit programs can be accessed from the Klickitat County Planning Department's website: http://klickitatcounty.org/Planning/default.asp?fCategoryIDSelected=301427788 (accessed April 19, 2012).

Klickitat County Zoning Ordinance

The Klickitat County Zoning Ordinance (CZO) was adopted in 1979 and has been amended over time. Much of the White Salmon River watershed is zoned by the CZO as "extensive agriculture" which requires a 20-acre minimum lot size for the purpose of dividing properties, and new development/uses are restricted to resource management uses/activities and other compatible uses. One permanent residential dwelling is allowed per lot. Some areas of the watershed are zoned for residential development. The allowable minimum lot size for new lots is either 1 or 2 acres; and one residential dwelling is allowed per lot. Other than residential development, most new development/uses in these zones is either prohibited or allowed per a zoning conditional use permit. The CZO and brochures land use permit programs can be accessed from the Klickitat County Planning Department's website: http://klickitatcounty.org/Planning/default.asp?fCategoryIDSelected=301427788 (accessed April 19, 2012).

Klickitat County Environmental Ordinance (CEO)

The Klickitat County Environmental Ordinance (CEO) was adopted pursuant to the SEPA. The CEO and SEPA require an analysis of probable significant adverse environmental impacts that may result from a proposed development. The CEO and SEPA require a threshold determination for each proposed development that is not exempt. The threshold determination is a determination that a project will or will not have probable significant adverse environmental impacts. If a project has probable significant adverse impacts, and an EIS is prepared, any proposed development/use that is not specifically exempt in SEPA, chapter 43.21C RCW, or the SEPA rules adopted by the Department of Ecology, Chapter 197-11 Washington Administrative Code, is required to comply with SEPA. Klickitat County provides applicable state agencies and tribes, as well as the public, the opportunity to review threshold determinations and EISs.

Washington State Water Pollution Control Act (Chapter 90.48 RCW)

This act gives Ecology the authority to protect water quality in the state and to promulgate regulations as needed to achieve this goal. The Act makes discharges of pollutants into waters of the state unlawful and has provisions for enforcement of violations, including the authority and process for issuing compliance orders and civil penalties, and for seeking criminal penalties. The Act also provides for permitting processes, cooperation with other entities, water quality monitoring, grants, and numerous other subjects regarding management of water quality issues in the state.

Washington's Statewide Monitoring Program

In 2001, Substitute Senate Bill (SSB) 5637 was signed into law. This act related to monitoring of watershed health and salmon recovery. The Monitoring Oversight Committee developed a comprehensive statewide strategy that addresses the actions identified in SSB 5637. Among other things, the Plan is intended to provide information regarding trends in fish, water, and habitat conditions and assess effectiveness of actions taken to improve watershed health and provide for salmon recovery. The strategy includes documentation of fish population trends in some areas of the state; however, the White Salmon River watershed is not one of the areas included to date in that monitoring effort. The strategy is also monitoring the effectiveness of habitat restoration efforts funded by the state. The monitoring of project effectiveness follows the Monitoring and Evaluation Strategy (Washington SRFB 2003) that was developed in support of the Comprehensive Statewide Strategy. The Monitoring and Evaluation Strategy specified methods to assess a wide range of restoration and protection projects.

On-Site Sewage Systems

Chapter 246-272 of the Washington Administrative Code regulates the onsite disposal of sewage in the state. The law is applicable to septic systems as well as larger on-site systems. The rule addresses location of systems, site evaluations, design, installation, inspection, operation and maintenance, repair, abandonment, and other areas of concern. The rule helps to prevent the discharge of sewage into fish-bearing streams.

Hydraulic Code

Chapter 75.20 RCW governs construction projects within the waters of the State of Washington. The law requires hydraulic project approvals from the WDFW, Department of Fish and Wildlife for wharves, bulkheads, bridges, culverts, fish habitat restoration projects, and other construction activities within the ordinary high water mark. This regulation helps to protect fish and fish habitat during construction.

Regulation of Dairy Farms

Chapter 90.64 RCW, the Dairy Nutrient Management Act, includes a number of requirements designed to protect water quality from dairy operations. These are in addition to NPDES requirements in the Federal and state Clear Water Acts for concentrated animal feeding operations. The Act requires inspection of all dairy farms, implementation of dairy nutrient management plans, technical assistance and enforcement (including civil penalties) against significant polluters. The intent of the regulation is to protect water quality and, subsequently, fish habitat. The WDOE is the primary regulatory authority under this Act.

Other Rules and Regulations

There are over 100 additional rules and regulations applicable to the protection of water quality and fish habitat in the State of Washington. These rules cover a broad range of subjects such as groundwater quality standards, application of pesticides, well construction, motor oil disposal, utilities, solid waste disposal and recycling, water supply facilities, mining, energy facilities, dikes and levees, aquiculture, etcetera. Lists of applicable laws and rules and links to the specific requirements of those laws and rules can be found at: www.ecy.wa.gov/laws-rules.

Yakama Reservation Forest Management Plan

The YN has a variety of protective land use regulations in effect on reservation lands. One of these is the FMP. Under the 1993-2002 FMP, the Yakama Administrative Forest was divided into 11 Land Use Management Areas (LUMA). Each LUMA was managed for multiple uses with emphasis on dominant resource features and objectives. The draft FMP soon to be ratified changes the designation of LUMAs to Management Emphasis Areas (MEA), which will be managed within the forest habitat types (BIA and YN 2004). The forestry program is using historical species composition and stand densities as references for the desired future stand conditions. Just as with the health of aquatic systems, forest health describes the ability of a forest ecosystem to remain productive, to maintain a diversity of plants and animals, aesthetic appeal, and resource sustainability, and to withstand disturbances over time. In addition, a healthy forest is resilient to periodic disturbances such as drought, insects, diseases, fires, climatic change, and management practices.

The FMP prescribes the number of miles and density of roads allowed to be built for the purpose of harvesting timber from the Administrative Forest, and forest treatments such as thinning and prescribed burns are being put into place to move the forest vegetation more toward the historical condition of seral stands rather than dense, late successional forest cover. Streams are classified according to their flow, use for domestic purposes and use by fish for spawning, rearing and migration, and buffers and harvest restrictions are set accordingly. The objectives are the preservation of stream bank and riparian cover, water quality and flow maintenance and soil stabilization (BIA and YN 2004).

Fisheries Management and Evaluation Plan

Recent policy changes will reduce potential harvest impacts. A Fisheries Management and Evaluation Plan (FMEP) for tributary fisheries in the Washington portion of the LCR

Chinook salmon, steelhead, and chum salmon ESUs (WDFW 2002) has been approved by NMFS. WDFW has also requested NMFS approval on a proposed supplement to the FMEP that covers tributary fisheries impacts on listed LCR coho salmon. The agency has also submitted a FMEP for MCR steelhead to NMFS that includes management for recreational fisheries in the White Salmon River. The FMEP minimizes harvest impacts to listed steelhead through the use of selective fisheries that target marked hatchery steelhead and requires the release of all unmarked steelhead. The FMEP also includes management actions that limit impacts to juvenile steelhead through fishing seasons, area closures, and gear restrictions. NMFS is currently reviewing the FMEP to determine if it can be approved under the 4(d) rule limit 4 for MCR steelhead.

Hatchery and Genetic Management Plans

The USFWS submitted HGMPs to NMFS for approval under section 7 of the ESA. NMFS issued a section 7 Biological Opinion on November 27, 2007 for these hatchery programs (http://www.nwr.noaa.gov/Salmon-Harvest-Hatcheries/Hatcheries/Sec-7-USFWS-Columbia.cfm) (accessed April 19, 2012). . Many actions and measures in the HGMPs have already been implemented. These HGMPs cover programs that release fish into the LWS River and at the Spring Creek NFH. WDFW has also submitted an HGMP to NMFS for the releases of summer and winter steelhead into the White Salmon River. These programs may adversely affect listed populations in the White Salmon River and are being evaluated in a Biological Opinion. All of these programs are funded in whole or partially through the Mitchell Act, which is administered by NMFS. An EIS for NMFS' funding of the Mitchell Act and its hatchery programs is being drafted and will include evaluation of the programs listed above.

Special Land Use Areas

Several areas in the White Salmon drainage have received special Federal protection.

Columbia River Gorge National Scenic Area

"The National Scenic Area was created to protect and enhance the scenic, natural, cultural and recreational resources of the CR Gorge while encouraging economic development" (www.fs.fed.us/r6/columbia/). The White Salmon River downstream of Condit Dam, RM 3.3-mouth, is within the boundaries of the Gorge National Scenic Area. All new development and land uses must be reviewed in the National Scenic Area to determine if they are consistent with the Act and the implementing land-use ordinances. The development guidelines of the management plan are implemented through land-use ordinances that must be consistent with the management plan.

Wild and Scenic Rivers

The Wild and Scenic Rivers Act was created by Congress to preserve in a free-flowing condition selected rivers of the nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historical, cultural, or other similar values. The nine-mile reach from confluence of Gilmer Creek near BZ

Corner to Buck Creek is a Federal Wild and Scenic River. A twenty-mile stretch of the upper White Salmon and Cascade Creek received Senate approval for Wild and Scenic designation and awaiting presidential approval. The Act restricts the construction of any dam or other water resource project on or directly affecting a designated river or that would have a direct and adverse effect on the values for which such a river was established, such as its free-flowing nature. The Act directed the Forest Service to develop management plans for these portions. The Wild and Scenic Rivers Act on the White Salmon River does not supersede local Shoreline Management Plans.

References

BIA (Bureau of Indian Affairs) and YN (Yakama Nation). 2004. Yakama Nation. Draft 2005-2014 Forest Management Plan.

Washington Salmon Recovery Funding Board. 2003. Monitoring and Evaluation Strategy for Habitat Restoration and Acquisition Projects. Draft. Available at: www.rco.wa.gov/doc_pages/other_pubs.shtml (accessed 13 July 2010).

WDFW 2002. Washington State Department of Fish and Wildlife. Salmonid Stock Inventory http://wdfw.wa.gov/fish/sasi/ (accessed April 19, 2012).

Appendix III. Jewett Creek

Jewett Creek is a small creek located 2 miles to the east of the mouth of the White Salmon River. Geographically, the creek is located within the ICTRT-identified Klickitat independent population spatial distribution boundary, and is, therefore, within the Klickitat River recovery planning area. Jewett Creek is discussed here since it was not considered in the Klickitat Recovery Plan. Any steelhead found in Jewett Creek are most likely hatchery strays or strays from the Klickitat or other independent steelhead populations.

Jewett Creek does not meet the minimum criteria for consideration in the ICTRT's assessment of intrinsic habitat potential (ICTRT 2008) and is not considered a major or minor spawning area for the Klickitat independent population of the MCR Steelhead DPS. The creek does not have sufficient habitat to support a viable population, and the population has not been identified as contributing to the viability of the middle Columbia steelhead DPS (ICTRT 2004).

The lower portion of the creek runs through roughly 100 yards of pipe located under an existing industrial plant. The Bonneville Pool may back up water within the pipe. The creek daylights for approximately 0.9 miles between the railroad and Highway 14, and then passes under the highway. Another 0.8 miles of habitat is available upstream of the Highway. The gradient of the creek becomes impassable at the Gorge bluffs, located at roughly river-mile 0.35.

Local residents have indicated that fish have been seen up to the gorge bluffs. The entire area of stream, which is accessible to anadromous fish, is within the Bingen City limits. No information is available regarding the quality of the 1.7 miles of available habitat; however, monitoring and evaluation actions have been proposed to identify anadromous fish usage and habitat conditions. The ICTRT determined that at least 9.3 miles (15 km) of habitat is necessary to support a viable population of 500 fish (ICTRT 2004).

References

ICTRT (Interior Columbia Technical Recovery Team). 2004. Preliminary Guidelines for Population-level Abundance, Productivity, Spatial Structure, and Diversity Supporting Viable Salmonid Populations: An Update. December 13, 2005. Interior Columbia Technical Recovery Team. Northwest Fisheries Science Center. Seattle, Washington.

ICTRT. 2008. Current status reviews: Interior Columbia basin salmon and steelhead ESUs. Volume III: MCR Steelhead DPS. May 2008 Draft.

Appendix IV. White Salmon River Implementation Schedule: Summary of Actions and Potential Costs to Restore White Salmon River Anadromous Fish Populations and Their Habitat

The following table lists the recovery actions identified by the Washington Gorge Implementation Team to address salmon and steelhead recovery in the White Salmon River watershed. Actions addressing implementation of PacifiCorp's decommissioning plans, restoration of the reaches affected by the former Northwestern Lake and the former Condit Dam, and harvest practices potentially affecting the rate of recovery are priority actions.

Detailed cost breakdown by specific action.

Recovery Strategies as Prioritized in Recovery Plan	Applicable Species				Action Type	Specific Action(s)	Potential Implementing Entity(s)	Total Estimated Cost ($)	Total Cost Secured	Funds Needed
	Chinook	Steelhead	Coho	Chum						
Species Reintroductions	x	x	x		Restore populations	Implement reintroduction plan for White Salmon salmonids	White Salmon Working Group	$0		$0
RM&E	x	x	x	x	Baseline Habitat Data Collection	Gather information needed to identify and prioritize habitat actions that will provide the greatest opportunity to contribute to recovery	PacifCorp, White Salmon Working Group	$131,000		$0
	x	x	x	x	Population Monitoring: - Monitor population abundance and productivity - Monitor proportion and origin of hatchery salmon and steelhead on the spawning grounds	Install & maintain large multiplexing PIT-tag detectors in the lower White Salmon mainstem, & in Buck & lower Rattlesnake Creeks. Report findings.	White Salmon Working Group	$176,000		$176,000

Recovery Strategies as Prioritized in Recovery Plan	Applicable Species	Action Type	Specific Action(s)	Potential Implementing Entity(s)	Total Estimated Cost ($)	Total Cost Secured	Funds Needed
		proportion and origin of hatchery salmon and steelhead on the spawning grounds - Assess the resident trout contribution to smolts below Condit Dam; assess change in resident population after steelhead re-colonization/re-introduction					
			Implement population monitoring in the White Salmon River & Rattlesnake Creek.	White Salmon Working Group	$300,000		$300,000
			Install two small stationary in-stream PIT-tag detectors in the lower most portion of Spring Creek.	USGS	$20,000		$20,000
			Pit-Tag 3,000 juvenile salmonid each year above & below Condit Dam to track individual movement & seasonal growth rates.	USGS	$10,000		$10,000

Recovery Strategies as Prioritized in Recovery Plan	Applicable Species				Action Type	Specific Action(s)	Potential Implementing Entity(s)	Total Estimated Cost ($)	Total Cost Secured	Funds Needed
						Conduct adult spawning ground surveys and monitor.	WDFW	$351,000		$351,000
						Create and maintain fish counts & biological database.	WDFW	$9,000		$9,000
						Mark adults for mark-recapture population estimates.	WDFW	$72,000		$72,000
						Derive estimates of salmonid population abundance & complete reporting	USGS & WDFW	$400,000		$400,000
					Population Monitoring: Genetic analses	Compare adult & smolt genetic analyses to ongoing adult salmon escapement estimates of WDFW & smolt outmigration estimates of USGS studies in the White Salmon River.	USFWS	$70,000		$70,000
Habitat	x	x	x		Restore channel, stabilize banks, replant banks, and restore habitat in inundated area currently occupied by the reservoir and habitats downstream of	Implement PacifiCorp's Decommissioning Management Plans.	PacifiCorp	$895,000 to 1,100,000+	$895,000 to 1,100,000+	$0

Recovery Strategies as Prioritized in Recovery Plan	Applicable Species				Action Type	Specific Action(s)	Potential Implementing Entity(s)	Total Estimated Cost ($)	Total Cost Secured	Funds Needed
					Condit dam impacted by dam removal	Restore channel mainstream above Condit Dam.	YN, WDFW, UCD	$400,000-600,000	$400,000-600,000	$0
						Restore riparian condition.	UCD	$260,000		$260,000
						Dredge mouth of River if needed	ACOE	TBA		TBA
	x	x	x	x	Protect and conserve existing natural ecological processes	Protect existing habitat from future degradation though existing regulatory structure	Federal, state, county, and local governments			$0
						Protect existing habitat from future degradation though land management plans, conservation easements, acquisitions, reclassification of lands as natural areas	UCD, NRCS, Counties, Land Trusts, landowners	$260,000	$10,000	$250,000

Recovery Strategies as Prioritized in Recovery Plan	Applicable Species				Action Type	Specific Action(s)	Potential Implementing Entity(s)	Total Estimated Cost ($)	Total Cost Secured	Funds Needed
	x	x	x		Restore vegetation along stream sections that exceed state standards for temperature	Identify stream segments that are excessively warm; within those areas, work with willing landowners to implement actions to increase density of riparian vegetation where sparse; implement programs to protect existing riparian vegetation, reduce sediment inputs to streams.	YN, WDFW, UCD, Mid-Columbia Regional Fishery Enhancement Group (MCRFEG), Klickitat Co.	$260,000		$260,000
		x	x		Restore passage and connectivity's to habitats blocked or impaired by artificial barriers	In cooperation with irrigation district and others, remove or replace barriers inhibiting upstream passage including dikes, culverts and irrigation structures, provide/upgrade screening of irrigation diversions.	YN, USFWS, WDNR, WDOT, Private landowners, USFS, UCD, or others	$700,000		$700,000
						Indian Creek culvert replacement.	UCD, USFWS, YN, Counties	$368,000	$118,000	$250,000
	x	x	x	x	Reduce nutrient inputs	Reduce runoff of nutrients from septic tanks, dairies, agricultural lands, and other sources.	UCD, WDOE, NRCS, landowners, Counties	$1,111,000	$10,000	$450,000

Recovery Strategies as Prioritized in Recovery Plan	Applicable Species				Action Type	Specific Action(s)	Potential Implementing Entity(s)	Total Estimated Cost ($)	Total Cost Secured	Funds Needed
	x	x	x		Improve LWD abundance and recruitment	In cooperation with landowners plan, design and install stable wood and other large debris in steambeds and develop approaches to ensuring long-term LWD recruitment.	UCD, MCRFEG, YN, FS, WDFW, landowners	$715,000	$0	$715,000
						In cooperation with landowners develop grazing strategies that promote riparian recovery.	UCD, landowners	$80,000	$0	$80,000
						Eradicate invasive plant species from riparian areas.	County weed control board, USFS, landowners	$120,000	Unknown	$120,000
					Restore channel	With willing landowners, stabilize streambanks, restore natural channel form, reduce sediment inputs as needed from roads	UCD, landowners, MCRFEG, YN, USFWS, USFS, WDNR	80,000-120,000	$0	80,000-120,000
					Reduce anthropogenic effects on stream flow	Quantify anthropogenic effects on stream flow and identify priority actions	Counties	$200,000	$0	$200,000
						With willing landowners, Implement water conservation measures	Counties, UCD, WDOE	$1,500,000	$0	$1,500,000

Recovery Strategies as Prioritized in Recovery Plan	Applicable Species				Action Type	Specific Action(s)	Potential Implementing Entity(s)	Total Estimated Cost ($)	Total Cost Secured	Funds Needed
						Improve irrigation conveyance and efficiency	UCD, landowners	$3,500,000	$0	$3,500,000
						Employ BMPs with willing landowners	Counties, WDFW, YN, USFS, landowners, UCD	$400,000	$0	$400,000
						Protect/restore springs with willing landowners	Counties, WDFW, YN, USFS, landowners, UCD, MCRFEG	$450,000	$0	$450,000
						Increase pool habitat	Counties, WDFW, YN, USFS, landowners, MCRFEG	$900,000	$0	$900,000
						With willing landowners restore wetlands	Counties, WDFW, YN, USFS, landowners, UCD, MCRFEG	$600,000	$0	$600,000
						Hydrologically disconnect roads from streams.	Counties, WDFW, YN, USFS, landowners	$1,500,000	$0	$1,500,000

Recovery Strategies as Prioritized in Recovery Plan	**Applicable Species**				**Action Type**	**Specific Action(s)**	**Potential Implementing Entity(s)**	**Total Estimated Cost ($)**	**Total Cost Secured**	**Funds Needed**
						Control road/stream interactions by reducing erosion potential	Counties, WDFW, YN, USFS, landowners	500,000-700,000	$0	500,000-700,000
	x	x	x	x	Public Awareness	Public Awareness regarding restoration projects and importance of wood in streams and riparian areas	UCD, MCRFEG, WDFW, YN, USFWS,	30,000 to 40,000	$0	30,000 to 40,000
Harvest	x	x	x	x	Harvest Management	Manage harvest for low impact fisheries and rapid population growth	PFMC, U.S. v. Oregon Parties	TBD	**$0**	**$0**
	x	x	x	x	Harvest Management	Adjust tributary harvest regulations in areas where harvest significantly impacts salmon and steelhead population growth	WDFW, YN, Co-managers	$50,000	**$0**	$0
Hatcheries	x	x	x	x	Reintroduction - hatchery production	Rehabilitate White Salmon Ponds and update intake screen	Co-managers USFWS	$450,000	**$0**	**$450,000**
Hydrosystem and Mainstem Predation	x	x	x	x	Maintain or improve hydropower operations and facilities at Bonneville Dam to enhance salmon and steelhead survival	Decrease water travel time during smolt outmigration	BPA, ACOE	Costs addressed in Middle-Columbia River roll-up plan		

Recovery Strategies as Prioritized in Recovery Plan	Applicable Species				Action Type	Specific Action(s)	Potential Implementing Entity(s)	Total Estimated Cost ($)	Total Cost Secured	Funds Needed
Hydrosystem and Mainstem Predation	x	x	x	x	Maintain or improve hydropower operations and facilities at Bonneville Dam to enhance salmon and steelhead survival	Improve operation of adult passage, maintain high standards of adult fish passage at Bonneville Dam	BPA, ACOE	Costs addressed in Middle-Columbia River roll-up plan		
Hydrosystem and Mainstem Predation	x	x	x	x	Reduce predation on salmonids	Reduce predation by pinnipeds, piscivores, cornorants, and Caspian terns	BPA, ACOE	Costs addressed in Middle-Columbia River roll-up plan		
Jewett Creek										
RM&E		x	x		Baseline data collection	Determine spatial distribution of salmonids in Jewett Creek.	MCFEG, YN, WDFW	$1,000		
RM&E		x	x		Baseline data collection	Complete gathering information on existing salmonid stocks: determine the status, life histories and genetic composition of fish in Jewett Creek	MCFEG, YN, WDFW,	$2,000		
RM&E		x	x		Baseline data collection	Assess fish passage and habitat conditions in lower Jewett Creek	MCFEG, YN, WDFW, landowners,	$5,000		

Recovery Strategies as Prioritized in Recovery Plan	Applicable Species				Action Type	Specific Action(s)	Potential Implementing Entity(s)	Total Estimated Cost ($)	Total Cost Secured	Funds Needed
Habitat		x	x			Restore riparian areas based on habitat assessment	MCFEG, YN, WDFW, landowners,	$75,000		
								$16,781,000	$1,873,000	$13,993,000