WENATCHEE

Subbasin Plan

Prepared for the Northwest Power & Conservation Council

Wenatchee Subbasin Plan

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1.1 Contributors

1.1.1 Lead Organizations

Chelan County and Yakama Nation

1.1.2 Coordinators

Lee Carlson and Bob Rose, Yakama Nation
Mike Kaputa and Jennifer Jerabeck, Chelan County

1.1.3 Planning and Technical Groups

Wenatchee Planning Unit
Wenatchee Technical Subcommittee
Upper Columbia Salmon Recovery Board

1.1.4 Technical Editor

Jean Johnson, Laura Berg Consulting

1.2 Subbasin Plan Approach and Public Involvement

Subbasin planning formally began after contracts between the subbasin co-planners and Northwest Power and Conservation Council (NPCC) were signed in October 2003. Under the Washington State Engrossed Substitute House Bill 2514 Watershed Planning Act, the Wenatchee Watershed Planning Unit (WPU) was formed to guide the development of state watershed planning. Many of the activities relevant to the WPU were highly consistent with NPCC subbasin planning. Co-planners chose to use the WPU and the associated subcommittees (water quality, water quantity, instream flow and habitat) as the primary body for public involvement and development of the subbasin plan. The WPU consists of a wide representation of citizen organizations and government agencies. The subcommittees include representatives from many agencies and stakeholders and are primarily responsible for development of the technical information for WPU consideration. The WPU is currently in its third year of formal recognition by the state of Washington and associated parties. All meetings associated with watershed and subbasin planning were advertised and open to the public.

During the early progress of the aquatic assessment, numerous meetings focused upon the development and utilization of the Qualitative Habitat Assessment (QHA) approach, specific to aquatic interests.

Information used for this assessment was derived from existing documents provided by Chelan County, state, federal and tribal government representatives. The primary purpose of the subcommittee work was to develop a concise and meaningful organization of existing technical information so that the information is accurately reflected in the subbasin plan, could be systematically evaluated, and easily understood by the lay audience.

The format used for the Inventory component of the subbasin plan was provided via internet to all publics that have likely sponsored and implemented on-the-ground projects. To date, little response by agency and the general public has been forthcoming. It is not clear if this is an indication of the extent of recent project implementation or a reflection of high work loads by these publics and agencies.

The draft management plan was developed in a manner similar to the assessment. Co-planners sponsored subbasin planning meetings in concert with regularly scheduled monthly meetings associated with state watershed planning. Occasional and additional subbasin planning meetings were held intermittently from February through April. The technical subcommittee was able to identify key areas from the assessment where habitat conditions have been altered to the greatest extent and where fish distribution has probably been most affected. From these findings, management strategies, management objectives and near-term opportunities were developed and organized by key habitat attributes. Much of the direction for both the assessment and management plan was provided during the regularly scheduled meeting times. Work completed outside of the meeting forum was presented to the technical subcommittee and modified by co-planner representatives as needed.

Washington Department of Fish and Wildlife (WDFW) were the primary sponsors in the development of the terrestrial assessment and management plan. Most of this work was accomplished at the regional level which contributed to a consistent document style and approach throughout the Columbia Cascade Province. The draft assessment and management plan were edited by WDFW staff at the local level and made available to the public through the

NPCC website in mid-April. Because of the fundamental differences in assessment techniques between fish and wildlife resources, the draft aquatic and terrestrial management plans are offered in this document separately.

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2 Executive Summary

2.1 Purpose and Scope

National Oceanographic and Atmospheric Administration Fisheries (NOAA Fisheries, formerly the National Marine Fisheries Service (NMFS)) released a biological opinion (BiOp) on the operation of the Federal Columbia River Power System (FCRPS) in 2000. This system is operated by the Bureau of Reclamation (BOR), the Bonneville Power Administration (BPA), and the Army Corps of Engineers (ACOE). The FCRPS operation has impacts on six fish species listed in 1999 under the Endangered Species Act (ESA). The FCRPS BiOp proposed a set of Reasonable and Prudent Alternatives (RPA) for the operation and configuration of hydropower facilities on the Columbia River to mitigate impacts to the survival of threatened and endangered juvenile and adult salmonids in the Columbia River basin. As part of the 2000 FCRPS BiOp, NOAA Fisheries advised the aforementioned federal agencies that, in addition to hydropower facility modifications, offsite mitigation for habitat, hatcheries, and harvest would be required to avoid jeopardy. It also established performance standards and schedules to monitor the success of mitigation measures.

In order to help meet offsite ESA obligations under the 2000 FCRPS BiOp, the Northwest Power and Conservation Council's (NPCC) Fish and Wildlife Program collaborated with other federal caucus members to develop the subbasin planning process. Subbasin plans identify and prioritize actions needed to recover listed salmonids in tributary habitats within the Columbia River basin and guide the expenditure of BPA revenues on these offsite mitigation projects. The Qualitative Habitat Assessment (QHA) methodology was utilized in the development of subbasin plans in order to compare the ecological effects of proposed actions and determine what benefit is likely from each restoration alternative.

The three main parts of a subbasin plan are:

The Assessment - A subbasin assessment is a technical analysis to determine the biological potential of each subbasin and the opportunities for restoration. It describes the existing and historic environmental resources, conditions, and characteristics within the subbasin.

The Inventory - The inventory includes information on fish and wildlife protection, restoration, and artificial production activities and management plans within the subbasin.

The Management Plan - The management plan is the heart of the subbasin plan. It includes a vision for the subbasin, biological objectives, and strategies. The management plan addresses a 10-15 year planning horizon.

2.2 Wenatchee Subbasin Vision

The vision of the Wenatchee subbasin plan is to voluntarily bring people together in a collaborative setting to improve communication, reduce conflicts, address problems, reach consensus and implement actions to improve coordinated natural resource management on private and public lands in the Wenatchee subbasin. The strategy is to complete a science-based watershed management plan using watershed specific information ultimately leading towards compliance with the federal ESA and Clean Water Act (CWA). End products will reflect a balance between existing natural resources and human uses, and will capitalize on opportunities to improve these values.

Specific goals to advance this vision under the Watershed Planning Act (WPA) are as follows:

- Optimize quantity and quality of water to achieve a balance between natural resources and human use, both current and projected
- Provide for coexistence of people, fish and wildlife while sustaining lifestyles through planned community growth, and maintaining and/or improving habitats
- Prevent avoidable human-caused mortality of state and federal threatened, endangered and candidate species
- Develop and implement an adaptive action plan to address priority issues, emphasizing local customs, and culture and economic stability in balance with natural resources. All actions will comply with existing laws and regulations, however, changes to existing laws and regulations will be recommended as needed to attain the common vision and avoid one-size-fits-all solutions.
- Recognize the significance of the roles of limiting factors outside of the watershed and natural events within the watershed. The long term goal is to have the Wenatchee River's existing and future habitats contribute to the recovery of listed species and to eventually provide harvestable and sustainable populations of fish and other aquatic resources.
- Since 1993, landowner members of the Columbia River Management Plan (CRMP) Group/Wenatchee Planning Unit (WPU) have insisted that good science be applied to the collection and interpretation of information for all resource elements of concern. Landowners hope that through the continued use of good science, the mission and goals of the group will be met and with landowner cooperation during implementation, regulating agencies may not find it necessary to apply one-size-fits-all regulations to achieve their management objectives for the Wenatchee subbasin (CCCD 2004).
- Wildlife and fisheries vision for the Wenatchee subbasin is to have natural habitats with sufficient quantity, quality, and linkages to perpetuate existing native wildlife and fish populations into the foreseeable future. Furthermore, the vision is to restore extirpated wildlife and fisheries through protection and restoration of the subbasin where sufficient habitat exists.

2.3 Goals and Ecological Objectives

Goal 1. Maintain existing high quality habitat and the native fish and wildlife populations inhabiting these areas

Goal 2. Enhance or restore degraded areas, and return natural ecosystem functions to the subbasin

- Maintain, enhance, or restore the distribution, diversity, and complexity of watershed and landscape scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted
- Maintain, enhance, or restore biological diversity associated with native species and ecosystems
- Maintain, enhance, or restore sustainable and productive range and upland vegetative communities to promote watershed health and native ecological diversity
- Maintain, enhance, or restore significant culturally related natural resources
- Maintain, enhance, or restore unique habitats associated with riparian corridors along streams and in the upland environments
- Maintain, enhance, or restore spatial and temporal connectivity within and between watersheds. Included are the drainage network connections, floodplains, wetlands, upslope areas, head water tributaries, and intact refugia
- Maintain, enhance, or restore natural stream flow regimes per temporal and spatial patterns
- Maintain, enhance, or restore habitat to support well-distributed populations of native plant and riparian-dependent species, including habitat necessary for sustaining salmonids at critical life history stages of spawning, rearing, and migration
- Maintain, enhance, or restore properly functioning floodplain and riparian conditions
- Maintain, enhance, or restore the water quality necessary to support healthy riparian, aquatic, and wetland ecosystems

Goal 3. Restore, maintain, or enhance fish and wildlife populations to sustainable and harvestable levels, while protecting biological integrity and the genetic diversity of the species

- Maintain or increase abundance of native fish and wildlife species to a level where populations can be harvested and can be sustained through natural reproduction and productivity
- Maintain or rebuild distribution of native fish and wildlife populations to perpetuate spatial structure, life history diversity, and genetic diversity
- Maintain and/or restore performance (productivity, abundance and life history diversity) of wild, indigenous populations in a manner that maintains or enhances genetic similarity

to naturally producing populations. Artificial propagation is considered a relatively short term measure and is not intended to replace naturally producing populations over the longer term

Goal 4. Increase public involvement, knowledge, and appreciation for the protection, restoration, and enhancement of fish and wildlife resources

- Provide scientific basis for protecting aquatic ecosystems and enhance open, public planning processes for sustainable resource management
- Develop tools and processes to increase greater public involvement in accurately assessing the responses in fish and wildlife populations and their habitats to specific strategies recommended and undertaken
- Assess current and future water supply and community needs, and develop a long term strategy for sustainable community growth and efficient water conservation
- Inform, educate, and involve landowners, recreationists, and the general public about the need to protect, restore, and enhance fish and wildlife resources

Goal 5. Improve fish and wildlife management, regulation and enforcement, public involvement, and government incentives and funding to maintain and restore natural ecosystems and the species they support

- Increase effectiveness of decision-making and management of fish and wildlife populations, and their habitats
- Strengthen plans and regulations to restore and maintain habitat that supports healthy, harvestable populations of fish
- Use incentives and government funding to support the protection and restoration of fish, wildlife, and their habitats
- Build citizen support and involvement in restoration, conservation, and enhancement of fish and wildlife habitat

Goal 6. Improve coordination for long term monitoring of fish and wildlife population and habitat, and develop the required institutional infrastructure to better insure consistency and efficiency with other local, tribal, state, and federal monitoring protocols

- Develop and employ a trend monitoring program based on remotely-sensed data obtained from sources such as aerial photography or satellite imagery
- Develop and implement a long term statistically-based monitoring program to evaluate the status of fish populations and habitat (This requires probability-based statistical site selection procedures and establishment of standard protocols and data collection methods.)
- Implement experimental research monitoring at selected locations to establish the underlying causes for the changes in habitat and population indicators

2.4 Logic Path and Documentation of the Subbasin Plan

Of primary interest to the Wenatchee Subbasin Plan is the logic, or rationale that supports the recommendations of the Management Plan. The fundamental premise in the development of this Plan is to identify 1)what habitat conditions have been most effected by developments in the last 200 years, 2)how have important species responded to these changes, and 3) what local resource managers and citizens can do to maintain and enhance these and other important terrestrial and aquatic populations and ecosystems.

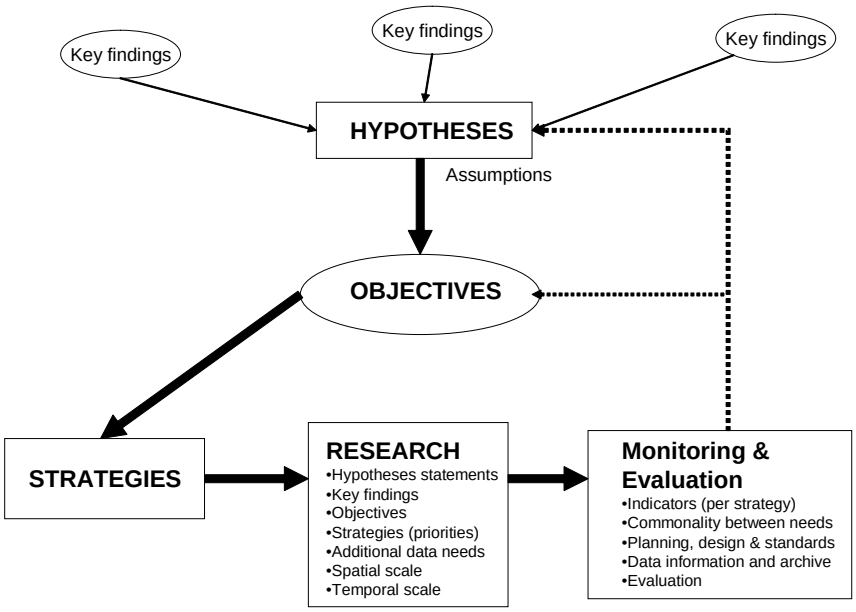

Figure 1. Logic path

While there are 11 numbered sections in this subbasin plan, six make up the major sections of the plan. All six are closely related but can be read and understood independent of the others. Below is a brief summary of the content and intent behind each of the major sections.

Subbasin Overview

Section 3, Subbasin Overview, provides a broad overview of the subbasin with respect to the Columbia Cascade Province and with the key environmental features within the Wenatchee subbasin. This information is simply descriptive in nature and is meant to help orient readers. Section 3 also provides a Scientific Conceptual Foundation which describes the underlying premises of how subbasin planners view and interpret ecological health and population responses within the subbasin, as well as the subbasin's relationship to the larger Columbia basin. This information provides the framework for the interpretation of assessment information and development of management recommendations.

Assessment

Section 4, Assessment, contains descriptive information that addresses terrestrial and aquatic considerations separately. Essentially all of the information used in the assessment exists in published literature, or was derived from technical subcommittee meetings assembled periodically for the development of this subbasin plan.

The terrestrial assessment is based upon focal habitats. These habitats are considered sensitive and/or vulnerable to changes in environmental conditions, especially from rural or urban developments. Representative species that have a direct association are identified for each of the focal habitats.

For aquatic considerations, focal species were selected based upon a) cultural significance, b) fulfillment of a critical ecological function, c) serves as an indicator to environmental health, d) are locally significant, and/or e) are a federally listed species. Focal species are seen as indicator species (canary in the coal mine) for ecosystems. Focal populations' health is a cumulative result of many environmental attributes. If these populations remain healthy, it is reasonable to conclude that the overall environmental condition and function are reasonably healthy. Focal species are described with an emphasis on life history strategies, relationship to various habitats, and population characteristics and status.

A significant component of the assessment is a description of habitat and ecological conditions within the Wenatchee subbasin. For the purposes of this document, the subbasin was dissected into 11 separate assessment anits based primarily upon major watersheds contained within the subbasin. Each assessment anit is described with regards to its overall watershed condition, riparian and floodplain condition, stream channel condition, water quality, water quantity (flow) and ecological condition. These topics are inclusive to key and measurable habitat attributes important to survival and productivity of the focal species. Specific habitat attributes are evaluated and summarized in the QHA report for over 80 stream reaches throughout the subbasin. Although using the QHA was problematic in many ways, it serves as a convenient method to summarize and convey a substantial body of information and a useful tool to identify key areas to consider for future management actions.

Each discussion of the assessment unit concludes with a brief discussion about important environmental/population relationships, areas of special interest, limiting factors (for focal species production) and key data gaps. These topics provide a brief synthesis of the Assessment Unit and highlight habitat conditions and functional relationships that should be considered in the determination of Recommended Management Strategies.

Inventory

Section 5, Inventory, is a list of on-the-ground projects that have been implemented in the recent past, using the last five years as a guideline. The purpose of the inventory is to indicate if recently implemented projects are consistent with the needs identified by the subbasin assessment. Comparing the projects from the inventory with the habitat needs is a gap analysis which serves as the conclusion to this section.

Synthesis and Interpretation

Section 6, Synthesis and Interpretation, focuses primarily upon aquatic resources and is the most complex section within the subbasin plan. The two key elements are 1) the key findings and hypothesis statements and 2) the determination of restoration priorities.

The key findings and hypothesis statements are organized in a similar manner as the assessment. First, a brief description concerning each of the focal species provides an overview of key factors and geographic areas that are and/or may be limiting production of these species. Following this discussion is an identification of key habitat attributes that limit focal species production within the subbasin and identification of attributes that remain in good ecological condition and should be maintained to support long term viability of these and other species. For those habitat attributes that are considered to be impaired, and are particularly important to the overall ecology of the subbasin, specific hypotheses statements are provided that estimate species response if these conditions could be improved to a natural range of variation (or the desired future condition, as discussed in the management plan). These discussions provide the basis for establishing priority actions within the management plan and monitoring strategy. An important component of the key findings is a summarization of four reference conditions: 1)presumed historic, 2)current, 3)existing trend, and 4)desired future condition. A reference condition is a benchmark from which habitat changes and/or population performance can be compared over time. These reference conditions are intended to be qualitative in nature and suggest potential trends rather than serving as absolute indicators of condition.

Concluding the synthesis is the determination of restoration strategies, taken from the Biological Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region (2004) developed by the Regional Technical Team and adopted by the Upper Columbia Salmon Recovery Board. This document describes the basic criteria for determining priorities in species distribution across the landscape, and provides guidance in prioritization of protection and restoration activities. Important to note here is that this logic does not specifically prioritize or discount any potential project or activity to benefit fish and wildlife resources, rather it provides guidance in overall funding considerations.

Management Plan

Section 7, Management Plan, as designed includes three key areas:

The vision, purpose and scope and subbasin planning guidelines provide the basic context and direction for the management plan.

The biological objectives and the habitat objectives establish a future benchmark or desired future condition. The biological objectives describe the basic concepts and units of measure important in long term monitoring of a populations response to conditions within and outside of the Wenatchee subbasin. Because many environmental factors affect populations, it important to have specific habitat objectives defined that can be monitored and evaluated over time. Although the habitat objectives are relatively general as provided, they are quantitative in nature and can be measured for trend and condition. Both biological and habitat objectives are based upon and consistent with criteria used by NOAA Fisheries and the US Fish and Wildlife Service (USFWS).

Management strategy recommendations maintain a consistent format with the Assessment and key findings. For each of the habitat attributes evaluated, general Management Strategy statements are provided, supported by management objective statements, each suggesting specific types of actions that would contribute to the overall strategy, as well as the subbasin goals and vision. Concluding this section of the document are the near-term opportunities and measurable objectives. The management actions recommended could be implemented and/or could be substantially advanced within a 10-year time period if managers are successful in developing an aggressive implementation strategy and secure appropriate funding. Because these actions are generally feasible within the foreseeable future, it is appropriate to identify a measurable level of accomplishment that would signal a highly successful implementation program.

Monitoring and Adaptive Management

Section 8 is Monitoring and Adaptive Management. Over the past two years, the Regional Technical Team of the Upper Columbia Region has been actively involved in the development of a large scale, long term monitoring strategy. This monitoring strategy is designed to be consistent with ongoing federal and state direction and will focus considerable attention to three key levels of monitoring: implementation, effectiveness and validation. Consistent with the ISAB (2003) recommendations, the Wenatchee monitoring strategy will (with an appropriate level of funding) 1)contain a trend monitoring program based upon remotely-sensed data obtained from sources such as aerial photography and/or satellite imagery, 2)develop and implement a long term statistical monitoring program to evaluate the status of fish populations and habitat (this requires statistical site selection procedures and establishment of common (standard) protocols and data collection methods), and 3)implement experimental research monitoring at selected locations to establish the underlying causes for the changes in habitat and population indicators.

2.5 Synopsis of Key Findings and Conclusions

Key findings are concise statements and determinations about environmental attributes found to have a relatively high importance to the focal species existence within the assessment unit. These statements describe habitat conditions that are functioning properly as well as those that have been altered or degraded to the point that they limit the ability for the focal species to thrive or exist within the assessment unit. Key findings are first described for terrestrial and then for aquatic considerations.

2.5.1 Key Findings: Terrestrial

The terrestrial assessment viewed the subbasin from a perspective of key and major vegetative communities. Three community types were identified as focal habitat for this evaluation include: ponderosa pine, shrubsteppe and riparian ecosystems. Within each of these focal habitats, representative species that are directly associated with these vegetative communities are identified for monitoring.

Factors Affecting Ponderosa Pine Habitat

- Repeated timber harvest removed large diameter ponderosa pine and snags, and left the understory. This has resulted in accelerated successional advancement and increased the Douglas fir component.

- Urban and residential development has contributed to loss and degradation of properly functioning ecosystems.
- Fire suppression/exclusion has contributed towards habitat degradation, particularly declines in characteristic herbaceous and shrub understory from increased density of small shade-tolerant trees. High risk of loss of remaining ponderosa pine overstories from stand-replacing fires due to high fuel loads in densely stocked understories.
- Historically, extensive grazing by domestic sheep may have altered understory composition, resulting in loss of forbs and a decrease in shrub densities.
- Overgrazing has resulted in lack of recruitment of sapling trees, particularly pines.
- Invasion of exotic plants has altered understory conditions and increased fuel loads.
- Fragmentation of remaining tracts has negatively impacted species with large area requirements
- Hostile landscapes, particularly those in proximity to agricultural and residential areas, may have high density of nest parasites (brown-headed cowbird), exotic nest competitors (European starling), and domestic predators (cats), and may be subject to high levels of human disturbance.
- The timing (spring/summer versus fall) of restoration/silviculture practices such mowing, thinning, and burning of understory removal may be especially detrimental to single-clutch species.
- Spraying insects that are detrimental to forest health may have negative ramifications on lepidopterans (butterflies) and other non-target bird species.

Factors Affecting Shrubsteppe Habitat

- Permanent habitat conversions of shrubsteppe/grassland habitats (e.g., approximately 60 percent of shrubsteppe in Washington to other uses (e.g., agriculture, urbanization). Significant acreage of shrubsteppe habitat continues to be converted to residential development between Wenatchee and Monitor (USFS 1999b).
- Fragmentation of remaining tracts of moderate to good quality shrubsteppe habitat
- Degradation of habitat from intensive grazing and invasion of exotic plant species, particularly annual grasses such as cheatgrass and woody vegetation such as Russian olive
- Degradation and loss of properly functioning shrubsteppe/grassland ecosystems resulting from the encroachment of urban and residential development and conversion to agriculture. Best sites for healthy sagebrush communities (deep soils, relatively mesic conditions) are also best for agricultural productivity; thus, past losses and potential future losses are great. Most of the remaining shrubsteppe in Washington is in private ownership with little long term protection (57%).

- Loss of big sagebrush communities to brush control (may not be detrimental relative to interior grassland habitats)
- Conversion of Conservation Reserve Program (CRP) lands back to cropland
- Loss and reduction of cryptogamic crusts, which help maintain the ecological integrity of shrubsteppe/grassland communities
- High density of nest parasites (brown-headed cowbird) and domestic predators (cats) may be present in hostile/altered landscapes, particularly those in proximity to agricultural and residential areas subject to high levels of human disturbance.
- Agricultural practices that cause direct or indirect mortality and/or reduce wildlife productivity. There are a substantial number of obligate and semi-obligate avian/mammal species; thus, threats to the habitat jeopardize the persistence of these species.
- Fire management, either fire suppression (USFS 1999b), which has resulted in succession of vegetation communities, or overuse of fire, both of which have lead to loss of shrubsteppe
- Much of the low-elevation shrubsteppe vegetation is currently dominated by cheatgrass and other nonnative plants (USFS 1999b). Invasion and seeding of crested wheatgrass and other introduced plant species reduces wildlife habitat quality and/or availability.

Factors Affecting Riparian Wetland Habitat

- Loss of habitat due to numerous factors including riverine recreational developments, inundation from impoundments, cutting and spraying of riparian vegetation for eased access to water courses, gravel mining, etc
- Habitat alteration from 1)hydrological diversions and control of natural flooding regimes (e.g., dams) resulting in reduced stream flows and reduction of overall area of riparian habitat, loss of vertical stratification in riparian vegetation, and lack of recruitment of young cottonwoods, ash, willows, etc., and 2)stream bank stabilization which narrows stream channel, reduces the flood zone, and reduces extent of riparian vegetation
- Habitat degradation from conversion of native riparian shrub and herbaceous vegetation to invasive exotics such as reed canary grass, purple loosestrife, perennial pepperweed, salt cedar, and indigo bush
- Fragmentation and loss of large tracts necessary for area-sensitive species
- Hostile landscapes, particularly those in proximity to agricultural and residential areas, may have high density of nest parasites (brown-headed cowbird), exotic nest competitors (European starling), and domestic predators (cats), and be subject to high levels of human disturbance.
- High energetic costs associated with high rates of competitive interactions with European starlings for cavities may reduce reproductive success of cavity-nesting species such as Lewis' woodpecker, downy woodpecker, and tree swallow, even when outcome of the competition is successful for these species

- Recreational disturbances (e.g., offroad recreational vehicles (ORVs)), particularly during nesting season, and particularly in high-use recreation areas

2.5.2 Key Findings: Aquatic

For the purposes of the aquatic assessment, the Wenatchee subbasin was divided into 11 independent assessment units. Within each assessment unit, information was organized by key environmental attributes including riparian/floodplain conditions, stream channel conditions, water quality, water quantity, obstructions to fish passage, and ecological conditions. The degree that habitat conditions have changed over the past 200 years and the presumed response of the focal fish species have been evaluated. Environmental conditions that limit the ability for a species to thrive are called limiting factors. Limiting factor are defined as a habitat element that limits the biological productivity and/or life history diversity of a focal species.

The focal species selected for this assessment include spring chinook salmon, late-run chinook salmon, sockeye salmon, coho salmon, steelhead trout, bull trout, Westslope cutthroat trout and Pacific lamprey. The key limiting factors that have been identified are summarized below by assessment unit.

Table 1. Summary of key limiting factors to focal fish populations by assessment unit

	Lower Wenatchee	Middle Wenatchee	Mission Creek	Peshastin Creek	Chumstick Creek	Icicle Creek	Nason Creek	Little Wenatchee	White River	Chiwawa River	Lake Wenatchee
Key Habitat	X		X	X	X		X				
Riparian Floodplain		X	X	X	X		X		X		
Habitat Diversity	X	X	X	X	X	X	X		X		
Channel Stability	X		X	X	X		X				
Sediment	X	X	X	X	X		X				
Flow	X		X	X	X	X	X				
Temperature	X		X	X		X	X				
Contaminants	X		X								
Obstructions		X	X	X	X	X	X				
Competition						X	X	X	X	X	

2.5.3 Summary of Restoration and Conservation Measures: Terrestrial

Ponderosa Pine

Goal: Provide sufficient quantity and quality ponderosa pine habitats to support the diversity of wildlife as represented by sustainable focal species populations

- Habitat Objective 1: Determine the necessary amount, quality, and juxtaposition of ponderosa pine habitats by the year 2008
- Habitat Objective 2: Based on findings of Objective 1, provide biological and social conservation measures to sustain focal species populations and habitats by 2010
- Habitat Objective 3: Maintain and/or enhance habitat function (i.e., focal habitat attributes) by improving silvicultural practices, fire management, weed control, livestock grazing practices, and road management in existing and restored ponderosa pine habitat
- Biological Objective 1: Determine population status of white-headed woodpecker, flammulated owl, and pygmy nuthatch by 2008

- Biological Objective 2: Within the framework of the focal species population status determinations, inventory other ponderosa pine obligate populations to test assumption of the umbrella species concept for conservation of other ponderosa pine obligates

Shrubsteppe

Goal: Provide sufficient quantity and quality shrubsteppe habitat to support the diversity of wildlife as represented by sustainable focal species populations.

- Habitat Objective 1: Determine the necessary amount, quality, and juxtaposition of shrubsteppe by the year 2008
- Habitat Objective 2: Based on findings of Objective 1, identify and provide biological and social conservation measures to sustain focal species populations and habitats by 2010
- Habitat Objective 3: Maintain and/or enhance habitat function (i.e., focal habitat attributes) by improving agricultural practices, fire management, weed control, livestock grazing practices, and road management on existing shrubsteppe
- Biological Objective 1: Determine population status of Brewer's sparrow by 2008
- Biological Objective 2: Within the framework of the Brewer's sparrow population status determination, inventory other shrubsteppe obligate populations to test assumption of the umbrella species concept for conservation of other shrubsteppe obligates
- Biological Objective 3: Maintain and enhance mule deer populations consistent with state/tribal herd management objectives

Riparian Wetlands

Goal: Provide sufficient quantity and quality riparian wetlands to support the diversity of wildlife as represented by sustainable focal species populations.

- Habitat Objective 1: Determine the necessary amount, quality, and connectivity of riparian wetlands by the year 2008.
- Habitat Objective 2: Based on findings of Habitat Objective 1, provide biological and social conservation measures to sustain focal species populations and habitats by 2010.
- Habitat Objective 3: Enhance beaver (*Castor canadensis)* habitat where appropriate to increase the quantity and quality of riparian wetlands for focal species by 2009.
- Habitat Objective 4: Enhance beaver populations to benefit habitat for threatened/endangered fish species.
- Habitat Objective 5: Maintain and/or enhance habitat function (i.e., focal habitat attributes) by improving silviculture and agricultural practices, fire management, weed control, livestock grazing practices, and road construction and maintenance on and adjacent to existing riparian wetlands.

- Biological Objective 1: Determine population status of red-eyed vireo (*Vireo olivaceous)* and yellow-breasted chat by 2008.
- Biological Objective 2: Within the framework of the focal species population status determinations, inventory other riparian wetlands obligate populations to test assumption of the umbrella species concept for conservation of other riparian wetlands obligates.

2.5.4 Summary of Restoration and Conservation Measures: Aquatic

Contained within the management plan are management strategies. These strategies outline general guidance for future management practices to move towards the stated vision and goals. Various management objectives are identified which suggest a range of activities that would contribute to achieving a specific management strategy. Listed below are the key management strategies identified for each of the assessment units.

Lower Wenatchee River Assessment Unit

- Reduce late summer mainstem temperatures
- Reduce elevated fine sediment in the mainstem and tributary stream substrates
- Enhance water quality for both mainstem and tributary streams
- Enhance mainstem flows
- Improve riparian and floodplain conditions in both mainstem and tributary streams
- Restore and enhance in-channel habitat diversity and structural complexity in both mainstem and tributary streams
- Continue to monitor and evaluate fish passage at Dryden Dam

Middle Wenatchee Assessment Unit

- Reduce late summer mainstem temperatures
- Reduce elevated fine sediment in the mainstem and tributary streams
- Maintain existing good water quality
- Maintain flows and hydrograph to current condition
- Maintain and improve mainstem riparian and floodplain conditions, particularly above Tumwater Canyon
- Maintain and improve mainstem in-channel structural diversity and habitat quality
- Improve tributary habitat quality and quantity in some locations
- Continue to monitor and evaluate fish passage at Tumwater Dam. Restore unhindered juvenile and adult passage if determined to be appropriate

Mission Creek Assessment Unit

- Improve water temperatures in Mission Creek and tributaries
- Reduce elevated fine sediment in the mainstem and tributary stream substrates
- Enhance water quality primarily for the mainstem of Mission and Brender creeks and preserve water quality in tributary streams
- Enhance mainstem flows by improving overall watershed vegetative and hydrologic conditions and water use efficiency
- Restore tributary flows towards the natural hydrograph
- Improve riparian and floodplain characteristics where feasible
- Improve in-channel attributes for the mainstem and tributary streams
- Restore adult and juvenile fish passage
- Control or eliminate brook trout

Peshastin Creek Assessment Unit

- Improve elevated water temperatures by improving low flow conditions and increasing riparian shade and floodplain function
- Improve elevated water temperatures in tributaries by reducing channel confinement and improving degraded riparian conditions
- Reduce elevated fine sediment in the mainstem and tributary stream substrates
- Enhance water quality in the mainstem Peshastin Creek
- Enhance mainstem flows by improving overall watershed vegetative and hydrologic conditions, and water use efficiency
- Improve tributary flows to the natural hydrograph by improving the road network, improving stream channel confinement, and relocating valley bottom roads where feasible
- Improve riparian and floodplain characteristics where feasible
- Improve in-channel attributes for the mainstem and enhance or maintain tributary streams
- Restore adult and juvenile fish passage

Chumstick Creek Assessment Unit

- Enhance elevated stream temperatures in the mainstem and tributaries
- Reduce elevated fine sediment in the mainstem and tributary stream substrates
- Enhance water quality primarily for the mainstem of Chumstick Creek

- Enhance water quality in tributary streams
- Enhance mainstem flows by improving overall watershed vegetative and hydrologic conditions and water use efficiency
- Restore tributary flows towards the natural hydrograph
- Improve riparian and floodplain characteristics where feasible
- Improve in-channel attributes for the mainstem and tributary streams
- Restore adult and juvenile fish passage
- Control or eliminate brook trout

Icicle Creek Assessment Unit

- Enhance elevated stream temperatures in the lower mainstem creek by improving low flow and degraded riparian conditions and maintain existing condition in tributaries
- Reduce fine sediment level in the lower mainstem and maintain existing conditions in tributaries
- Maintain or enhance water quality in the lower mainstem
- Improve stream flow in lower mainstem
- Improve riparian and floodplain characteristics in the lower portion of the assessment unit (mainstem river below Snow Creek) and enhance local conditions in the upper watersheds
- Enhance in-channel attributes in the lower portion of the assessment unit (mainstem river below Snow Creek) and in local areas in the upper watershed
- Restore adult and juvenile fish passage within the lower Icicle Creek (below Snow Creek)

Nason Creek Assessment Unit

- Improve elevated stream temperatures in the lower mainstem (below Mill Creek) by improving low flow conditions, channel confinement, and degraded riparian conditions
- Reduce fine sediment level in the lower mainstem
- Enhance water quality in the lower mainstem (below Mill Creek)
- Enhance mainstem flows by improving overall watershed vegetative and hydrologic conditions and water use efficiency
- Improve riparian and floodplain characteristics in the lower mainstem (below Mill Creek) where feasible
- Improve in-channel attributes for the mainstem (focus on lower 15 miles of Nason Creek) and some tributary streams

- Restore adult and juvenile fish passage

Little Wenatchee Assessment Unit

- Maintain existing water quality condition and trend in mainstem and tributary streams
- Maintain existing water quantity condition for mainstem and tributaries
- Maintain and enhance lower mainstem riparian vegetation along the Little Wenatchee River
- Enhance lower Little Wenatchee River in-channel habitat diversity
- Control or eradicate brook trout

White River Assessment Unit

- Maintain existing water quality condition for mainstem and tributaries
- Maintain existing water quantity condition for mainstem and tributaries
- Enhance in-channel attributes for the mainstem (focus on lower 11 miles of the White River)

Chiwawa River Assessment Unit

- Maintain existing water quality condition and trend for mainstem and tributaries
- Bring sediment delivery into the range of natural conditions in Big Meadow Creek
- Maintain existing condition for water quantity for mainstem and tributaries
- Maintain and enhance riparian and floodplain conditions in the lower mainstem
- Enhance lower mainstem in-channel habitat attributes

Lake Wenatchee Assessment Unit

- Maintain the existing high quality riparian and perennial wetland habitats surrounding Lake Wenatchee
- Develop and implement long term water quality evaluation strategy to monitor condition and trend of Lake Wenatchee
- Develop and implement a long term biological community evaluation and strategy to monitor condition and trend with a particular focus on bull trout and sockeye salmon abundance and ecological relationships
- Evaluate the effects of existing and future developments surrounding the lake on the associated floodplains and biological conditions
- Evaluate the benefits and risks of enhancing nutrients in Lake Wenatchee to salmonid, specifically sockeye production

2.6 Summary of Monitoring and Infrastructure Needs

2.6.1 Summary of Monitoring and Infrastructure Needs: Terrestrial

Recommended monitoring and evaluation strategies summarized below for each focal habitat type are derived from national standards. Deer and elk sampling methodology follow standard protocols established by the Washington Department of Fish and Wildlife (WDFW). Protocols for specific vegetation monitoring/sampling methodologies are drawn from US Department of Agriculture (USDA) Habitat Evaluation Procedure (HEP) standards. A common thread in the monitoring strategies contained in this subbasin plan is the establishment of permanent census stations to monitor bird populations and habitat changes.

Wildlife managers will include statitistically rigorous sampling methods to establish links between habitat enhancement prescriptions, changes in habitat conditions, and target wildlife population responses.

Specific methodology for selection of monitoring and evaluation (M&E) sites within all focal habitat types follows a statistical sampling procedure, allowing for statistical inferences to be made within the area of interest. Protocols identified in this document describe how M&E sites will be selected. The following summarizes the basic concepts of the wildlife monitoring strategy.

Ponderosa Pine

Focal Species: Flammulated owl, white-headed woodpecker, and pygmy nuthatch.

Overall Habitat and Species Monitoring Strategy: Establish monitoring program for protected and managed Ponderosa pine sites to monitor focal species population and habitat changes and evaluate success of efforts.

Focal Habitat Monitoring

Factors affecting habitat:

- Direct loss old growth forest and associated large diameter trees and snags
- Fragmentation of remaining Ponderosa pine habitat
- Agricultural and sub-urban development and disturbance
- Hostile landscapes which may have high densities of nest parasites, exotic nest competitors, and domestic predators
- Fire suppression/wildfire
- Overgrazing
- Noxious weeds
- Silvicultural practices
- Insecticide use

Shrubsteppe

Focal Species: Sharp-tailed Grouse, Brewer's sparrow, and mule deer.

Overall Habitat and Species Monitoring Strategy: Establish monitoring program for protected and managed shrubsteppe sites to monitor focal species population and habitat changes and evaluate success of efforts.

Focal Habitat Monitoring

Factors affecting habitat:

- Direct loss shrubsteppe due to conversion to agriculture, residential, urban and recreation developments
- Fragmentation of remaining shrubsteppe habitat, with resultant increase in nest parasites
- Fire Management, either suppression or overuse, and wildfires
- Invasion of exotic vegetation
- Habitat degradation due to overgrazing, and invasion of exotic plant species
- Loss and reduction of cryptogamic crusts, which help maintain the ecological integrity of shrubsteppe/grassland communities.

Riparian Wetlands

Focal Species: Red-eyed vireo, yellow-breasted chat, and American Beaver.

Overall Habitat and Species Monitoring Strategy: Establish monitoring program for protected and managed Riparian Wetland sites to monitor focal species population and habitat changes and evaluate success of efforts.

Overall Habitat and Species Monitoring Strategy: Establish permanent census stations to monitor bird population and habitat changes.

Focal Habitat Monitoring:

Factors affecting habitat:

- Direct loss of riparian deciduous and shrub understory
- Fragmentation of wetland habitat
- Flooding and dewatering of areas by beaver
- Agricultural and sub-urban development and disturbance
- Reduction in water quality
- Organochlorines such as dieldrin or DDE may cause thinning in egg shells which results in reproductive failure

2.6.2 Summary of Monitoring and Infrastructure Needs: Aquatic

The monitoring plan described section 8 draws from the existing regional strategies (ISAB, Action Agencies/NOAA Fisheries, and Washington Salmon Recovery Funding Board) and outlines an approach specific to the Wenatchee subbasin. The plan addresses the following basic questions:

What are the current habitat conditions and abundance, distribution, life-stage survival, and age-composition of ESA-listed fish in the Wenatchee subbasin (status monitoring)?

How do these factors change over time (trend monitoring)?

What effects do tributary habitat actions have on fish populations and habitat conditions (effectiveness monitoring)?

The monitoring plan is designed to address these questions and at the same time eliminate duplication of work, reduce costs, and increase monitoring efficiency. The implementation of valid statistical designs, statistical sampling designs, standardized data collection protocols, consistent data reporting methods, and selection of sensitive indicators will increase monitoring efficiency. For this plan to be successful, all organizations involved must be willing to cooperate and freely share information. Cooperation includes sharing monitoring responsibilities, adjusting or changing sampling methods to comport with standardized protocols, and adhering to statistical design criteria. In those cases where the standardized method for measuring an indicator is different from what was used in the past, it may be necessary to measure the indicator with both methods for a few years so that a relationship can be developed between the two methods. Measurements generated with a former method could then be adjusted to correct for any bias.

The monitoring report is divided into eight major parts. The first part (section 2) identifies valid statistical designs for status/trend and effectiveness monitoring. Section 3 discusses issues associated with sampling design, emphasizing how one selects a sample and how to minimize measurement error. Section 4 examines how sampling should occur at different spatial scales. Section 5 describes the importance of classification and identifies a suite of classification variables. Section 6 identifies and describes biological and physical/environmental indicators, while Section 7 identifies methods for measuring each indicator variable. These 7 sections provide the foundation for implementing an efficient monitoring plan in the Wenatchee subbasin. The last two sections deal with how the program will be implemented. Section 8 provides a checklist of questions that need to be addressed in order to implement a valid plan. Section 9 begins to lay out a monitoring plan for the Wenatchee subbasin by answering the questions identified in Section 8.

At this time entities that collect information relevant to fish and wildlife interests in the Wenatchee subbasin do not have a centralized location to store or retrieve critical or timely information. Key questions yet to be addressed at the subbasin and regional level concerns data management, data interpretation and data presentation. One of the significant challenges yet to be resolved is in describing the organizational and cooperative manner in which agencies and entities can integrate the regular collection and interpretation of natural resource information and provide this information to the public in a manner that allows full involvement in future decision making processes.

3 Subbasin Overview

3.1 Wenatchee Subbasin in Regional Context

3.1.1 Introduction and Objectives

The NPCC is responsible for implementing the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (P.L. 96-501) and the Fish and Wildlife Program mandated by the act. For planning purposes, the NPCC divided the more than 50 subbasins comprising the Columbia River basin south of the Canadian border into 11 ecological provinces.

Each of the 11 ecological provinces will develop its own vision, biological objectives, and strategies consistent with those adopted at the subbasin level. NPCC's intent is to amend these subbasin plans into the 2000 Fish and Wildlife Program during later rulemaking. The biological objectives at the ecological province scale will then guide development of the program at the subbasin scale.

3.1.2 Columbia Cascade Province

The Columbia Cascade Ecological Province extends over an area of 14,333 sq. mi. It is defined as the Columbia River from Wanapum Dam to the limit of anadromous fish passage at Chief Joseph Dam and is situated in north central Washington. Tributary subbasins are, for the most part, high gradient streams that begin in the North Cascade Mountains and drain directly to the Columbia River. The province also includes a few smaller streams that drain smaller watersheds adjacent to the Columbia as well as a number of gulches that arise from the channeled scablands to the east. The Columbia Cascade Ecological Province is divided into 6 subbasins: the Wenatchee, Entiat, Lake Chelan, Methow, Okanogan, and Upper Middle Mainstem Columbia River.

The Wenatchee subbasin is located in north central Washington and lies entirely within Chelan County. The subbasin comprises 9.3% of the Columbia Cascade Province and consists of approximately 854,000 acres (1,300 mi^2) (Table 2). Approximately 81% of the subbasin is in federal (primarily US Forest Service (USFS)) and state ownership. The remaining 19% of the lands in the subbasin is in private ownership (Table 3).

Table 2. Subbasin size relative to the Columbia Cascade Ecoprovince

Subbasin	Size		Percent of Ecoprovince	Percent of State
	Acres	Mi^2		
Entiat	298,363	466	3.2	.7
Lake Chelan	599,925	937	6.5	1.4
Wenatchee	851,894	1,333	9.3	2.0
Methow	1,167,795	1,825	12.7	2.8
Okanogan	1,490,079	2,328	16.2	3.5
Upper Middle Mainstem Columbia River	1,607,740	2,512	17.5	3.8
Crab	3,159,052	4,936	34.4	7.4
Total for Ecological Province	**9,174,848**	**14,337**	**100**	**21.6**

Ashley and Stovall 2004

Note: Values may be somewhat inconsistent with other tables in this document due to differing sources of information. Values may be revised as significant errors are discovered and time is available.

Table 3. Land ownership of the Columbia Cascade Province

Subbasin	Federal Lands (acres)	Tribal Lands (acres)	State Lands (acres)	Local Government Lands (acres)	Private Lands (acres)	Water (acres)	Total (subbasin) (acres)
Entiat	247,064	0	13,629	0	37,670	0	298,363
Lake Chelan	517,883	0	3,549	0	78,493	0	599,925
Wenatchee	682,295	0	11,836	0	159,182	0	853,313
Methow	985,234	0	55,836	0	126,724	0	1,167,794
Okanogan	400,496	311,826	261,598	0	516,159	0	1,490,079
Upper Middle Mainstem Columbia River	124,492	29,507	284,996	0	1,168,744	0	1,607,739
Crab	303,136	0	13,629	25	2,681,363	16,100	3,014,253
Total for Ecological Province	**3,260,600**	**341,333**	**645,073**	**25**	**4,768,335**	**16,100**	**9,031,466**

Asheyly and Stovall 2004

Note: Values may be somewhat inconsistent with other tables in this document due to differing sources of information. Values may be revised as significant errors are discovered and time is available.

Native American Tribes

Native people traditionally lived, hunted, gathered and fished within the Columbia Cascade Province. The province includes land ceded by the Confederated Tribes and Bands of the Yakama Nation (Yakama Nation) under the Treaty of 1855 to the United States. Members of the Yakama Nation and the Confederated Tribes of the Colville Reservation continue to exercise their hunting, gathering, and fishing rights within the province.

3.1.3 Terrestrial/Wildlife Context

The upper watersheds in the Columbia Cascade Province are primarily forested and have undergone substantial management activities. Lower reaches of the principal streams within each of the subbasin are almost completely privately owned and primarily managed through agricultural practices. In all cases, habitat conditions range from pristine to significantly altered.

[No further information to date]

3.1.4 Aquatic/Fish Context

Construction of Grand Coulee Dam in 1934 blocked over 1,000 miles of habitat in upstream of the Columbia Cascade Province in the upper Columbia River basin. Another 52 miles of habitat was blocked in 1961 by the completion of the Chief Joseph Dam. In addition, there are 6 hydroelectric projects downstream of this ecological province: Wanapum Dam and Priest Rapids Dam, and four federally owned projects, McNary Dam, John Day Dam, The Dalles Dam and Bonneville Dam.

To offset the loss of anadromous salmonid production by the federally built projects, the federal government built and continues to operate the Leavenworth National Fish Hatchery (NFH) in the Wenatchee subbasin, and later, the Entiat and Winthrop NFHs in the Entiat and Methow subbasins, respectively. No federal mitigation facility was constructed in the Okanogan subbasin.

With the construction of each of the privately owned mid Columbia hydroelectric projects, additional production/hatchery facilities were developed in the Columbia Cascade Province. The recent Habitat Conservation Plan (HCP), initiated by Chelan and Douglas Public Utility Districts (PUDs) for ESA Section 10 consultation, identified the mitigation obligation of the PUDs. The HCP also provides the groundwork for future changes in facility production goals and operations. Details of these changes in hatchery production will be resolved over the next several years.

In spite of past mitigation efforts, declining salmonid populations in the Columbia Cascade Province have resulted in ESA listings of spring chinook (endangered March 1999) and summer steelhead (endangered August 1997). Upper Columbia late-run chinook and Lake Wenatchee sockeye were also petitioned (March 1998) but were determined not warranted for listing. Recent years have shown improved salmonid runs to the province, consistent with findings throughout the Columbia basin.

3.1.5 Subbasin Planning and the Regulatory Context

Federal

The US Forest Service (USFS) manages approximately 76% of the Wenatchee subbasin. Other federal land mangers include the Bureau of Land Management (BLM) and the US Fish and Wildlife Service (USFWS), the latter of which is responsible for the operation and management of the Leavenworth NFH. Actions on USFS, BLM and USFWS lands within the Wenatchee subbasin result from the execution of various federal laws and regulations. Some of the major federal laws governing agency practices that were considered during the development of this plan are described below.

National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969 mandates that all federal agencies "utilize a systematic, interdisciplinary approach that will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making, which may have an impact on [the] environment." NEPA integrates with a wide variety of existing environmental legislation, including the: Clean Air Act (CAA), Clean Water Act (CWA), Coastal Zone Management Act (CZMA), National Historic Preservation Act (NHPA), Marine Protection, Research and Sanctuaries Act (MPRSA), Pollution Prevention Act (PPA), and the ESA. NEPA further requires that a detailed statement on the environmental impact of major federal actions that significantly affect the environment be included in every recommendation or report on proposals for legislation.

Endangered Species Act

The Endangered Species Act (ESA) of 1973 applies to the management of fish, wildlife and plant species that are in danger of or threatened with extinction. The purpose of the ESA is to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, and to provide a program for the conservation of such threatened and endangered species. All federal departments and agencies must seek to conserve threatened and endangered species and utilize their authorities to further the purposes of the ESA. Federal agencies are also required to cooperate with state and local agencies to resolve water resource issues in concert with conservation of endangered species.

In addition to mandating specific federal management actions, the ESA also applies to the actions of any person subject to the jurisdiction of the United States. It prohibits the harm or “take” of species listed as threatened or endangered under the ESA. Significant consideration is given to the ESA when any type of activity within the Wenatchee subbasin is proposed or undertaken, as threatened and endangered species exist within the management area on lands under both public and private management. Proposed habitat recommendations in this plan have been designed to help protect and restore endangered spring chinook and steelhead habitat as well as threatened bull trout habitat on private lands within the subbasin.

Clean Water Act

The Federal Water Pollution Control Act of 1972, as amended in 1977, is commonly known as the Clean Water Act (CWA). The CWA was established a basic structure to regulate discharge of pollutants into United States waters, and gave the EPA the authority to implement pollution

control programs. The EPA set federal water quality standards, and delegated authority to the Washington Department of Ecology (WDOE) to monitor federal water quality standards within the state's surface waters. WDOE is also required to maintain a list of impaired streams. The water quality recommendations in this plan have been designed to help address these concerns within the Wenatchee subbasin.

Federal Land Policy and Management Act

The Federal Land Policy and Management Act (FLPMA) requires the BLM to develop land use plans. In order to meet this requirement the BLM developed the Spokane Resource Management Plan (RMP), which includes lands within the Wenatchee subbasin (approximately 200 acres). BLM administered lands in the subbasin are designated as Scattered Tracts, and allow most resource activities including recreation, timber harvest, and grazing. These lands have high value as wildlife winter range.

National Forest Management Act and Northwest Forest Plan

The National Forest Management Act (NFMA) is a significant law affecting the management and decisions of USFS. The NFMA directs the USFS to develop a RMP for each national forest. In 1990, the Wenatchee NF released a Final Environmental Impact Statement (FEIS) and a Record of Decision (ROD) for the preferred Land and Resource Management Plan. The forest plan contains management direction in the form of forest-wide standards and guidelines and management prescriptions for specific management areas (USFS 1990). The various management areas emphasize certain key values and indicate what practices will or will not occur within each management area.

The Northwest Forest Plan amended the Wenatchee Forest Plan in April 1994. This amendment modified the Wenatchee management designations and created Late Successional and Riparian Reserves. The Northwest Forest Plan also provides numerous standards and guidelines directing management practices on federal lands. Table 4 summarizes the resulting national forest land allocations by acreage within the Wenatchee subbasin and describes permitted management actions. The BLM's management plan was not affected by the amendment because its administrative lands in the Wenatchee subbasin are outside of the range of the northern spotted owl.

Table 4. USFS land allocations, acreages, and management emphasis

LAND ALLOCATION	ACRES	MANAGEMENT EMPHASIS
Congressionally Withdrawn Areas	25,554.37	Part of the Glacier Peak Wilderness Area. Managed for primitive recreation and research in a primitive setting. No timber harvest.
Late-Successional Reserves	60,139.33	Managed to protect and enhance habitat for late-successional and old-growth related species. No scheduled timber harvest, but allows some tree thinning to enhance desired late successional/old-growth habitat.
Administratively Withdrawn	34,834.61	Wenatchee Forest Plan: Unroaded Dispersed Recreation. No timber harvest.
Riparian Reserves		Emphasizes protection along all streams, wetlands, ponds and lakes. No scheduled timber harvest but some silvicultural treatments are permitted when they benefit riparian resources.

LAND ALLOCATION	ACRES	MANAGEMENT EMPHASIS
Matrix	130,822.96	Lands outside of reserves and managed under prescriptions described in The Wenatchee Forest Plan land allocations. Approximately 65% or 62,958 acres are available for regularly scheduled timber harvest.
Forest Service Pending	3531.31	Lands acquired through exchange or purchase that do not have a Forest Plan allocation assigned to them yet.

CCCD 2004

In addition to creating reserves and prescribing standards and guidelines, the Northwest Forest Plan identified key watersheds in Washington, Oregon and northern California as part of the Aquatic Conservation Strategy. Key watersheds provide habitat critical for the maintenance and recovery of anadromous salmonids and resident fish species.

The Northwest Forest Plan requires that watershed assessments be completed before federal land managers proceed with most activities within key watersheds. Each of these plans has been completed in the Wenatchee subbasin and is incorporated into this document.

A key product of the watershed assessment process was the description of existing resource conditions, identification of desired ecological conditions, and the development of management strategies that would move elements in the watershed to ward the desired future condition.

State

Many Washington state laws that regulate actions on private lands within the Wenatchee subbasin, and that direct state and local agency decision-making about projects, were also considered while developing this plan. Some of these pertinent laws include, but are not limited to:

Salmon Recovery Act of 1998 (Chapter 75.46 RCW) and Watershed Planning (Chapter 90.82 RCW)

Additional detail about the Salmon Recovery Act (SRA) is provided below because of the close link between SRA and the State Watershed Planning Act. For more information about these and other state laws, see the following link: http://www.leg. wa.gov/rcw/index.cfm

The SRA authorizes a lead entity to coordinate the development of locally-directed Habitat Restoration Project lists and salmon recovery plans. The lead entity for salmon recovery activities occurring in Chelan County is the county. If a planning unit opts to include the habitat component in its plan, and restoration activities are already being developed under the SRA, the planning unit is required to rely upon those activities as "the primary non-regulatory habitat component" of their plan.

The habitat restoration actions put forth in this plan were developed using the Critical Path ways Methodology identified in the SRA, and are the result of a locally-directed, collaborative effort among federal, tribal, state, local, and other stakeholder interests.

Various state legislative actions have provided guidance to natural resource management. Several of the more important regulatory acts are listed below:

- Shoreline Management Act of 1971 (Chapter 90.58 RCW)
- Water Resources Act o f 1971 (Chapter 90.54 RCW)
- Growth Management Act of 1990 (Chapter 36.70A RCW)
- Forestry Practices Act of 1974 (Chapter 76.09 RCW)
- State Environmental Policy Act of 1971 (Chapter 42.21C RCW)

Regional/Local

Regional Salmon Recovery Planning

It is anticipated that information contained in this document pertinent to habitat restoration and salmon recovery in the Wenatchee subbasin will contribute to the regional recovery strategy being developed for the Columbia Cascade Province.

Tribal Recovery Planning; Wy-Kan-Ush-Mi Wa-Kish-Wit (Spirit of the Salmon)

Wy-Kan-Ush-Mi Wa-Kish-Wit (Spirit of the Salmon) is the Columbia River anadromous fish restoration plan of the Nez Perce, Umatilla, Warm Springs and Yakama Tribes developed with the Columbia River Inter-Tribal Fish Commission (CRITFC). One of the plan's long term objectives is to restore salmon populations to a level that will support tribal ceremonial, subsistence, and commercial harvests. For more information on tribal recovery, refer to the following link: http://www.critfc.org/text/ water_action.html

Chelan County Comprehensive Land use Planning

Planning units are required to consider city and county planning activities during the development of their watershed plan. The WPU has given particular attention to local planning being done under the Growth Management Act (GMA). GMA is significant in that it mandates cities and counties to plan for land use and development, and designate and protect critical areas including wetlands, aquifer recharge areas, frequently flooded areas, and fish and wildlife habitat conservation areas. GMA also guides the development of comprehensive plans using other goals such as enhancing water quality and water availability, promoting new businesses, and involving citizen participation in the planning process. Actions recommended in this plan were designed in consideration of the goals used to guide planning under GMA and to provide local input to Chelan County during the update of its Comprehensive Plan, which is scheduled for completion by December 1, 2006.

3.2 Subbasin Description

3.2.1 Location

The Wenatchee subbasin drains a portion of the east Cascade Mountains in north central Washington within Chelan County. The Wenatchee River enters the Columbia River at river mile (RM) 470. The subbasin covers 849,777 acres, with 231 miles of major streams. Wenatchee River has about163 lineal miles of stream accessible to anadromous salmonids. The watershed originates in the Cascade Mountains, including the Alpine Lakes and Glacier Peak wilderness areas.

3.2.2 Topography and Climate

During the last large scale glaciation more than 10,000 years ago, large masses of ice gradually moved from higher elevations down slope cutting through rock masses and filling the watershed. This glacial action also provided huge amounts of melt water that flowed downstream towards the Columbia River creating out wash deposits composed of deep deposits of silt, sand, and gravel.

More recently rivers have scoured the bedrock and glacial deposits and redeposited them as sand and gravel terraces and plains. A review of well logs indicates that sediments thicken to over 170 ft. along the main axis of the Lake Wenatchee valley (Economic and Engineering Services and Golder Associates 1998). In some places within the subbasin, e.g., near the confluence of Icicle Creek and the Wenatchee River, the deposits may be up to 300 ft. (Andonaegui 2001).

Prevailing west winds uplift moist air from the Pacific over the Cascade Mountains. As a result, temperature and precipitation vary widely in the basin, depending upon elevation and nearness to the mountains.

The Cascade Mountain area of the subbasin is characterized by heavy precipitation, with nearly 150 in. of precipitation occurring annually at points along the Cascade crest. Snow depths in the mountains range from 10 to 25 ft., and snow covers the mountain areas from late fall through early summer. Daily temperatures in winter average 25 to 40°F, while average summer temperatures range from 60° to 80°F.

Air masses rapidly lose moisture as they move east ward resulting in semi-arid conditions in the lowermost portion of the subbasin. In contrast with the mountainous areas, the semiarid city of Wenatchee has an annual precipitation of less than 9 in., with maximum summer temperature of 95 to 100°F. Summer thunderstorms occur periodically and can result in flash flood conditions in local watersheds (Andonaegui 2001).

Vegetation and Land Cover

The climatic, elevation, and geologic diversity of the Wenatchee subbasin is reflected in its plant communities. Although most of the subbasin is forested, the species composition of the forest plant communities changes as elevation decreases and distance from the Cascade Mountain crest increases. Non-forest vegetation occurs primarily at the lowest elevation in shrubsteppe communities and the highest elevation in alpine meadow communities (Table 5).

Assessment units (sub watersheds in the subbasin are referred to as assessment units in this plan) closest to the Cascade Mountain Crest experience a maritime climatic influence as moist

maritime air incursion occur. Maritime-influenced vegetation is dominant in the White, Nason, Chiwawa, and Little Wenatchee assessment unit. Icicle Creek assessment unit supports significant amounts of both maritime and arid continental vegetation. Shrubs and herbs dominate the vegetated alpine areas of these assessment units; wetter areas support more herbaceous vegetation while red mountain heather and moss-heathers are found in well-drained areas. Mountain hemlock, silver fir and western hemlock dominate the maritime influenced forest communities which also support numerous understory plants such as cascade huckleberry, rusty menziesia, devil's club, rosy twisted stalk and coolwort foamflower. Open forests of mountain hemlock, whitebark pine and subalpine larch can be found at the extreme upper elevation limit for trees.

In the eastern portion of the subbasin, assessment units are lower in elevation and experience much less moisture, resulting in a more arid continental climate. Plant communities found in the mainstem Wenatchee, Mission, Chumstick and Peshastin assessment units, as well as portions of the Icicle assessment unit are more continental in nature. Vegetated alpine areas can still be moist herb dominated or drier shrub or grasslands not often seen in maritime-influenced alpine areas. Green fescue usually dominates these high elevation dry grasslands. Forest areas in these assessment units are dominated at climax by subalpine fir, grand fir, Douglas fir, or ponderosa pine. Understory plants include pinegrass, elk sedge, heartleaf arnica, dull Oregon grape, bigleaf sandwort, vanilla leaf, oceanspray, serviceberry and lupine. Nonforest plants occurring at the lowest elevation include bitterbrush, bluebunch wheatgrass, arrowleaf balsamroot, and yarrow among others.

Wetter habitats, such as riparian areas and wetlands support moisture dependent species including willows and sedges, while dry forest openings favor forest understory species or plants from drier plant communities common to lower elevations. Aspen, black cottonwood, bigleaf maple, alder and red osier dogwood are common in riparian communities.

A summary of vegetation is provided below.

Table 5. Land cover in the Wenatchee subbasin

Classification	Acres	% of Basin Area
Water	8,449	1.0%
Perennial Ice, Snow	2,944	0.3%
Low Intensity Residential	1,759	0.2%
Commercial, Industrial, and/or Transportation	1,497	0.2%
Bare Rock, Sand or Clay	45,252	5.3%
Quarries, Strip Mines, or Gravel	28	0.0%
Transitional	15196	1.8%
Deciduous Forest	17,417	2.1%
Evergreen Forest	567,650	67.0%
Mixed Forest	7,907	0.9%
Shrubland	66,488	7.9%

Classification	Acres	% of Basin Area
Orchards, Vineyards, Other	11,573	1.4%
Grasslands, Herbaceous	98,054	11.6%
Pasture, Hay	933	0.1%
Row Crops	28	0.0%
Small Grains	257	0.0%
Fallow	8	0.0%
Urban, Recreational Grasses	38	0.0%
Woody Wetlands	1,402	0.2%
Emergent Herbaceous Wetlands	73	0.0%
Total	**846,951**	**100.0%**

Montgomery et al. 2003

Land Ownership and Land use

The largest landowner in the Wenatchee subbasin is the federal government. The USFS is responsible for 76% of the subbasin (671,220 acres), while the BLM manages about 200 acres. USFS land is divided into 316,561 acres of congressional-designated wilderness, 242,957 acres multiple resource (including timber harvest) land and 111,702 acres is managed as non-harvest areas. Washington Department of Natural Resources (WDNR) manages about 8,700 acres of state-owned land. Longview Fiber Company owns about 47,760 acres, while other private commercial and non-commercial landowners own the remaining 149,560 acres of the subbasin. Although less than 25% of the subbasin is privately owned, nearly two-thirds of the lineal area of the anadromous streams, primarily lower gradient streams, is bordered by private lands (Chelan County PUD 1998). (Table 6)

Table 6. Estimates of land area and zoning in the Wenatchee subbasin

Area within each assessment unit (acres)													
Land Use Classification	**Chiwaukum**	**Chiwawa**	**Chumstick**	**Icicle**	**Lake Wenatchee**	**Little Wenatchee**	**Lower Wenatchee**	**Mission**	**Nason**	**Peshastin**	**Upper Wenatchee**	**White**	**Totals**
Commercial Agricultural	0	0	0	0	0	0	6,161	1,412	0	622	0	0	8,195
Commercial Forest	30,243	123,758	39,454	131,586	10,322	64,146	16,079	46,288	63,407	81,923	30,104	94,899	732,209
Public	0	0	4	171	801	0	179	0	71	0	0	0	1,226
Total Rural Residential/Resource	1,655	3,118	11,924	5,436	1,536	816	42,802	11,356	5,339	3,501	5,349	5,001	97,833
Rural Village	0	0	100	1	59	0	1,628	71	0	0	0	0	1,860
Rural Commercial	0	0	0	0	3	0	83	0	105	34	10	0	236
Rural Industrial	155	0	0	0	0	0	221	0	0	0	0	0	376
Rural Recreational and Resource	0	183	20	0	212	0	0	0	322	108	8	0	853
Rural Waterfront	0	387	57	11	402	0	32	0	0	0	581	15	1,484
City Urban Growth Area	0	0	1,315	0	0	0	667	668	0	0	19	0	2,669
Open water	8	73	95	120	2,984	1	438	0	7	0	438	159	4,325
Totals	**32,092**	**127,518**	**52,969**	**137,325**	**16,321**	**64,963**	**68,311**	**59,794**	**69,252**	**86,369**	**36,509**	**100,104**	**851,527**

Montgomery et al. 2003

Demographics

The majority of the population and industry within the Wenatchee subbasin is located in the lower elevations along the mainstem of the Wenatchee River. A discussion of current and projected demographic trends is located in Montgomery et al., 2003. Provided below is a summary of existing and projected population estimates in the Wenatchee subbasin.

Table 7. Forecasted population growth in the Wenatchee subbasin

Census By County Division	2000	2002 Projection	2035 Projection
Cashmere	10,824	11,217	17,092
Leavenworth – Lake Wenatchee	5,902	6,068	8,453
Wenatchee	34,678	35,895	54,061
Total Population Forecasted	**51,404**	**53,180**	**79,606**

Montgomery et al. 2003

3.2.3 Hydrologic

Four large tributaries; the Chiwawa River, White River, Little Wenatchee River and Nason Creek; join at or near Lake Wenatchee Lake to form the Wenatchee River, which flows 53 miles to the Columbia River. Snowmelt in the upper subbasin is the principal source of water for the subbasin's larger streams and provides over 80% of the total runoff from the subbasin. The 1,328 sq. mi. of subbasin drainage produces 2.5 million acre ft. of annual runoff.

Most of the stream flow in the Wenatchee River subbasin originates from tributaries in the upper subbasin. Five major tributaries; the Chiwawa, White, Little Wenatchee rivers and Nason and Icicle Creek; are the source of over 94% of the surface waters within the subbasin even though their drainage area only represents 58% of the total subbasin area (CCCD 1998).

Annual peak instantaneous flows usually occur from mid May through mid June fueled by snow melt in the upper regions of the subbasin. Record high flows have been recorded in November and December due to rain-on-snow events. Average flows recorded at Monitor (RM 7) during the months of August (1500 cubic feet per second (cfs)) and September (800 cfs) are16.7% and 9.2% of average June flows, respectively. Winter flows are typically almost double that of September flows but they occasionally drop below 300 cfs (Chelan County PUD 1998).

Water Quality

Although the Wenatchee River is rated Class AA, (extraordinary) by the Washington Department of Ecology (WDOE) from the head waters to the Wenatchee NF boundary near Leavenworth and Class A (excellent) from that point to the confluence with the Columbia River, significant water quality problems have been documented.

The 1998 approved 303(d) report from WDOE to the US Environmental Protection Agency (EPA) listed sections of the mainstem Wenatchee River, and Icicle, Chumstick and Peshastin creeks as exceeding standards for dissolved oxygen, temperature, instream flow and pH.

Sections of Mission Creek were listed for not meeting instream flow standards, as well as for elevated pesticide and fecal coli form levels. Sections of Little Wenatchee River, Chiwakum and

Nason creeks were also cited for exceeding temperature standards. Brender Creek, a tributary of Mission Creek was listed for low dissolved oxygen and elevated fecal coli form levels. Of these concerns, low instream flow and elevated temperatures pose the greatest threats to anadromous fish production.

Water Uses

Domestic Water Supply

Total municipal and domestic water use for the Wenatchee subbasin is estimated to be 3.9 million gallons per day (mgd) on an average daily basis and 9.4 mgd on a maximum daily basis. This equates to 6.0 cfs on an average day and 14.6 cfs on a maximum day. The total annual amount used is 4,400 acre ft. per year (AF/yr). The Chelan County Conservation District (CCD) contains the highest water use, at 2,170 AF/yr. Of this amount, 45% is associated with exempt well use. In the Leavenworth CCD, the majority of water usage is accounted for by the city of Leavenworth, with less than 15% of total usage associated with individual household wells. As noted earlier, the majority of the population residing within the Wenatchee CCD receives water from outside the subbasin. However, 548 AF/yr is produced from within the subbasin, the majority of which is associated with exempt wells. Considering the entire subbasin, public water systems comprise 58% of the total municipal and domestic water use, with 42% of usage accounted for by exempt wells (Montgomery et al. 2003).

Industrial Use

Several industries in the Wenatchee area rely on ground water for processing requirements and others are able to use the untreated Columbia River water to meet their needs. Industrial water use is not great in the basin and includes principally fruit packing, processing, and warehouse operations.

Impoundments and Irrigation

Irrigation has been practiced in the Wenatchee River valley from the time of the first settlers. The Gunn ditch began taking water from the Wenatchee River in 1891, and in the years that followed, several other ditches were constructed on tributary streams. The Peshastin ditch was built about 1898 to irrigate lands near Peshastin, Dryden, and Cashmere. The Peshastin Irrigation District took over the operation of this canal in 1917 and added lands served by the Tandy and Gibb ditches. The three irrigation entities have a cooperative service area agreement among them for distribution of irrigation water. The Icicle Irrigation District, which serves lands near Leavenworth and Cashmere, is also integrated with the Peshastin District and Tandy-Gibb Company.

The four major irrigation districts in the Wenatchee subbasin and two smaller irrigation groups have about 68% of the total issued water rights; other users are domestic (10%), commercial and industrial (8%), municipal (6%), fish hatcheries (3%) and all others (4%). Combined, these users have 420 cfs in water rights permits and certificates (357 cfs surface water, 63cfs ground water). The largest user is the Wenatchee Reclamation District, which serves over 9,000 users by diverting up to 200 cfs at Dryden Dam

Estimated irrigation water demand for consumptive use based on 1992 land cover data shows the estimated irrigation water demand for each assessment unit and the Wenatchee subbasin. The

total estimated consumptive use of water for irrigation purposes is 35,000 acre ft. per year. The on-farm demand, including field application efficiency, would likely be 30-40% greater. Most of the additional water used will seep into shallow ground water aquifers and may be a source of water supply for ground water users or may return to surface water via a stream or wetland.

Table 7. Agricultural crops and acres planted by assessment unit

Land Cover Type	Chiwawa	Upper Wenatchee	Chumstick	Icicle	Peshastin	Mission	Lower Wenatchee	Wenatchee Subbasin
Orchards Vineyards Other	94	536	1255	416	1,889	5,290	23,210	32,690
Pasture Hay	133	457	168	122	42	0	709	1,631
Row Crops	0	0	0	0	2	0	69	71
Small Grains	0	0	5	0	2	0	545	552
Fallow	0	0	0	0	0	0	20	20
Urban Recreational Grasses	0	0	56	0	0	0	1	57
Total Consumptive	**227**	**992**	**1,485**	**538**	**1934**	**5,290**	**24,554**	**35,020**

Montgomery et al. 2003

Additional quantities of water are diverted from the Wenatchee River for use outside of the watershed. The Wenatchee Reclamation District delivers water to 12,500 acres; approximately 8,114 acres are located outside of the Wenatchee subbasin and water delivered to them would not return to the Wenatchee River. It is assumed that the diversion of flow for those water users represents a consumptive use to the Wenatchee River. The estimated consumptive use is 33,000 acre ft. (Montgomery et al. 2003).

Mandated instream flow requirements were established in 1983 for three reaches on the Wenatchee River, one reach on Icicle Creek and one reach on Mission Creek. In each case, these flow requirements are often not met during the winter and late summer as a result of naturally low flows and diversions during summer. These flow requirements condition issuance of new water rights but do not affect water rights acquired prior to adoption. There are no minimum instream flow protection levels established for the upper watershed tributaries.

3.2.4 Terrestrial/Wildlife

Wildlife Species

There are an estimated 341 wildlife species that occur in the subbasin. Of these species, 96 (28%) are closely associated with riparian and wetland habitat and 76 (21%) consume salmonids during some portion of their life cycle. Seventeen wildlife species are non-native. Eight wildlife species that occur in the Subbasin are listed federally and 42 species are listed in Washington as threatened, endangered, or candidate species. A total of 98 bird species are listed as Washington

State Partners in Flight priority and focal species. A total of 57 wildlife species are managed as game species in Washington.

Ninety-three percent of the wildlife species that occur in the Columbia Cascade Province occur in the Wenatchee subbasin. In addition, 94% of the amphibian species and 100% of the reptile species that occur in the province occur in the subbasin. A general summary of species richness is provided in Table 8 below. For additional information, refer to Appendix A.

Table 8. Species richness and associations for the Wenatchee subbasin

Class	Wenatchee	% of Total	Total (Ecoprovince)
Amphibians	16	94	17
Birds	215	92	234
Mammals	91	94	97
Reptiles	19	100	19
Total	**341**	**93**	**367**
Association			
Riparian Wetlands	70	90	78
Other Wetlands (Herbaceous and Montane Coniferous)	26	68	38
All Wetlands	96	83	116
Salmonids	76	93	82

Ashley and Stovall 2004

Wildlife

The wide diversity of available habitats in the Wenatchee subbasin provides a diverse assemblage of wildlife species. Table 9 lists information on species of particular importance to the Wenatchee subbasin including their listing status under Washington Department of Fish and Wildlife (WDFW) Priority Habitat Criteria.

1=Species determined to be in danger of failing, declining, or vulnerable due to factors such as limited numbers, disease, predation, exploitation, or habitat loss or change

2=Uncommon species, including Monitor species, occurring in forest environments and that may be affected by habitat loss or change

3=Species in forest environments for which the maintenance of a stable population and surplus for recreation may be affected by habitat loss or change)

And their formal listing regarding WDFW Species of Concern State status (E=endangered, T=threatened, S=sensitive, C=candidate) and ESA status (E=endangered, T=threatened, C=candidate, SC=species of concern, PT=proposed threatened, PE=proposed endangered)

Special Plant Species

Some of the most rare plant species endemic to Washington state are found in the subbasin, including showy stickseed, Wenatchee larkspur, Wenatchee checkmallow, clustered lady's slipper, several grapeferns, Thompson's chaenactis, bristly sedge, bulb-bearing waterhemlock, pine broomrape, Ross' avens, and long-sepaled globe mallow, Spalding's Catchfly, and Ute Ladies. A number of other sensitive plants are also found in the subbasin (Andonaegui 2001).

Exotic Plant Species

Introduced plant species are having a significant deleterious impact on the vegetation of the subbasin. Exotic weed species include cheatgrass, knapweed, dalmation toadflax, and purple loosestrife. These species have become established in some areas and are capable of excluding native vegetation, particularly in non-forest, riparian or open forest conditions (CCCD 1996).

Table 9. Species of particular importance in the Wenatchee subbasin

Species	Scientific Name	WDFW PHS Criteria	State SOC Listing Federal ESA Status	Habitat Types
Amphibians				
Larch Mountain Salamander	*Plethodon larselli*	1	C/SC	Talus slopes, caves, boulders, cirques
Columbia Spotted Frog	*Rana luteiventris*	1	C/SC	Montane coniferous wetlands, riparian-wetlands
Birds				
Common Loon	*Gavia immer*	1,2	S/	Open water
Harlequin Duck	*Histrionicus histrionicus*	2,3	/SC	Riparian wetlands, open water
Northern Goshawk	*Accipiter gentiles*	1	C/SC	Interior mixed conifer
Bald Eagle	*Haliaeetus leucocephalus*	1	T/T	Riparian-wetlands, open water
Peregrine falcon	*Falco peregrinus*	1	E/SC	Cliffs, talus slopes
Flammulated Owl	*Otus flammeolus*	1	C/	Montane mixed conifer, Ponderosa pine
Northern Spotted Owl	*Strix occidentalis*	1	E/T	Interior mixed conifer, Lodgepole & Ponderosa pine
Vaux's Swift	*Chaetura vauxi*	1	C/	Montane coniferous wetlands, riparian-wetlands
White-headed Woodpecker	*Picoides albolarvatus*	1	C/	Ponderosa pine, montane mixed conifer, interior mixed conifer
Golden Eagle	*Aquila chrysaetos*	1		Shrubsteppe, interior grasslands
Marbled Murrlet	*Brachyyamphus marmoratus marmoratus*	1	T	Montane coniferous wetland – crest of the Cascades
Yellowbilled Cuckoo	*Coccyzuz americanus*	1	C	Riparian wetland

Mammals				
American Beaver	*Castor canadensis*			Upland aspen, montane coniferous wetlands, riparian-wetlands
Western Small-footed Myotis	*Myotis ciliolabrum*	2		Talus slopes, cliffs, Ponderosa pine
Gray Wolf	*Canis lupus*	1	E/E	Lodgepole pine, sub alpine parklands, alpine grass/shrub
Black Bear	*Ursus americanus*			Urban and agricultural mixed environs, montane coniferous wetlands, Riparian-wetlands
Grizzly Bear	*Ursus arctos*	1	E/T	Montane mixed conifer, Lodgepole pine, montane coniferous wetlands, riparian-wetlands
American Marten	*Martes americana*	3		Alpine grass/shrub, montane mixed conifer, interior mixed conifer, riparian-wetlands
Canada Lynx	*Lynx Canadensis*	1	T/T	Montane mixed conifer, interior mixed conifer, alpine grasslands
Mule Deer	Odocoileus hemionus	3		Ponderosa pine, riparian-wetlands, Interior mixed conifer, agricultural (everywhere)
Mountain Goat	Oreamnos americanus	3		Cliffs, talus slopes
Elk	Cervus elaphus	3		Sub alpine parkland, alpine grasslands, agricultural, urban mixed, montane mixed conifer
Fisher	Martes pennanti	1	E/SC	
Wolverine	Gulo gulo	1	C/SC	Talus slopes, caves

3.2.5 Aquatic/Fish Resources

The Wenatchee River is unique among subbasins in the upper Columbia region in that it supports the greatest diversity of populations and overall abundance of salmonids. There are core populations of sockeye salmon, steelhead, bull trout and both spring and later-run chinook salmon in the upper Wenatchee subbasin that are relatively strong, when compared to other populations in the Columbia basin.

Anadromous fish

The Washington state Salmon and Steelhead Stock Inventory (SASSI) has identified four spring chinook stocks in the Wenatchee subbasin; the Chiwawa River, Nason Creek, Little Wenatchee River, and White River stocks. A fifth stock, the Leavenworth NFH stock is unlisted and supports the only spring chinook fishery in the mid and upper Columbia basin. Spring chinook and steelhead trout are listed as endangered under the ESA. SASSI has also identified the Wenatchee River late-run chinook stock. It is likely that a fall run chinook salmon once used the lower Wenatchee River to varying extent, although very little information is available to substantiate this. For the purposes of this subbasin plan, fall and summer chinook life history types will be consolidated as late-run chinook. One stock of sockeye has been identified for this subbasin as well as one summer steelhead stock, the Wenatchee summer steelhead (WDF/WDW 1993).

Indigenous coho salmon no longer occur in the upper Columbia River region. By the early 1900s coho salmon populations were already decimated by lower Columbia River harvest rates, impassable dams, unscreened irrigation diversions, logging, mining, grazing, and water use practices in the tributaries. Through current and substantial efforts by the Yakama Nation, naturally reproducing coho salmon have been reintroduced into the Columbia Cascade Province. The restoration program is generally in its infancy but the YN and other resource managers intend to continue and expand the re-introduction effort in the Province.

Pacific lamprey is known to exist in the Wenatchee subbasin but at this time there is no empirical information to suggest population abundance or distribution.

Resident fish

A number of resident fish are present in the assessment units comprising the Wenatchee subbasin.

Table 10 lists the location of these species by watershed. The Wenatchee subbasin supports adfluvial, fluvial and resident forms of bull trout. The upper Columbia distinct population segment (DPS) of bull trout is listed as threatened (June 1998) under the federal ESA. Westslope cutthroat trout are fairly widespread within the subbasin, found mostly in the head water and higher elevation streams. Two species, the mountain sucker and Umatilla dace are Washington state priority habitat species and have state candidate listings.

Table 10. Resident fish present in the Wenatchee subbasin

Species Present	Assessment Units in the Wenatchee subbasin							
	White/Little Wenatchee	Chiwawa	Nason	Mainstem Wenatchee	Icicle	Mission	Peshastin	Chumstick
Bull Trout	X	X	X	X	X		X	
Westslope Cutthroat	X	X	X	X	X	X?	X	
Rainbow Trout	X	X	X	X	X	X	X	
Eastern Brook Trout	X	X	X	X	X	X		
Sculpin	X	X	X	X	X	X	X	
Northern Pike Minnow	X			X	X			
Redside Shiner	X			X	X	X		
Mountain Whitefish	X	X		X	X			
Sucker	X	X	X		X	X	X	
Bridgelip sucker				X	X			
Largescale sucker				X				
Kokanee salmon	X							
Pacific Lamprey	X			X	X			
Yellow perch				X				
Speckled dace				X	X	X	X	
Shiner perch				X		X		
Crappie				X		X	X	
Long nose Dace					X		X	
Long nose Sucker					X			
Chiselmouth				X				

Species Present	Assessment Units in the Wenatchee subbasin							
	White/Little Wenatchee	Chiwawa	Nason	Mainstem Wenatchee	Icicle	Mission	Peshastin	Chumstick
Mountain Sucker				X				

European carp have been introduced to Lake Wenatchee

3.3 Scientific Conceptual Foundation

3.3.1 Definition and Overview of a Scientific Conceptual Foundation

A conceptual foundation is a set of scientific theories, principles and assumptions, which in aggregate describe how a system functions. The conceptual foundation determines how information is interpreted, what problems are identified and, as a consequence, it also determines the range of appropriate solutions to achieve desired management goals. It is through the conceptual foundation that management goals are translated into the conditions within the system that are needed to achieve those goals; and management strategies which could achieve the appropriate or desired conditions (NPPC 1997). The importance of the conceptual foundation is emphasized in the above citations, and most thoroughly discussed in *A Conceptual Foundation for the Management of Native Salmonids in the Deschutes River* (Lichatowich 1998). The latter forms the basis for much of the conceptual foundation of this Wenatchee Subbasin Plan.

3.3.2 Purpose and Scope

The conceptual foundation plays a powerful, albeit often unrecognized, role in natural resource management and restoration programs. It forms the premise and framework from which management goals and actions are based. Management goals should be achievable within the logical framework of the conceptual foundation and conditions within the ecosystem should relate to each other in ways which are specified in the logical framework. Managers need to recognize and clearly describe the implications of strategies derived from our conceptual foundation.

Laws and policies typically form the basis for many management plans. Often, these are based on a set of theories, premises or simply ideas which in whole define a conceptual foundation. Although these theories or premises guide the development and implementation of a program, rarely are they explicitly stated. As long as the conceptual foundation remains unstated it cannot be reviewed, evaluated and debated in open forums. False assumptions, outdated science, unsupported principles and unintended consequences in the conceptual foundation cannot be identified and corrected unless they are explicitly stated and publicly discussed.

A conceptual foundation must address ecosystems at various scales. Clear definitions of ecosystems are always problematic because ecosystem function occurs at various temporal and spatial scales simultaneously. For example, organisms are a product of their native environment, but just as importantly, many environments are products of certain species and populations. Species like anadromous salmonids use many ecosystems and are very sensitive to environmental changes. Changes in one ecosystem, such as the ocean can change salmonid abundance in the fresh water environments, which in turn can alter environmental conditions for other organisms.

The focus and organization of the assessment, inventory, and management strategies of a subbasin plan should directly reflect the conceptual foundation. The foundation should also consider the increasingly broader geographic scales within which other fish and wildlife management plans or actions operate. For example, in the Columbia Basin, this means that the way the conceptual foundation views events at the smallest scale—the individual fish and its surrounding habitat—should be consistent with and mirror how the fish communities and habitat characteristics are viewed at the river reach scale, subbasin tributary, entire subbasin, multiple

subbasins or regional scale (e.g., Evolutionary Significant Unit (ESU) scale), and aggregate Columbia basin anadromous fish stocks in the estuary and ocean environments. Ensuring conceptual consistency across multiple geographic scales in the management and recovery of fish, wildlife, and their habitats is a daunting challenge which has yet to be fully realized—primarily because the conceptual foundation at each geographic level is not explicitly stated and there has not been adequate communication and coordination regarding scientific principles and assumptions between the ever increasing numbers of management entities and governmental boundaries (i.e., local, state, and national) as geographic scale increases.

The conceptual foundation is defined at the largest geographic scale applicable to a planning effort. In this case, the Columbia Basin will usually be the largest geographic scale, although other out of basin scales may be appropriate for some migratory birds and the salt water life stage of anadromous fish. As the plan focuses with increasing detail on management strategies for smaller geographic areas, subbasin planners should then continue to check for conceptual consistency. The only current examples of an explicitly stated conceptual foundation are the "alternative conceptual foundations" of *Return to the River* and the NPCC's An Integrated Framework for Fish and Wildlife Management in the Columbia Basin (NPPC 1997), which are reviewed and synthesized in Lichatowich (1998).

3.3.3 Guiding Principles

Four sets of guiding principles derived from Lichatowich's (1998) synthesis in the Columbia Basin Conceptual Foundation introduce principles and corollaries relevant to the Wenatchee subbasin. These four guiding principles, in bold and shaded, have been modified to make them applicable to both fish and wildlife. Following them, and interspersed with the Guiding Principles are the thirteen numbered principles applicable to the Wenatchee Subbasin Conceptual Foundation with discussion.

The Columbia River is a natural-cultural system characterized by natural environmental variability and fluctuation in production. Salmon restoration and management must consider the whole ecosystem, natural as well as cultural, in the fresh water, estuary, and ocean. Suitable ecosystem attributes can be achieved by managing human interference in the natural habitat forming processes and by use of technology to support those processes. The use of technology to circumvent natural ecological processes should be avoided, if possible.

Principle 1. Strategies for recovery or maintenance of viable populations need to be evaluated within the context of the entire life history of the populations.

The Wenatchee Subbasin Plan can only identify, evaluate and prioritize alternative strategies for anadromous and migrating species recovery that can be fully implemented within the subbasin by authorized local, state, federal and tribal managers. The subbasin plan addresses strategies that can be implemented locally and that effect life stages that subbasin managers can influence or control through their decisions. However, planning and implementing actions for fish and wildlife within the Wenatchee subbasin must also consider out of basin affects, which will influence the success or failure of population recovery.

Ideally, populations should be tracked or accounted for throughout the geographical range of their life history to ensure that differential survival/mortality rates specific to that population can be evaluated in preparation of management or recovery strategies.

For species whose entire life history is confined to the Wenatchee subbasin, it is possible to make informed and logical decisions regarding all strategies necessary for management. For fish and wildlife species that spend a portion of their life history outside of the subbasin boundaries, management goals, the desired ecosystem attributes, and restoration strategies should generally be universal and integrated across the subbasin, eco-region (ESU), Columbia Basin, and full life history including estuary and marine scales to be successful. Where differing parts of a population's life history or habitat are managed by different entities, those populations and their interactions with the environment, with other populations, and their responses to management actions should be monitored and communicated in a common language. The broader and more inclusive the management planning process becomes, the greater the potential that these common and integrated goals, attributes, strategies will be successful in recovering far-ranging migratory species.

Principle 2. The Wenatchee Subbasin contains an evolving, natural-cultural system that will continue to change into the future.

The Wenatchee subbasin's natural and cultural elements must be considered in any management planning. Unless a balance between the needs and constraints of the natural and cultural components of the ecosystem is achieved, the status of many of the native fish and wildlife populations in the basin will continue to decline. To move to ward a balance, science and resource managers need to present the values and benefits of the natural elements and must show when their benefits outweigh the costs of protection and recovery. In addition, it must be made clear that healthy natural and cultural elements are not mutually exclusive.

Principle 3. Important environmental attributes that determine the distribution and productivity of fish and wildlife populations have been influenced by human activity in and outside the subbasin.

Cultural impacts have occurred at different rates and to varying degrees throughout the subbasin. For example the transportation system and rural along the mainstem Wenatchee River and along Chumstick, Peshastin and Nason creeks has directly altered floodplain, riparian and in-channel characteristics to a large degree. Many culverts or other obstacles have reduced or eliminated fish passage into areas that could significantly contribute to increased productivity and/or life history diversity. Possibly one of the greatest impacts to overall stream condition is channel and riparian simplification, present throughout much of the subbasin which has dramatically altered channel morphology, habitat diversity and geo-fluvial processes important for maintaining critical ecological functions. These changes undoubtedly have affected habitat use and the relationship many of these species once had to these effected areas.

Many habitat attributes, now out of synch or timing with the life history strategies that fish and wildlife populations had evolved prior to those alterations, may be lethal to fish or wildlife for part of the year, or have directly resulted in habitat loss. These alterations have resulted in decreased abundance and productivity, and changes in the distribution of native fish and wildlife populations.

Fish and wildlife productivity requires a network of complex, interconnected habitats that are created, altered, and maintained by natural physical processes in terrestrial, fresh water, estuary, and ocean areas. Management and restoration goals depend on achieving suitable ecosystem attributes.

Principle 4. Viable native fish and wildlife populations are dependent upon the natural environment and the natural processes that sustain them.

Discovering which of the natural processes most influence various populations is fundamental to management direction. Usually the original conditions represent the best models we will ever have. Subbasin planners and managers must avoid a common tendency to become excessively or exclusively species-centric in developing management strategies. Instead, focusing on restoring terrestrial and aquatic/riparian ecosystem health and function will provide habitat attributes that will enable holistic management or recovery for larger assemblages of native biota.

Principle 5. Changes to the physical characteristics and connectivity of the Wenatchee subbasin have contributed to the decline of native fish and wildlife populations.

Understanding the predevelopment conditions, the current conditions, the trend in these conditions, and their effect on ecosystem attributes is crucial to formulation of recovery strategies. Throughout much of the Wenatchee subbasin, management and recovery of fish and wildlife productivity requires an emphasis on restoration of the natural range of hydrological attributes and fluvial processes, reconnection of isolated physical habitat, and protection or reintroduction of populations once reconnection has been achieved.

Principle 6. Changes to the physical characteristics of the alluvial valley and floodplains of the Wenatchee River have resulted in changes in ecosystem attributes.

Changes to the physical characteristics of the alluvial valley and floodplains of the Wenatchee River have resulted in changes in relatively largescale ecosystem attributes. Some of these changes are reversible from a societal perspective; some are not. Floodplain management and restoration where possible is a key to successful recovery of physical and biological characteristics that support native fish and wildlife species.

Principle 7. The historical distribution of fish and wildlife populations and species in the Wenatchee Subbasin was controlled by relatively abrupt changes in physical attributes, i.e. steep environmental gradients.

In the Wenatchee subbasin, examples of environmental gradients existed at:

- Mouths of the lakes (thermal control or feeding stations for bull trout)
- Presence of lakes (refuge for cutthroat or rearing for sockeye juveniles)
- Stream temperature (segregation of species)
- Stream gradients (slope) (provision to habitat types more conducive to certain species or life stages)
- Aspect, elevation or precipitation-based changes in vegetation zones (such as the forest/shrubsteppe interface)

Changes to or elimination of the environmental gradients are expected to affect the presence and distribution of species or populations. Not all species respond in the same way to a similar gradient. Increasing the summer water temperature and lowering the winter temperature would have a powerful effect on aquatic species distribution and life history. Similarly, reducing the quality and quantity of "edge effects" from vegetative interfaces can significantly reduce habitat diversity required for many species to thrive.

Species diversity and the biotic community are a reflection of the ecosystem attributes. The co-evolved assemblage of species share requirements for similar ecosystem attributes and those attributes can be estimated by intensive study of focal or indicator species.

Principle 8. For aquatic and fish related interests, selection of a broad range of focal species provide a basis for developing holistic management strategies. For terrestrial and wildlife related interests, the selection of focal habitats and related focal species provide a basis for developing holistic management strategies.

Bull trout, cutthroat trout, sockeye, coho, spring chinook, late-run chinook, steelhead, and Pacific lamprey are the aquatic focal species for the Wenatchee subbasin. Through evaluating and planning for these species we assume that viable and sustainable ecosystem function and processes occurs in most geographic areas for important floodplain and riverine associated habitats.

In the case of terrestrial wildlife, focal habitat types can often be characterized by vegetation patterns. By maintaining adequate quality, quantity and connectivity of key vegetative communities we assume that viable and sustainable habitats are available and ecosystem function occurs over a wide range of the focal species. Ponderosa pine forests and woodlands, shrubsteppe and riparian habitats are the terrestrial focal habitats which cover most of the mid and low elevation areas within the subbasin.

Viability, a key concept in the context of conservation planning, refers to the ability of a species or a community/ecological system referred to in this document as focal habitats to persist over some specified time period. Species viability at the population level is affected by chance events that may dictate whether a species remains viable or goes extinct. Three general factors generally referring to size, condition, and landscape context, characterize community or ecological systems viability:

- demography of component species populations
- internal processes and structures among these component species
- landscape level processes that sustain the community or system

Principle 9. The scientific concept of environmental stress is a legitimate means to evaluate the degree to which a threat to an environment by natural or human induced stressors may result in significant and undesired ecological changes or the vulnerability of an environment to those stressors.

Environmental stressors such as an altered fire regime, rapid spread of invasive species or pathogens, or altered habitat composition can affect environmental conditions at relatively small and large scales. Environmental stressors operate on habitat size and condition as well as

landscape-scale attributes. The sources of these stresses are both natural and human-caused. Understanding the causes and likelihood of environmental stressors provides for long term perspective of how future environmental conditions may relate to long term management goals. The combination of stresses and sources provides a deeper analysis of potential viability impairment, thus forming a basis for management strategies.

Principle 10. Fish and wildlife are components of their own environment.

Inter and intra-specific competition are the drivers for species abundance, fitness and life history diversity within a given species assemblage. Restoration of individual populations may not be possible without restoration of other fish or wildlife populations with which they co-evolved. Beyond direct relationships between various populations, fish and wildlife alter key habitat characteristics (e.g., nutrients, cleaned spawning beds, beaver ponds, forest understory, etc.) which can directly and indirectly affect other species/populations by changing important environmental characteristics.

Life history, genetic diversity, and metapopulation organization are ways that fish and wildlife adapt to their habitat. Diversity and population structure are how fish and wildlife species cope with spatial and temporal environmental variations. Such diversity promotes production and long term persistence at the species level.

Principle 11. Most native fish and wildlife populations are linked across large areas which decrease the possibilities for extinctions or extirpations. An important component for recovery of depressed populations is to work within this framework and maintain or recreate largescale spatial diversity.

Attempting to maintain or restore populations outside a framework of largescale spatial diversity will be difficult or impossible. Management of Wenatchee subbasin fish and wildlife populations in the wild and in the hatchery environment should include strategies to maintain a close connection to the ecosystem attributes that influence and shape the population (i.e., environmental selective pressures), while also allowing for gene flow across populations. Any program to restore fish and wildlife to the Wenatchee subbasin must be capable of detecting and monitoring new, locally adapted life histories, if and when they occur in unique habitats.

Reintroduction or supplementation programs for fish or wildlife should concentrate on specific environments within the basin, selection of an appropriate stock for reintroduction to that environment or locally adapting a donor stock where a local stock no longer exists. When supplementing native populations, the facilities and programs should mimic the native environment as closely as possible. For example, in the hatchery environment, this includes maintenance of life history diversity such as spawn timing, matching hatchery incubation temperatures to the natural incubation environment, and simulating the natural rearing environment in the hatchery to the extent feasible.

Population management using supplementation must consider habitat quality and quantity to determine if existing habitat has the carrying capacity to support the number of fish or wildlife needed for genetic expression and to meet population goals.

Principle 12. Populations with the least amount of change from their historic spatial diversity are the easiest to protect and restore, and will have the best response to restoration actions.

The ability to predict population responses to changes in the environment is highest for those populations that are closest to their pre-settlement population structure. At some point along the scale from intact populations to former populations that have had entire metapopulation (groups of related populations that share genes at low rates over time) extirpated from the basin and adjacent basins, emphasis on recovery actions is better focused on rebuilding population structure than on habitat restoration. If the goal of cost- effective restoration is to be achieved, subbasin planners need to assess the optimal mix of habitat restoration and population structure restoration to achieve biological goals.

Populations that have multiple life histories (e.g., multiple locations or times where rearing takes place, multiple ages/times of year when out-migration occurs, multiple ages at sexual maturity, multiple spawning areas) minimize risk to the population as a whole. These life history strategies are linked to population structure and genetics.

Principle 13. All else being equal, small populations are at greater risk of extinction than large populations, primarily because several processes that affect population dynamics operate differently in small populations than they do in large populations.

In some cases, small populations will need measures in addition to habitat protection and/or restoration if they are to survive into the future. Such measures may include specific forms of artificial production (broodstock collection programs for supplemented salmonid populations), artificial introduction from outside the population, or special consideration where habitat alterations or restoration modifies the only known sites where a particular life history is expressed.