Klickitat Subbasin Supplement

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Introduction

The Yakama Nation is charged with producing a supplement to the Draft Klickitat Subbasin Plan which includes five tasks. Those tasks are 1) to explain the key limiting factors limiting biological potential; 2) to prioritize, if possible, which limiting factors should be addressed first; 3) to identify objectives and strategies that address the limiting factors; 4) provide a prioritization of strategies, or a description of a prioritization framework, for proposed actions in a future project selection process; 5) and to discuss artificial production (supplemention), including its relationship to natural production and habitat strategies. All five tasks are addressed in this supplement.

In addition, wildlife limiting factors and strategies have been included. There are substantial opportunities within the Klickitat Subbasin for projects to produce significant fish and wildlife benefits concurrently. Numerous examples exist of wildlife projects, such as floodplain acquisition and management by the Yakama Nation within the Yakima Subbasin, where long term benefits to fish are unmistakable. In the Klickitat Subbasin, stream restoration projects (Klickitat Meadows) by the Yakama Nation Fisheries Program will result in better habitat for wildlife species such as American beavers and western toads.

This supplement not only addresses these five tasks, identifying wildlife strategies and objectives as well, but also attempts to produce a document which outlines, highlights, and prioritizes the major known information, significant uncertainties, and types of future actions believed to be reasonable contributions to the improvement of fisheries and wildlife conditions within the Klickitat Subbasin.

This supplement presents a practical, short understanding of what biologists and stakeholders concerned with the Klickitat Subbasin believe progresses the health of fish and wildlife, the underlying in-basin processes that determine health, and the research needed to improve our understanding. However, these twenty pages cannot supplant the information, detail, and discussion of the complete subbasin plan draft.

The Draft Klickitat Subbasin Plan was created in a short time with limited funding. Subsequently, personnel and other resources were often inadequately available. However, there is a fairly high level of confidence in the material produced given the circumstances under which participants labored. The supplement presented intends to emphasize those aspects of our current understanding of the Klickitat Subbasin that will advance fish and wildlife conditions in-basin. It acknowledges that this is a living document, our understanding will change, and there must be room and future processes for our actions to evolve.

Organization of Document and Approach to Presenting Content

The document is organized such that Habitat and Artificial Production are presented separately. Although these two subject areas are fully integrated in conception-- where applicable and practical-- in order to present strategies and actions in a reasonable manner this division proves useful. Extensive information is available within

the Klickitat Subbasin Plan Draft that detail the habitat considerations(by 133 reaches in the assessment) and artificial production factors (in Appendix F).

Strategies are identified and prioritized geographically for fish in Figure 5, page 10. For wildlife, strategies are presented in Figure 7, page 21. For fish, actions identified are associated with geographical areas, limiting factors, and a priority. When creating the prioritization several approaches were considered but the one taken envisions suites of actions taking place to address limiting factors. A prioritization process which would rank actions(limiting factors and geographical areas) numerically in order of importance would not acknowledge a watershed process oriented approach that recognizes how specific habitat information was put in a larger watershed process context.

For wildlife, limiting factors and strategies are presented in a listed order of general priority within focal habitats. However, all strategies are considered of high importance because many strategies could not be deemed more or less important or implementable than one another. Each strategy is also associated with geographical areas, objectives and limiting factors.

Artificial production information is presented as overall goals, objectives and strategies. Extensive detail is available within the subbasin plan that discusses risks, rationales, and methods. The detail is too voluminous to include in this supplement, but readily available in Appendix F.

Habitat

Ecosystem Diagnosis and Treatment(EDT) Modeling in the Klickitat

The Ecosystem and Diagnosis Treatment (EDT) model is a fundamental tool for planning in the Klickitat Subbasin. Within the subbasin planning process it was used in two manners, as an organizational tool and a hypothesis generating tool (See Figure 1). There is a third role within the Yakima-Klickitat Fisheries Program that is being developed, as a predictive tool, that needs more confidence, calibration, and verification for realization.

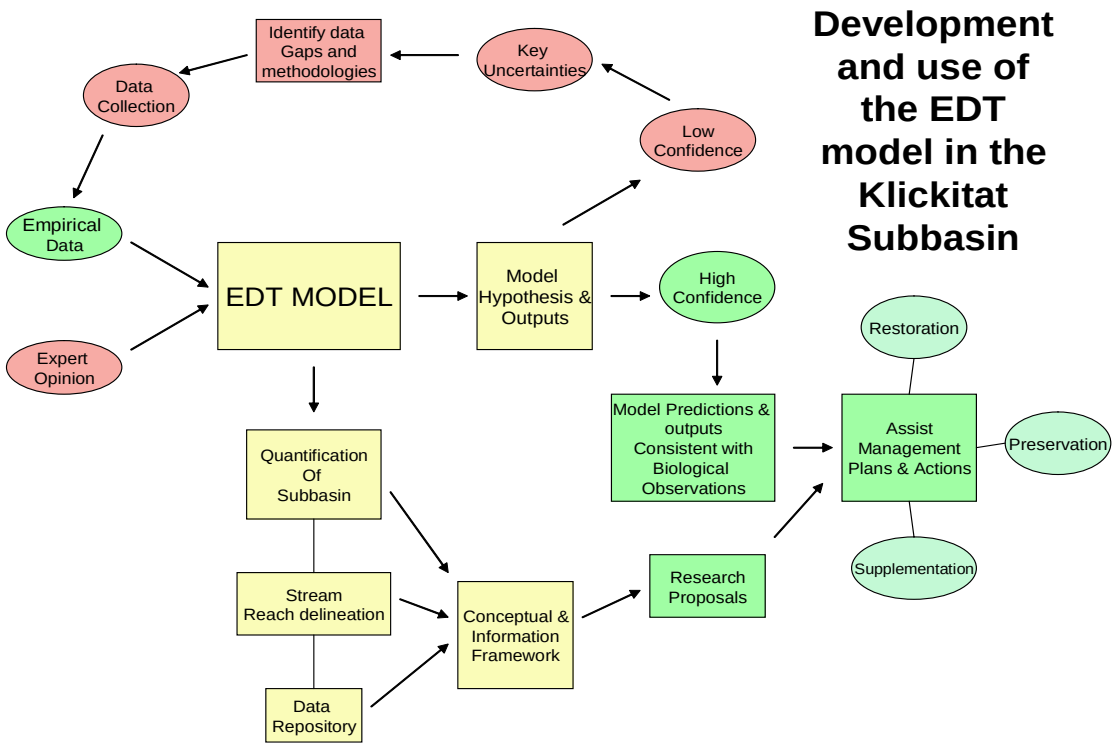
Currently, EDT acts as one repository for habitat data which contributes to the guidance of monitoring and assessment. It also generates hypotheses about the effects of habitat change in specific reaches within the watershed which affect abundance and productivity, identifying preservation and restoration potential.

Within the EDT framework, one set of empirical data with expert opinion which characterizes current conditions within the subbasin is compared with another set characterizing historical conditions. For the purposes of subbasin planning, public meetings were held wherein data and expert opinion building the rankings of the EDT model were discussed and agreed upon. The results of the utilizing EDT in this manner are not just the outputs the model provides or the analysis available by looking within the model itself at the effects of habitat changes, but also the generation of an agreed upon view of current and historical conditions within the watershed. It was this commonly derived perspective on current and historical conditions that fundamentally contributed to the identification of limiting factors within the subbasin as well as strategies to address the limiting factors. However, data available for specific geographical areas and

experienced expert opinion in those areas most heavily influenced the identification of limiting factors and strategies.

Because of the local timing of products from the Washington State Watershed Planning Process and Washington State Salmon Recovery Planning Process, new materials were considered in the production of this supplement that were not available for the initial Draft Klickitat Subbasin Plan. They served to help identify limiting factors and strategies for recovery.

Figure 1. Development and Use of EDT in the Klickitat Subbasin



EDT Model Results Regarding Steelhead Abundance and Productivity

The EDT model shows a 30% decrease in the life history diversity index for the entire Steelhead population below Castile Falls. The overall rankings are based on a summation of individual population performance parameters which results in several reaches displaying the same overall ranking. Reaches that have the same restoration ranking are grouped together but are not displayed in any order of importance.

Figure 2. Reaches Below Castile Falls with High Potential For Steelhead Restoration According to EDT Model

Location	Rank	Productivity Increase	Abundance Increase
Swale Creek (Mile 4-7)	1	2%	2%
Klickitat River: Dead Canyon-Summit Cr	2	12%	4%
Swale Creek (Mouth to mile 4)	2	1%	3%
Klickitat River: Beeks Canyon to Dead Canyon	3	6%	4%
Klickitat: Little Klickitat River to Beeks Canyon	4	5%	3%
Klickitat River: Snyder Creek to Swale Creek	4	3%	2%
Swale Creek (Mile 7-10.5)	4	1%	2%
Klickitat River: Summit Creek to White Creek	4	4%	2%
White Creek: Brush Creek to 1st Meadow(4.7 miles)	5	1%	2%
Klickitat River: Dillacort Canyon to Logging Camp	6	3%	2%
Klickitat River: Wheeler Canyon to Snyder Canyon	7	3%	2%

Figure 3. Reaches Above Castile Falls with High Potential For Steelhead According to EDT Model

Location	Rank	Productivity Increase	Abundance Increase
Klickitat River: Klickitat Meadows to Huckleberry Creek	1	9%	9%
Klickitat River: McCreedy Creek to Piscoe Creek	2	9%	13%
Klickitat River: Upper end of Castile Falls to Chaparrel Creek	3	6%	8%
Piscoe Creek (Mile 3.6 to 6.6)	3	2%	3%
Klickitat River: Chaparrel Creek to McCreedy Cr.	4	5%	8%
Klickitat River: Piscoe Creek to Diamond Fork	5	3%	4%
Diamond Fork: Mouth to Mile 1.58	6	1%	2%
Diamond: Butte Meadows downstream 2.2 miles	7	1%	3%
Klickitat River: Trout Creek to Big Muddy Creek	8	1%	2%
Klickitat River: Diamond Fork to Klickitat River Meadows	9	3%	3%

Research, Monitoring, and Evaluation

Research, Monitoring and Evaluation activities within the Klickitat Subbasin have invaluably directed, informed, and improved habitat projects as well as supplementation efforts. It is critical that current activities not only continue but expand to address vital characteristics of species life history patterns, abundance, productivity, spatial structure, and diversity.

Primary uncertainties immediately identified for study in the subbasin are: the presence of pathogens in juvenile and adult fish, assessments of the relative contributions of various sources of fine sediment, the significance and nature of predation on fish populations (avian and piscivorous), the frequency and difficulty of passage at Lyle Falls, the effectiveness and utilization of the Castile Falls tunnels.

Fish related priorities are identified as High, Medium, or Low in Figure 4. The prioritization considers not only biological value, but issues related to feasibility (access, cost, benefit). In some cases, a Low ranking does not mean it has a Low biological value but that practicable issues make it lower priority. An elk symbol has been placed next to fish strategies that that have wildlife benefits: P .

Figure 4. Fish Habitat Priorities for Research, Monitoring, and Evaluations

Strategy	Location	Key Limiting Factor	Fish Priority
Inventory existing and potential beaver habitat; include reintroduction of beaver into restoration planning P	Entire Subbasin	Reduction of habitat; population reduction and fragmentation from past human actions	**Medium**
Study presence of pathogens in juveniles and adults during high temperatures	Mainstem Klickitat, West Fork Klickitat, Lower Little Klickitat River, Lower Canyon Creek	Tributary high temperatures have resulted in increased susceptibility of native salmonids to pathogens	**High**
	Trout Creek Watershed, White Creek Watershed		**Medium**
Explicitly include desired carcass numbers within escapement goals to benefit ecosystem processes in population/ harvest management decisions P	Entire Watershed	Carcasses of anadromous fish were critical components of inland food web greatly increasing aquatic, riparian, and upland ecosystem productivity	**Medium**
Study/characterize productivity in relation to water quality parameters P	Entire Watershed	Fluctuations in water quality parameters have reduced native aquatic vegetation and faunal(insect, vertebrate) communities and productivity	**Medium**

Assess significance of predation by native birds P	Lower Mainstem Klickitat	Loss of abundance of salmonids has resulted in greater proportional impact(observations around hatchery and during outmigration)	**Low**
Study specific habitat relationships for pacific lamprey	Mainstem Klickitat, Lower Little Klickitat River	Poor passage accommodations in Mainstem Columbia severed life history pathways, reduced abundance, productivity and spatial diversity; changes in habitat conditions reduced habitat suitability, productivity, abundance, spatial diversity	**Medium**
Assess Bull Trout distribution, species interaction, life history forms, and potential for artificial production	Upper Klickitat Subbasin, Klickitat River Mainstem	Bull Trout populations severely threatened. Core distribution of remaining Bull Trout known; extent of habitat usage and movement within subbasin incomplete. Need to complete genetic assemblage information. Brook Trout/Bull Trout interactions and overlap need study.	**High**
Investigate opportunities for Brook Trout eradication	Upper Klickitat Subbasin, Klickitat River Mainstem	See above.	**High**
Assess Coastal Cutthroat distribution, species interaction, and life history	Klickitat River Mainstem	The Klickitat River is the upper most extent of the proposed Coastal Cutthroat ESU. Population information is not known.	**Medium**
Study and assess sources, attribute relative contributions of sediment load	Upper Klickitat Subbasin	Increased percentages of fine sediment from background levels in spawning gravels and interstitial spaces; decrease in egg incubation survival,	**High**

		entombment of juveniles	
Conduct comprehensive study of fish passage at Little Klickitat Falls, utilization by steelhead	Little Klickitat Falls	Height of falls measures 12-16' depending on flow conditions; unconfirmed accounts of blasting at falls, possible subsequent rerouting of flow	**High**
Construct passage improvements to Lyle Falls Fishway No. 5 to maximize desired species' passage while preventing non-native predator passage	Lyle Falls	Lyle Falls historically acted as a barrier to aquatic predator species; ladder and presence of non-native predators create access and impact	**Medium**
Study effectiveness of actions, utilization by anadromous species, and maintenance needs of new baffles and weirs in Snyder Creek	Snyder Creek	2,400' flume, 2 culverts, dam in Snyder create depth/velocity barrier	**Medium**
Study and monitor groundwater withdrawals	Swale Creek	Loss of wetland structure; groundwater withdrawals lower base flows in some lower Swale, decreasing perennial area	**Medium**
Determine repeat spawner success of steelhead kelts; design program to mitigate for kelt loss	Mainstem Klickitat, Swale Creek, White Creek Watershed	Survival of steelhead kelts is unkown but suspected to be a severely jeopardized life history	**High**
Provide monitoring and evaluation of passage effectiveness with radio telemetery, video monitoring, and pit tag detection at Castile Fishway	Castile Falls	Falls Measure near end of ability for Spring Chinook to pass; blasting, fishway tunnels, and upper most headworks dam in 1960s under Mitchell Act decrease passage	**High**

Prioritized Habitat Strategies to Address Key Limiting Factors Identified Geographically

General Discussion

A number of conditions exist within the Klickitat Subbasin that limit fish populations. Significant changes from historical condition that have negatively affected fish populations include increases in fine sediment delivery, increases in hydroconfinement, loss of large woody debris, deteriorization of riparian area and function, as well as a net loss of salmon carcasses.

Strategies and actions that may be implemented within the subbasin are presented in Figure 5 and include the following: increasing floodplain roughness, reconnecting side channels, improving floodplain connectivity, relocating floodplain infrastructure and roads, improving road maintenance, rehabilitating and decommissioning roads, re-establishing and enhancing native vegetation, implementing actions for large woody debris recruitment as well as artificially placing large woody debris. Fish populations must be restored to abundance levels sufficient to provide adequate numbers of carcasses.

Figure 5. Geographically Prioritized Habitat Strategies for Fisheries

Strategy	Location	Limiting Factor	Fish Priority
Restore fish populations such that escapement is sufficient in numbers to provide adequate carcasses P	Entire Subbasin, excluding reaches directly below hatchery	Food availability decreased by lack of nutrient transport/carcasses	**High**
Fertilize streams with artificial carcasses P	Entire Subbasin, excluding reaches directly below hatchery	Food availability decreased by lack of nutrient transport/carcasses	**Medium**
Improve Grazing Management P		1) Increased sediment supply from tributaries contributing to channel instability; 2) decreased channel sinuosity in meadows; 3)tributary habitat availability decreased from pre-settlement time; 4) hydrologic routing modified, timing and discharge altered	**Medium**
Increase floodplain and channel roughness P	White Creek Water Shed, Mainstem Klickitat	1) Loss of riparian vegetation; 2) modification of streambank; 3) Increased sediment supply from tributaries contributing to channel instability; 4) decreased channel sinuosity in meadows; 5)tributary habitat availability decreased from pre-	**High**

		settlement time; 6) hydrologic routing modified, timing and discharge altered	
	Remaining Areas in Subbasin	See one or more above	**Medium**
Improve floodplain connectivity P	White Creek Watershed, Mainstem Klickitat	See one or more above	**High**
	Remaining Areas in Subbasin	See one or more above	**Medium**
Reconnect side channel P	Diamond Fork, Upper Mainstem Klickitat River	See one or more above	**High**
Relocate floodplain infrastructure, roads; improve maintenance, rehabilitate, decommission as appropriate P	Entire Subbasin	See one or more above	**High**
Implement road management actions that reduce sediment inputs	Tributary Watersheds	See one or more above	**High**
Re-establish and or/enhance native vegetation within floodplain P	White Creek Watershed, Mainstem Klickitat, Swale Creek, Lower Little Klickitat River	See one or more above	**High**
	Remaining Areas in Subbasin		**Medium**
Implement practices which leave sources of Large Woody Debris to naturally enter and remain in system P	Upper and Middle Klickitat Subbasin, Upper Little Klickitat River Watershed	Lack of LWD recruitment due to riparian harvest, stream cleaning, and change in upstream riparian zone	**High**
	Remaining Areas in Subbasin		**Low**
Artificially introduce Large Woody Debris P	White Creek Watershed, Trout Creek Watershed, Upper and Middle Mainstem Klickitat, Lower	See above	**High**

	Little Klickitat River		
	Remaining areas in subbasin		**Low** (need more study)
Encourage beaver colonization P	Entire Subbasin	Reduction of habitat; population reduction and fragmentation from past human actions	**Medium**
Implement road management actions that reduce sediment inputs	Entire Subbasin	Increased percentages of fine sediment from background levels in spawning gravels and interstitial spaces; decrease in egg incubation survival, entombment of juveniles	**High**
Implement upland management practices that mimic natural runoff and sediment production	Entire Subbasin	Increased percentages of fine sediment from background levels in spawning gravels and interstitial spaces; decrease in egg incubation survival, entombment of juveniles	**High**
Implement habitat restoration actions for pacific lamprey	Mainstem Klickitat River, Lower Little Klickitat River	Poor passage accommodations in Mainstem Columbia severed life history pathways, reduced abundance, productivity and spatial diversity; changes in habitat conditions reduced habitat suitability, productivity, abundance, spatial diversity	**Medium**
Implement program of Bull Trout artificial production	Upper Klickitat Subbasin, Klickitat River Mainstem	Bull Trout populations severely threatened. Core distribution of remaining Bull Trout known; extent of habitat usage and movement within subbasin incomplete. Need to complete genetic assemblage information. Brook Trout/Bull Trout interactions and overlap need study.	**Medium** (need study first)
Implement program of Brook Trout eradication	Upper Klickitat Subbasin, Klickitat River Mainstem	Bull Trout populations severely threatened. Core distribution of remaining Bull Trout known; extent of habitat usage and movement within subbasin incomplete. Need to complete genetic assemblage information. Brook Trout/Bull Trout interactions and overlap need study.	**Medium** (need study first)
Make necessary modifications at Little Klickitat Falls for passage	Little Klickitat Falls	Height of falls measures 12-16' depending on flow conditions; unconfirmed accounts of blasting at falls, possible subsequent rerouting of flow	**Medium** (need study first)
Improve passage percentage at Lyle Fish Ladder	Lyle Falls on Mainstem Klickitat	Observed difficulties and mortality in fish ladder	**High**
Improve passage opportunities at Dead Canyon	Dead Canyon	Access to Dead Canyon limited due to change in plan form due to undersized road crossing and road bed construction	**High**

Remove road fill from alluvial floodplain in Dead Canyon	Dead Canyon	See above	**High**
Restore historical hydrologic regime and increase extent and distribution of perennial habitat P	Swale Creek	Historic data suggests loss of wetland structure in Upper Swale	**High**
Increase abundance of salmonid populations to reduce proportion of predation due to native species	Entire Subbasin	Loss of abundance of native salmonids has resulted in greater proportional impact from native predation	**High**
Reduce habitat suitability for predatory non-native fish	Lower Klickitat River	Increased temperatures in lower river increase habitat for non-native predators while also triggering increase in feeding levels	**Medium**
Increase kelt survival and repeat spawner success	Entire Subbasin	Survival of steelhead kelts migrating to Pacific Ocean through Columbia hydro system is at or near zero	**Medium** (need study first)
Reduce distribution of coho within subbasin	Lower and Middle Klickitat Subbasin	Hatchery fish compete with natural origin fish for space and food resources	**High**
Increase run sizes, implement hatchery and harvest practices that do not decrease fitness, run size, timing	Lower and Middle Mainstem Klickitat River	Historic hatchery and harvest practices altered run timing, size and genetic fitness	**High**
Improve flow, cover, available habitat, and habitat diversity to reduce potential for predation by native birds P	Lower and Middle Mainstem Klickitat River	Loss of abundance of native salmonids has resulted in a greater proportional impact from predation	**Medium**
Operate and maintain Castile Fishway	Castile Falls	Falls Measure near end of ability for Spring Chinook to pass; blasting, fishway tunnels, and upper most headworks dam in 1960s under Mitchell Act decrease passage	**High**

Artificial Production and Supplementation

Artificial production and supplementation efforts in the Klickitat Subbasin focus on coho, fall Chinook, spring Chinook, and steelhead. The overall goals of the programs, objectives and strategies are outlined below by species. The programs were developed in consideration of general habitat goals for natural production and within a multi-species framework. Extensive discussion of this approach is available in Appendix F of the subbasin plan. The outline of the programs provided herein capture the major actions and strategies.

Spring Chinook

Overall Goal. While improving the fitness of the target stock, increase the number of returning spring chinook adults that result from both artificial and natural production (Ferguson and Sharp 2002), which will serve to increase harvest. Consistent with the regional goal of doubling salmon returns (NPPC 1994), the goal is to at least double the annual river mouth return, harvest, and escapement from current levels.

Objective 1. Increase spring chinook returns, harvest, and natural escapement as follows:

Strategy 1a. Beginning in approximately 2006, increase the production goal for spring chinook at Klickitat Hatchery from 600,000 to 800,000 smolts, using capacity made available by reductions in hatchery coho production.

Strategy 1b. By 2006, begin releases of acclimated spring chinook smolts as follows:

- 200,000 from acclimation sites in the upper Klickitat basin
- 600,000 from the on-station acclimation pond at Klickitat Hatchery

Objective 2. Implement methods to improve the fitness of the spring chinook population.

Strategy 2a. Transition from hatchery-origin broodstock to natural-origin broodstock, so that by 2010, the vast majority (approaching 100%) of releases would be the progeny of at least one natural-origin parent.

Strategy 2b. Implement strategies and protocols for broodstock collection, spawning, rearing, and release that are consistent with the strategies and protocols developed under the YKFP for spring chinook in the Yakima River basin.

Objective 3. Monitor and evaluate survival, life history, and habitat use. Appendix G of the Master Plan summarizes data to be collected on these topics and the methods to be used.

Strategy 3a. Use existing rotary traps and manual PIT tag detection (hand-held portable scanners) to document juvenile emergence timing, out-migration timing, and age composition; and to estimate overall basin productivity (by treatment group).

Strategy 3b. Use coded wire tags and PIT tags to assess differences in survival (smolt-smolt and smolt-adult) among sizes of fish released and acclimation/release locations.

Strategy 3c. Continue to conduct spawner surveys throughout the Klickitat basin.

Strategy 3d. Use radio telemetry, mark-recapture, and/or run reconstruction to determine passage and entrainment rates at Lyle and Castile Falls and to track natural spawners to their spawning grounds.

Strategy 3e. Implement automated data tracking systems in use at Cle Elum and Prosser hatcheries.

Objective 4. Monitor and evaluate ecological interactions.

Strategy 4a. Use findings from Yakima and upper Columbia Basin studies in conjunction with information from risk assessments to target ecological interactions studies in the Klickitat basin.

Objective 5. Monitor and evaluate the genetic changes in the spring chinook population, both hatchery and naturally produced.

Strategy 5a. Collect DNA samples and morphometric data from fish passing through the Lyle Falls and Castile Falls traps. Use findings from Yakima and other Columbia Basin studies in conjunction with information from these samples to target genetic studies in the Klickitat basin. Convene meetings of tribal and state geneticists as necessary to further develop sampling rates, protocols, and evaluation measures.

Objective 6. Monitor in-basin and Columbia River harvest of Klickitat-origin spring chinook.

Strategy 6a. Increase tribal and sport fishery monitoring and bio-sampling rates as necessary to maintain a minimum 20% sampling rate.

Strategy 6b. Update and maintain all Klickitat-related databases with historical and current harvest data.

Strategy 6c. Use run reconstruction methods developed for Yakima Basin spring chinook to reconstruct Klickitat run and harvest to the Columbia River mouth.

Strategy 6d. Use the regional mark information system (RMIS) to monitor CWT recoveries of Klickitat spring chinook in marine and freshwater fisheries coast-wide.

Steelhead

Overall Goal: Enhance natural populations of steelhead throughout the subbasin utilizing supplementation and kelt reconditioning.

Objective S1. Rebuild natural populations of steelhead in the Klickitat subbasin.

Strategy 1a. Use supplementation to enhance the summer-run steelhead stock.

Strategy 1b. Beginning in 2006, release summer steelhead from new acclimation sites above Castile Falls.

Strategy 1c. Beginning in approximately 2006, eliminate scatter-plant releases of 120,000 Skamania stock steelhead smolts in the Klickitat subbasin. To minimize fishery impacts (*sport*) , termination of the Skamania release may be phased gradually over one or more years to ensure that local stock production can fully replace these out-of-basin smolts.

Strategy 1d. Collect data to test the feasibility of using supplementation to enhance the winter-run steelhead population in the Klickitat basin.

Strategy 1e. Investigate and develop potential for kelt reconditioning program for live spawned brood fish and collection of wild fish from tributaries and mainstem.

Objective 2. Monitor and evaluate ecological interactions.

Strategy 2a. Use findings from Yakima and upper Columbia Basin studies in conjunction with information from risk assessments to target ecological interactions studies in the Klickitat basin.

Coho

Overall Goal: Focus the Klickitat coho program on harvest augmentation, with a combined annual average harvest (ocean, Columbia River, and Klickitat basin) of approximately 14,000 coho, while releasing in-basin production capacity for priority species (spring chinook and steelhead).

Objective 1. Reduce efforts to establish a natural run of coho in the Klickitat subbasin.

Strategy 1a. Beginning in approximately 2006, eliminate production of approximately one million coho at Klickitat Hatchery, and phase out direct stream releases of coho in the Klickitat subbasin if harvest goals can be met with acclimated smolts.

Strategy 1b. Install an adult trap at the outfall of the Wahkiacus acclimation site.

Objective 2. Maximize survival of coho releases to ensure continuation of substantial returns of coho to Columbia and Klickitat river fisheries.

Strategy 2a. Develop a new acclimation site (Wahkiacus) for coho in the lower Klickitat subbasin.

Strategy 2b. Beginning in 2006, release one million coho smolts (transferred from facilities in the Lower Columbia Basin) from acclimation site(s) in the lower Klickitat subbasin.

Objective 3. Maintain a combined average annual harvest (ocean, Columbia River, and Klickitat basin) of approximately 14,000 coho.

Strategy 3a. Continue direct stream releases of coho pre-smolts until studies show that acclimated smolt releases can meet harvest goals.

Strategy 3b. If the 1 million acclimated smolt releases meet harvest goals, investigate alternative locations in the Columbia Basin above Bonneville Dam for release of the 2.5 million *U.S. v. Oregon* coho currently programmed for the Klickitat subbasin that are scatter planted directly into the river.

Objective 4. Monitor and evaluate factors that will help to determine whether goals and objectives are being achieved.

Strategy 4a. Monitor and evaluate survival of acclimated and direct-stream-released coho.

Strategy 4b. Monitor and evaluate harvest numbers of acclimated and direct-stream-released coho.

Strategy 4c. Conduct spawning surveys in the Klickitat basin to determine location and amount of natural coho spawning.

Strategy C4d. Use findings from Yakima and upper Columbia Basin studies in conjunction with information from risk assessments to target ecological interactions studies in the Klickitat basin.

Strategy C4e. Use the regional mark information system (RMIS) to monitor CWT recoveries of Klickitat coho releases in marine and freshwater fisheries coast-wide.

Fall Chinook

Overall Goal: Maintain the Klickitat fall chinook program for harvest augmentation, with a combined annual average harvest (ocean, Columbia River, and Klickitat basin) of 14,000 fish.

Objective 1. Leave current production numbers unchanged at 4 million.

Strategy 1a. Maintain production of 4 million URB (Priest Rapids Hatchery) fall chinook in the Klickitat subbasin. Shift half the production from Klickitat Hatchery to Wahkiacus Hatchery & Acclimation Facility (WHAF).

Objective 2. Distribute fall chinook spawning throughout the lower Klickitat subbasin.

Strategy 2a. By 2007, release half the current 4 million fall chinook production from the WHAF in the lower Klickitat subbasin.

Objective 3. Monitor and evaluate factors that will help to determine whether goals and objectives are being achieved.

Strategy 3a. Monitor and evaluate survival.

Strategy 3b. Monitor and evaluate harvest numbers.

Strategy F3c. Conduct spawning surveys in the Klickitat subbasin to determine location and amount of natural spawning.

Strategy F3d. Use the regional mark information system (RMIS) to monitor CWT recoveries of Klickitat fall chinook releases in marine and freshwater fisheries coast-wide.

Wildlife

Limiting Factors

Because of the large number of wildlife species and habitats in the subbasin, the subbasin wildlife assessment focuses on four focal habitats and their representative focal species. The purpose of the assessment was to discuss each habitat broadly, and from this discussion emphasize the key ecological attributes of each habitat identifying the biggest problems occurring today that keep wildlife populations from reaching their full potential in the subbasin. These are the limiting factors for both the habitat and its representative focal species. Only the limiting factors for habitats will be discussed in this supplement, as most of the limiting factors for species are truly related to habitat issues.

For each habitat, one or more limiting factor was identified. These are not the only limitations in the subbasin, but are the factors most limiting populations, and have the highest need of immediate funding to address restoration and protection. The most common limiting factors identified across habitats were, in order of priority: habitat fragmentation, conversion and loss, altered fire regimes, inappropriate grazing, inappropriate silviculture practices and presence of invasive, non-native weeds. These issues are believed to have had the most detrimental effect on habitats and wildlife throughout the subbasin.

Within the originally proposed management plan, the limiting factors were initially placed in order of priority for action and funding. This was done during the first creation of the management plan and can be found also in the revised Klickitat Subbasin Plan (provided on a concurrently submitted CD). Although all limiting factors identified are considered to be of high importance, prioritization will make it clear where strategies will need to be emphasized. A summary of limiting factor prioritization is provided in table X1.

All of the limiting factors have had significant effects on many wildlife species' populations, and some have had additional significant impacts on fish populations as well, particularly: habitat fragmentation, conversion and loss, inappropriate grazing, inappropriate silviculture practices, and presence of invasive, non-native weeds. Additionally, inappropriately placed roads and other stream alterations, loss of beavers, stream incision and disconnection from floodplain, off-road vehicles and pesticide/herbicide use were other limiting factors identified that also negatively impact fish as well as wildlife. Factors that limit both fish and wildlife populations are denoted with a ♀ symbol.

Figure 6. Limiting Factors Prioritized by Wildlife Focal Habitats

	FOCAL HABITAT			
	Montane Coniferous Wetlands	**Ponderosa Pine / Oregon White Oak**	**Shrub Steppe / Interior Grasslands**	**Interior Riparian Wetlands**
LIMITING FACTORS	Altered Fire Regime Q	Inappropriate Silviculture Practices	Habitat Fragmentation and Loss	Presence of Invasive, Non-Native Vegetation Q
	Habitat Fragmentation and Incised Streams Q			Inappropriate Placement / Damaged Roads, Levees and Other Alterations Q
	Loss of Beavers Q	Altered Fire Regime	Presence of Invasive, Non-Native Vegetation	
	Presence of Invasive, Non-Native Vegetation			Inappropriate Silvicultural Practices Q
	Inappropriate Grazing Q	Habitat Fragmentation and Loss	Inappropriate Grazing	Habitat Fragmentation and LossQ
	Inappropriate Road Placement, Excessive Vehicle Use Q			
	Off-Road Vehicles Q	Inappropriate Grazing	Off-Road Vehicles	Inappropriate Grazing Q
	Inappropriate Silviculture Practices Q			

Montane Coniferous Wetlands

The historical extent of this focal habitat within the Klickitat Subbasin is unknown. The quality of habitat has been significantly diminished. Even the wetlands that remain in high quality have become greatly fragmented. Wet meadows have decreased in size due an altered fire regime (resulting in conifer encroachment), roads and livestock grazing. These factors have dewatered and converted wet meadows into dry openings. The effects of roads and road drainage, grazing, off-road vehicles and other disturbances have undoubtedly degraded and fragmented large areas. Excessive timber activities and a loss of beavers in montane streams have reduced water quality and stream complexity. Montane Coniferous Wetlands support a large number of unique, wetland-dependant plant and animal species and are important to the Native American community, as well as to the surrounding ecosystem.

Ponderosa Pine/Oregon White Oak

The Ponderosa Pine/Oregon White Oak focal habitat has experienced significant fragmentation and degradation in the Klickitat Subbasin. The biggest causes are excessive logging practices and fire suppression. Inappropriate logging has removed the majority of late-seral, large diameter trees and snags. The loss of Old Growth ponderosa pine forests has been dramatic. Fire suppression has additionally altered the natural fire

regime, leading to denser forest stands composed of smaller diameter trees. This natural disturbance would normally keep tree recruitment low, selecting for larger trees and wider spacing. Oak woodlands have also been reduced in quantity and quality by land conversion and an altered fire regime. Grazing has further altered the understory vegetation and introduced non-native weeds. Many animal species depend on the unique qualities of late-seral ponderosa pine and oak communities for breeding and foraging.

Shrub Steppe/ Interior Grasslands

It has been estimated that only 40 percent remains of the roughly 10.4 million acres of shrub steppe that once existed in Washington State prior to the 1850s. In the Klickitat Subbasin, much of what remains of intact shrub steppe and grassland is degraded. The most significant cause of loss of this habitat is the conversion to agriculture. Other significant problems are non-native weeds that compete with natives, and large-scale wildfires. An altered fire regime has converted many areas of shrub steppe into weedy grassland. Off-road vehicles have also contributed to degradation and increasing susceptibility to non-native weeds.

Interior Riparian Wetlands

Since the early 1800s, 50-90% of Interior Riparian Wetlands habitat in Washington State has been lost or extensively modified. Land use practices-- such as, roads, dams, and agriculture-- have removed important riparian vegetation while also affecting the structural and functional diversity of riparian habitat. These practices increased susceptibility to invasion by non-native weeds. Inappropriate logging has further altered the vegetative structure and decreased water quality. Road and levee development, as well as other stream alterations, have resulted in the river's separation from its historical floodplain and overall fragmentation of the habitat.

Riparian areas support a high diversity of fish and wildlife. They also have values related to aesthetics, flood control, and water purification. Fish and wildlife utilize them as breeding habitat, movement corridors and seasonal ranges.

Strategies

After identifying limiting factors for each focal habitat and their representative species, wildlife subbasin planners compiled a list of objectives (goals) to address each limiting factor. Strategies were then created that would work to achieve success for each objective. The overall goal for both the objectives and strategies is to provide habitat that will allow the wildlife focal species to reach their full potential. This will also result in a significant increase in population trends for many other wildlife species, especially those listed under the Endangered Species Act, as well as the quantity and quality of the unfragmented habitats on which they depend. For the purpose of this supplement, as with limiting factors, only strategies addressing focal habitat limiting factors are shown here. For further simplification, many strategies were grouped or omitted to reduce redundancy and increase readability. For wildlife, this supplement is only meant to orient the reader to the problems in the subbasin, it is not meant to replace the full management plan in important funding decisions. For proposed projects, it is recommended to refer to the original management plan, in particular when considering focal species-specific projects.

The focal species addressed in the plan are: Yellow Warbler, American Beaver, Mule / Black-Tailed Deer, Grasshopper Sparrow, Western Gray Squirrel, Flammulated Owl, White-Headed Woodpecker, Greater Sandhill Crane, Oregon Spotted Frog.

Strategies appear within each habitat in order of relative priority. A category (high, medium, low) was not assigned to each strategy as each priority was considered of high importance and could only be ranked in order of each other. Again, the symbol Q was used to point to strategies considered to have direct benefits to fish.

Figure 7. Prioritized Wildlife Strategies by Focal Habitats

Interior Riparian Wetlands			
Strategies	**Associated Biological Objective (s)**	**Associated Limiting Factor (s)**	**Location**
Continue and enhance riparian weed control programs. Q	Restore riparian habitat quality by increasing native vegetation in degraded habitat.	Presence of Invasive, Non-Native Vegetation	Lower Klickitat Subbasin, White Creek Watershed, Upper Klickitat Subbasin
Inventory, relocate, remove, or repair roads that are causing loss of hydrological function. Q	Restore ecologically functional floodplain / wetland habitats.	Inappropriate and Damaged Roads, Levees and Other Alterations	Lower, Middle and Upper Klickitat Subbasin
Use lease, easement or purchase practices to protect functioning floodplain areas and streams. Q	Slow stream flow, restore water table, repair stream banks, restore riparian vegetation and reconnect floodplain.	Inappropriate and Damaged Roads, Levees and Other Alterations	
Reintroduce beavers, plant native vegetation and reintroduce large woody debris. Q			
Create / implement guidelines to retain and enhance riparian buffers to a functional status. Q	Protect remaining riparian areas from excessive logging.	Inappropriate Silviculture Practices	
Promote silviculture practices that retain large woody debris within riparian buffers. Q	Utilize silviculture to enhance degraded riparian areas.		
Place large woody debris. Q	Increase large woody debris in riparian areas.		

Utilize purchase easements, leases or agreements, for landowners to restore or protect riparian vegetation ♀	Restore and protect remaining riparian areas from conversion.	Habitat Loss and Fragmentation	Lower, Middle and Upper Klickitat Subbasin
Provide incentives through easements, leases or agreements, for landowners to manage livestock to provide for vegetation restoration. ♀	Restore native riparian tree and shrub habitats degraded by inappropriate grazing.	Inappropriate Grazing	Lower Klickitat Subbasin

Shrub Steppe / Interior Grasslands			
Strategies	**Associated Biological Objective (s)**	**Associated Limiting Factor (s)**	**Location**
Use lease, easement or purchase practices to protect high quality areas from land-use conversion.	Protect remaining deep-soil shrub steppe / grassland sites.	Habitat Fragmentation and Loss	Swale Creek Lower Klickitat Subbasin
Augment or support conservation oriented farm programs (e.g. CRP).	Restore attributes of shrub steppe and grasslands.	Habitat Fragmentation and Loss	Swale Creek Lower Klickitat Subbasin
Reduce sources of introduction of non-native seed.	Limit non-native plants and restore native plant communities.	Presence of Invasive, Non-Native Vegetation	Swale Creek
Continue and enhance shrub steppe / grassland weed control programs.			
Encourage and support coordinated resource management programs.	In areas of inappropriate grazing, improve grassland vegetation and microbiotic crusts.	Inappropriate Grazing	Swale Creek Lower Klickitat Subbasin
Encourage rotational grazing regimes.			
Use proper grazing to reduce sagebrush cover where excessive.			
Create inventory of historical and current locations of ephemeral wetlands.	Maintain and restore ephemeral wetlands.	Habitat Conversion	Data Gap
Remove access of off-road vehicles to sensitive areas and enforce closures.	Reduce off-road damage in high use areas.	Off-Road Vehicles	Data gap

Ponderosa Pine / Oregon White Oak			
Strategies	**Associated Biological Objective (s)**	**Associated Limiting Factor (s)**	**Locations**
Encourage silviculture practices that retain large diameter trees and reduce understory density.	Increase average dbh and decrease understory density.	Inappropriate Silviculture Practices	Data Gap
Create / implement guidelines to retain specified number of large diameter, decadent live trees.	Retain late seral stands and large decadent trees.		
Reduce fuel loads.	Decrease stand density of ponderosa pine. Decrease stem density of ponderosa pine.	Altered Fire Regime	Data Gap
Reintroduce low intensity, controlled, site-specific fires, or fire mimicking practices.			
Augment and support conservation oriented programs on small private land holdings.	Retain existing tracts of late seral forests and reduce future fragmentation.	Habitat Fragmentation, Conversion and Loss	Data Gap
Use lease, easement or purchase practices to conserve remaining intact pine / oak forests.			
Create site-specific grazing management plans for habitat improvement.	Reduce weed species presence, reestablish native communities.	Inappropriate Grazing	Data Gap

Montane Coniferous Wetlands			
Strategies	**Associated Biological Objective (s)**	**Associated Limiting Factor (s)**	**Locations**
Prescribing low intensity burns for vegetation stimulation and biomass reduction. Q	Remove encroaching conifers and brush from meadows.	Altered Fire Regime	White Creek and Tepee Watersheds Upper Klickitat Subbasin Glenwood Valley
Mechanical removal of invasive trees and shrubs. Q			
Reintroduce beavers. Q	Restore stream channel planform and roughness,	Stream Incision and	White Creek and Tepee

Plant native vegetation. Q	restore water table and riparian vegetation, repair stream banks and reconnect floodplain.	Disconnection from Floodplain	Creek Upper Klickitat Subbasin
Reintroduce large woody debris. Q			
Reintroduce beaver into areas that have suitable habitat. Q	Restore historical beaver populations.	Loss of Beavers	Upper Klickitat Subbasin Data Gap
Restore areas to prepare for beaver reintroduction. Q			
Provide incentives through easements, leases or agreements, for landowners to manage livestock for riparian vegetation restoration. Q	Restore native riparian tree and shrub habitats on the degraded river and tributary areas.	Presence of Invasive, Non-native Plant Species	Upper and Middle Klickitat Subbasin
Treat non-native species.			
Use fencing around sensitive meadows. Q	Reduce damage to vegetation and water quality from excessive grazing.	Inappropriate Grazing	White and Tepee Watersheds, Upper Klickitat Subbasin
Provide incentives through easements, leases or agreements, for landowners to manage livestock to provide for riparian vegetation restoration. Q			
As appropriate, relocate, remove, or repair roads that are causing loss of hydrological function. Q	Reduce damage to wetland hydrology from road presence.	Inappropriate Road Placement, Excessive Vehicle Use	
Remove access to sensitive meadows and enforce closures. Q	Reduce damage to wetland plants and soil from ORV traffic.	Off-Road Vehicles	Middle and Upper Klicktitat Subbasin
Apply current guidelines on maintaining adequate riparian and meadow buffers. Q	Reduce damage to wetland habitat from timber activities.	Inappropriate Silviculture Practices	CNWR Upper and Middle Klickitat Subbasin

Klickitat Subbasin Plan Revision

On August 12, 2004, comments from the Northwest Power Council were submitted to the subbasin planners. For the Klickitat Subbasin Plan Wildlife Sections, there were three main comments that planners felt could to be addressed and revised in the second draft:

1) Incorrect wording of limiting factors - limiting factors are stated as symptoms rather than causes.

2) Problems in logic path – limiting factors are not tied well, and are sometimes contradictory, to the assessment.

3) Lack of prioritization of objectives.

Several revisions were made to the Klickitat Subbasin Plan draft for wildlife. First, whenever possible, the limiting factors were reworded to make it clear the direct cause of the degradation, rather than stating the degradation itself. For example, we replaced the formerly stated "tree and shrub encroachment (symptom)" with "altered fire regime (cause)". This resulted in some minor revisions of the overall table. Some limiting factors were combined and reprioritized.

Second, we compared the management plan to the assessment and made better connections between them. At the end of each focal habitat and species write-up, there is a "limiting factors and other concerns" section that describes each limiting factor. At the very end there is a summary table that summarizes each limiting factor and associated key finding and working hypothesis.

Last, we addressed prioritizations of objectives and strategies. This was done, in part, in the first draft, but we did not make it clear how. In the first draft, we only prioritized limiting factors, objectives and strategies within a focal habitat or species. Overall prioritization was not done. For this supplement we provide instead, a list of the top five limiting factors, regardless of habitat or species. We then grouped strategies into nine categories, which are listed, not necessarily in order of prioritization, but in order of the number of strategies within that category. This is as close to a list of prioritization that we can come up with in the short time given for this project.