Deschutes Subbasin Plan
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Executive Summary

1. Purpose and Scope

The Deschutes Subbasin Plan shares the vision and cooperation of numerous people who are committed to restoring and/or sustaining healthy fish, wildlife and plant communities, water quality and instream flows in the Deschutes watershed. Many stakeholders took an active role in its formation including fish and wildlife managers, tribes, governmental agencies and citizens. This wide involvement reflects the foundation of the planning process — that the responsibility of subbasin planning ultimately lies with the people of the Deschutes Subbasin.

The Deschutes Subbasin Plan will ultimately be adopted as part of the Northwest Power and Conservation Council's Columbia River Basin Fish and Wildlife Program. It and similar plans for other Columbia River subbasins that were prepared through the Council's Fish and Wildlife Program, will help direct Bonneville Power Administration funding of projects that protect, mitigate and enhance fish and wildlife that have been adversely impacted by the development and operation of the Columbia River hydropower system. The Council, Bonneville, NOAA Fisheries, and U.S. Fish and Wildlife Service will use adopted subbasin plans to help meet the requirements of the 2000 Federal Columbia River Power System Biological Opinion. NOAA Fisheries and USFWS will also use the plans as building blocks for recovery planning for threatened and endangered species.

The foundation of the Deschutes Subbasin Plan is the belief that the physical and cultural environments of the Deschutes Subbasin — and larger Columbia River Basin — control the distribution, composition, and structure of fish and wildlife communities and populations in the watershed. These environments extend beyond the banks of the Deschutes River and tributaries, and reach from ridge top-to-ridge top. Consequently, strategies are designed to protect and restore the functions of natural processes within the subbasin. They include direction to protect, restore and expand core production areas for focal fish and wildlife species in the watershed. Strategies focus on restoring and reconnecting fragmented stream reaches; increasing instream flows and returning seasonal flows to more natural flow regimes; restoring overall watershed health to increase water infiltration, retention and permeability rates, and soil stability; and protecting existing critical habitats that currently provide high quality habitat conditions.

The Deschutes Subbasin Plan consists of three parts:

- The Assessment forms the scientific and technical foundation for development of the Deschutes Subbasin vision, objectives and strategies.

- The Inventory summarizes fish and wildlife protection, restoration and artificial production activities and programs that have already occurred in the subbasin or are currently being implemented.

- The Management Plan — the heart of the subbasin plan — defines the environmental and biological vision, objectives and strategies specific to fish and wildlife within the Deschutes Subbasin. The management plan has a 25-year planning horizon. It includes direction for research, monitoring and evaluation.

The development of the subbasin plan will be iterative. The plan is a living document and will be updated and refined through adaptive management, research and evaluation. It will be maintained to reflect new direction of other agencies and stakeholders. Information and direction in the subbasin plan will be revisited and updated through the Northwest Power and Conservation Council's Rolling Provincial Review Process once every three years.

2. Subbasin Planning Process

The Deschutes Coordinating Group (DCG) led the Deschutes Subbasin planning process. The DCG addresses natural resource issues from a subbasin-wide perspective. The group includes representatives from subbasin organizations, watershed councils, cities, counties, irrigation districts, hydropower operators, state agencies, and federal and resource management agencies. All meetings of the DCG have been open to the public and participation of others interested in the subbasin planning effort has been, and continues to be, encouraged.

The overall purpose of the DCG's planning efforts goes beyond the requirements of the Northwest Power and Conservation Council's subbasin planning process. The DCG seeks to develop a watershed restoration plan that identifies and prioritizes actions needed to:

- *Protect and enhance streamflows to meet water quality standards, instream water rights, fish and wildlife habitat objectives and existing water rights;*

- *Maintain the resource land base in the subbasin, consistent with acknowledged comprehensive land use plans, and the economic viability of the resource-based economy in the subbasin;*

- *Meet municipal and industrial water needs over the next 50 years; and*

- *Promote sustainability and conservation consistent with the custom, culture and quality of life in the subbasin.*

Fish and Wildlife technical teams with participants from ODFW, the Warm Springs Tribes, state and federal natural resource agencies, watershed councils and the public played an essential role during the planning process. These technical experts shared in-depth knowledge needed to characterize fish and wildlife populations and habitat attributes in diverse and widespread Deschutes River drainages. Their input was also critical in the development of management strategies to protect and restore focal populations.

Overall Planning Approach

Subbasin planners worked with the technical teams and DCG to make several key decisions that focused the scope and breadth of the planning effort. They selected focal fish and wildlife species that were then used to characterize the status, functions and management actions in the subbasin. They also divided the Deschutes watershed into eight different assessment units with similar climatic, hydrologic, biologic and geologic characteristics.

Focal Species

Five aquatic species and seven terrestrial species in the Deschutes River Subbasin were chosen as the focal species for the subbasin plan. The five aquatic focal species include Chinook salmon, steelhead/redband trout, bull trout, sockeye salmon and Pacific Lamprey. The seven terrestrial focal species include: American beaver, Columbia spotted frog, white-headed woodpecker, mule deer, Greater sage grouse, Columbian sharp-tailed grouse, and golden eagle. These five aquatic species and seven terrestrial species are all indigenous to the Deschutes Subbasin.

Focal species were selected based on their significance and ability to characterize the health of the ecosystem and the effectiveness of management actions. Criteria used in selecting the focal species included a) designation as a federal threatened or endangered species, b) cultural significance, c) local significance, and d) ecological significance, or ability to serve as indicators of environmental health for other aquatic or terrestrial species.

Assessment Units

Because of the size and diversity of the Deschutes Subbasin, the planning team divided the watershed into eight smaller assessment units. The assessment units generally display unique physical characteristics, and often support different salmonid populations and life history characteristics because of their differing environmental conditions. The eight assessment units and their unique characteristics include

- **Lower Westside Deschutes Assessment Unit:** Lower Deschutes River from RM 0 to RM 100, the Warm Springs River and Shitike Creek, and all small tributaries entering the lower Deschutes River, except for Buck Hollow, Bakeoven, and Trout creeks. The assessment unit provides important spawning and rearing habitat for fall and spring Chinook, summer steelhead, redband trout, bull trout and Pacific lamprey.

- **White River Assessment Unit:** the White River watershed above White River Falls (RM 2). The assessment unit supports production of unique redband trout populations that are genetically and morphologically different from lower Deschutes redband trout. White River Falls prevents anadromous fish access to the assessment unit and isolates populations of redband trout and other resident fish above the falls from those downstream.

- **Lower Eastside Deschutes Assessment Unit:** Major Deschutes River tributaries draining the lower eastern portion of the Deschutes Subbasin, including Buck Hollow, Bakeoven, Trout and Willow creeks. Three of these systems —Buck Hollow, Bakeoven and Trout creeks — provide important

spawning and rearing habitat for summer steelhead in the Deschutes Subbasin. All the tributaries also support redband trout.

- **Lower Crooked River Assessment Unit:** Lower Crooked River drainage below Bowman and Ochoco dams, including lower Ochoco Creek and McKay Creek. The assessment unit supports several resident indigenous fish populations, including redband trout. The Pelton Round Butte Complex blocks all anadromous fish access to the drainage.

- **Upper Crooked River Assessment Unit:** Upper Crooked River drainage above Bowman and Ochoco dams, including upper Ochoco Creek, north and south forks of the Crooked River and Beaver Creek. Redband trout are the only native game fish left in the upper basin and reside primarily in the headwaters of smaller tributaries located on forest lands.

- **Middle Deschutes Assessment Unit:** The 32-mile reach of the Deschutes River from the Pelton Round Butte Complex (RM 100) to Big Falls (RM 132) and its two major tributaries, Metolius River and Squaw Creek. The two major tributaries in the assessment unit once provided important salmonid spawning and rearing habitat, and continue to provide important habitats for bull trout and redband trout populations. The drainages will provide important habitat for reintroduced salmon and steelhead when fish passage is restored at the Pelton Round Butte Complex.

- **Upper Deschutes Assessment Unit:** The upper Deschutes River drainage from Big Falls (RM 132) to Wickiup Dam (RM 222), including Tumalo Creek, Spring River, the Little Deschutes River and Fall River. Big Falls was historically considered the upstream limit of anadromous fish passage. The assessment unit supports resident redband trout.

- **Cascade Highlands Assessment Unit:** The Deschutes River drainages above Wickiup Dam, including the Cascade Lakes. The assessment unit supports redband trout. In addition, the Odell Creek/Odell Lake complex, which is also part of this assessment unit, supports a remnant population of bull trout that is the only known resident, non-reservoir, adfluvial population remaining in Oregon.

Assessment Tools

Subbasin planners used three assessment tools to evaluate biological and physical characteristics of the subbasin, and bring information together for the development of biological objectives. The fish assessment employed the Ecosystem Diagnosis and Treatment (EDT) and Qualitative Habitat Assessment (QHA) analyses to compare focal fish species needs during different life stages with the conditions existing in various stream reaches. The analyses integrated knowledge of the environmental attributes critical to fish with species-specific environmental requirements, reproductive potential and life history strategies to predict the performance of a population subject to current, historic or hypothetical environmental conditions. The wildlife assessment relied heavily on information from the Northwest Habitat Institute Interactive Biological Information System (IBIS). Historic and current habitats from IBIS were examined and compared to identify focal habitats, and to assess habitat changes that have occurred throughout the subbasin.

3. Foundation of the Subbasin Plan

Vision for the Deschutes Subbasin

The Vision describes the desired future condition for the subbasin. Crafted by the Deschutes Coordinating Group, it incorporates the conditions, values and priorities of a wide spectrum of stakeholders in the Deschutes Subbasin. The vision for the Deschutes Subbasin also is consistent with and builds from the vision described in the Northwest Power and Conservation Council's Columbia River Basin 2000 Fish and Wildlife Program.

The Vision for the Deschutes Subbasin is:

> *To promote a healthy, productive watershed that sustains fish, wildlife and plant communities as well as provides economic stability for future generations of people. An inclusive consensus-based process will be used to create a plan for the achievement of sustainable management of water quality standards, instream flows, private water rights, fish and wildlife consistent with the customs and quality of life in this basin.*

This vision of the Deschutes Subbasin framed the development of the biological objectives and thereby the strategies that are incorporated to change conditions within the subbasin.

Conceptual Foundation

A conceptual foundation was also developed for the Deschutes Subbasin during the planning process. This foundation summarizes the underlying ecological conditions that define how salmonid and lamprey producing ecosystems in the Deschutes watershed function. It recognizes that fish and wildlife are part of the physical and cultural landscape, and that by understanding how ecosystem functions affect the vitality of fish and wildlife populations, we can better define steps needed to sustain a productive ecosystem that will support these populations.

The Conceptual Foundation includes several guiding principles:

- *Fish and wildlife populations in the Deschutes Subbasin have complex life histories that respond to the subbasin's considerable variation in habitat conditions. Such diversity promotes production and long-term persistence at the species level and must be protected.*

- *The Deschutes Subbasin is part of a coevolving natural—cultural system. Suitable ecosystem attributes can be achieved by managing human interference in the natural habitat forming processes.*

- *Productivity of focal fish species requires a network of complex interconnected habitats.*

- *There is a physical connection between the upper and lower Deschutes Subbasin. Changes in land and water uses in the upper watershed could affect the stability of the lower river environment, and thus the distribution and performance of native salmonids. Potential impacts must be understood and considered.*

- *Activities outside the Deschutes Subbasin can have tremendous influence on salmonid production and genetics. Potential impacts of out-of-subbasin programs must be considered and addressed.*

Strategies identified in the Management Plan describe actions needed to fulfill the vision for the Deschutes Subbasin. They are also consistent with, and based upon, the guiding principles. While the vision is a policy choice about how the subbasin will be managed, the guiding principles describe our current understanding of the biological realities that will ultimately determine the success of various resource management solutions.

4. Subbasin Description and Assessment

Physical and Human Landscape

The Deschutes Subbasin stretches over 10,700 square miles of land in central Oregon. Covering eleven percent of Oregon's land area, the Deschutes River subbasin is larger than other Oregon watersheds, except the Willamette. The subbasin extends west to the crest of the Cascade Mountains, south to lava plateaus, east into the Ochoco Mountains and to the plateau between the Deschutes and John Day Rivers, and north to its confluence with the Columbia River. Its length reaches 170 air miles from peaks in the Cascade Mountains to where it joins the Columbia River, 205 miles from the Pacific Ocean. In width, it extends up to 125 miles from the eastern slopes of the Cascades to the western slopes of the Ochoco Mountains, and over the high desert landscape that covers much of the subbasin's interior.

The headwaters of the Deschutes River and most major tributaries receive large amounts of precipitation, but much of the subbasin lies in the rain shadow of the Cascade Mountains and is sheltered from western Oregon's heavy rainfall. Average annual precipitation amounts to more than 100 inches on the eastern slopes of the Cascades, mostly as snow, but drops to only 40 inches in the Ochoco Mountains and 10 inches at lower central locations.

Land ownership in the Deschutes Subbasin is about 51 percent public, 7 percent Tribal, and 42 percent private. The federal government owns and manages most public land in the subbasin, including three national forests, one national grassland and one Bureau of Land Management District. Most of the public land lies in the upper watershed. Lands of the Warm Springs Tribal Reservation extend over approximately 641,000 acres and lie mostly in the lower Deschutes River subbasin. Lands in private ownership cover much of the lower and interior of the subbasin. Many of these private lands support agricultural, forest and range uses.

Population growth in the upper and middle Deschutes watershed continues at a tremendous rate. Deschutes County continues a 20-year trend of leading the state with the highest population growth. The county's population grew about 54 percent between

1990 and 2000 (Hough 2002) and growth is projected to continue. Crook and Jefferson counties, in the central and eastern Deschutes watershed, have also experienced higher levels of growth than other areas in the state. Population growth continues at a much slower rate in Wasco and Sherman counties in the lower Deschutes watershed.

Water Resources

In a natural state, the Deschutes River displayed a unique flow regime that sets it apart from other eastern Oregon rivers. The U.S. Reclamation Service recognized the river's unique character in 1914 and reported

> *"The flow of the river is one of the most uniform of all streams in the United States, not only from month to month, but also from year to year."*

The steady flows through the length of the Deschutes River were primarily due to the volcanic geology of the upper subbasin and substantial groundwater storage. Porous volcanic soils and lava formations absorb much of the snow and rain that falls on the Cascade Basin, creating a large underground aquifer. Much of this groundwater surfaces as springs in the upper and middle watershed. As a result of spring releases, the Deschutes River near its confluence with the Columbia River has a mean monthly flow ranging from 4,388 cfs in August to 7,511 cfs in February (Deschutes River at Moody). The highest monthly flows usually occur in early spring because of snowmelt in the Cascade Range. The lowest flows typically occur in late summer during July, August and September. The average annual discharge for the Deschutes River Subbasin is 4.2 million-acre feet, with the lower watershed contributing about 1.2 million-acre feet to this runoff (O'Connor et al. 2003).

Natural flows in tributaries are often more variable than those in the mainstem Deschutes River. Annual, and sometimes daily, stream flows are particularly changeable in eastside tributaries draining semi-arid lands in the Cascade rain shadow that do not receive abundant groundwater discharges. Stream flows in westside tributaries that drain the wetter, cooler slopes of the Cascades and benefit from groundwater and surface water are generally less variable. For example, flows in the Crooked River are highly variable, while those in the Metolius River fluctuate little.

Today, water regulation by upstream reservoirs and irrigation diversion systems alters the Deschutes River's stable natural flow pattern. Two main water projects on the upper Deschutes River, Crane Prairie and Wickiup Dam, regulate flows in the upper and middle Deschutes River. Water storage and releases create very low flows in the upper Deschutes River above the City of Bend during the winter, when reservoirs are being filled, and very high flows during the summer irrigation season, when water is being released from the reservoirs. Six irrigation diversion canals remove water from the Deschutes River near Bend. Consequently, water storage reduces flows in the middle Deschutes during winter months and irrigation withdrawals reduce flows during summer months. Natural flows in the Crooked River are altered through water storage and releases at Bowman and Ochoco Dams, and other smaller reservoirs, as are flows in the White River system. Flows in the Deschutes mainstem improve substantially near the Pelton Round Butte Complex with spring releases and tributary surface flow.

Water quality in the Deschutes Subbasin varies from pristine to degraded. Some changes in water quality occur naturally because of differences in geography, climate

and vegetation. For example, because of their different environmental attributes, water temperatures in most streams on the lower eastside of the subbasin rise naturally to higher levels than those on the west side of the subbasin.

Focal Species and Habitats

The rich landscape and unique flow regime of the Deschutes River subbasin provide a wide variety of habitats for fish and wildlife. Stable flows and habitats in the lower Deschutes River produce healthy salmon, steelhead and resident fish populations. They also support the seasonal migration and rearing habitat for fish produced in tributaries — which often exhibit very different climates, geology and vegetative conditions, and produce fish populations that reflect these differences. Wildlife habitat conditions also vary throughout the watershed. These habitats range from alpine to semi-arid desert areas and support a wide number of big game and furbearing species, including elk, deer, antelope, black bear, beaver, mink, otter, and bobcat, as well as more than 100 species of birds.

Focal Fish Species

Anadromous fish historically ranged as far as Big Falls (RM 132) in the Deschutes Subbasin, but today are restricted to areas below the Pelton Round Butte Complex (RM 100). Spring Chinook and summer steelhead production in the subbasin may expand in the near future if passage is restored past the Pelton Round Butte Complex.

- **Chinook salmon** are an indigenous anadromous species in the Deschutes Subbasin with strong ecological and cultural value. Historically, they returned to the Deschutes Subbasin from spring until fall. Spring Chinook, usually the smallest of the Chinook, returned to the subbasin first. They spawned and reared in the mainstem Deschutes River below Big Falls and in the headwaters of several tributaries. The larger fall Chinook spawned in the lower Deschutes River mainstem. A summer Chinook run is believed to have also once returned to the Deschutes. However, this run was likely lost after construction of the Pelton Round Butte Complex.

  Today, spring Chinook spawning and rearing habitat is concentrated in several small geographic areas, though run information indicates that the stock is fairly healthy and productive (French and Pribyl 2003). Fall Chinook spawn and rear in the lower 100 miles of the Deschutes River mainstem. The size of this run varies considerably from year to year, but is now substantially larger than it was a decade ago.

- Redband trout are a hardy race of rainbow trout generally found in more arid regions east of the Cascade Mountains. Two distinct life forms of redband trout, **resident redband trout** and anadromous **summer steelhead**, are native to the Deschutes River subbasin. Redband trout remain a valued ecological and cultural resource in the Deschutes Subbasin and attract anglers from around the world.

  NOAA Fisheries has identified two demographically independent summer steelhead populations in the Deschutes Subbasin, which are included in the Mid-

Columbia ESU and have been designated as a threatened species under the federal Endangered Species Act. Rationale for this listing included the genetic risks posed to the wild population by thousands of stray, upper Columbia River Basin, hatchery-origin, steelhead.

- **Bull Trout** in the Deschutes Subbasin are federally listed as threatened. They are part of the Deschutes Recovery Unit, which encompasses the Deschutes River and its tributaries and contains two core bull trout habitat areas separated by Big Falls on the mainstem Deschutes River. The Odell Lake Core Area in the Cascade Range also supports a small remnant bull trout population. Bull trout also have cultural and ecological value in the subbasin. Bull trout included in the Deschutes Recovery Unit are considered at an intermediate risk, while those in the Odell Lake – Davis Lake population are at an increased risk of extinction (USFWS 2002).

- The **Pacific Lamprey** is an indigenous, anadromous species in the Deschutes Subbasin with cultural significance. Historically this species likely had the widest distribution of any of the anadromous species in the subbasin. Today it is confined to the Deschutes River and select tributaries downstream of the Pelton Round Butte Complex.

- **Sockeye salmon** in Suttle Lake, part of the Metolius River system, were an indigenous species that used Link Creek for spawning and Suttle Lake for rearing. While now extirpated from the subbasin, they were selected as a focal species because of their historic ecological value, tribal significance and potential for re-introduction if remedial fish passage issues at the Pelton Round Butte Complex are successful.

Focal Wildlife Species and Habitats

The Deschutes Subbasin displays a large number of wildlife species and habitats. Because of this, the subbasin wildlife assessment identified focal species and habitats. Focal species were selected because of their status as threatened or endangered, cultural significance, and/or value as an indicator of overall habitat condition. Focal habitats were identified based on the amount of decline and sensitivity of the habitat to alteration or degradation.

- **American beaver** was chosen as a focal species because of its unique habitat-altering role in riparian habitats. This unique species alters the riparian habitat by constructing dams across streams to form still-water ponds, building stick lodges in the ponds, felling large trees into the water, and transporting smaller woody material into the aquatic environment.

- The **Columbia spotted frog** represents species that require a permanent-water habitat. Immediate opportunities also exist for habitat restoration in its former range.

- The **white-headed woodpecker** serves as a focal species due to the unique large ponderosa pine tree habitat required by this species, which was of some special concern in the subbasin, and its role as a primary excavator of tree cavities that are used by other species.

- **Mule deer** serve as an example of species that use aspen groves, oak groves, and ungulate winter ranges.

- **Greater sage grouse** represents species with unique habitat requirements within the steppe habitats.

- The **Columbian sharp-tailed grouse** has unique habitat requirements that require a mix of riparian and grassland habitat types within the steppe habitat.

- The **Golden eagle** is protected by the Bald Eagle Protection Act and serves as an example of species that require cliffs and rimrocks for habitat.

Focal habitats evaluated in the wildlife assessment include: riparian wetlands and herbaceous wetlands, interior grasslands, shrub-steppe, Ponderosa pine forest and oak woodlands, lodgepole pine forests, large juniper woodlands, and rimrock and cliff habitat.

5. Key Assessment Findings

The QHA and EDT models provided information on the quantity and quality of stream and riparian habitat. The wildlife habitat assessment provided information about upland watershed habitat changes over the past 150 years. When the QHA/EDT and wildlife habitat information was considered together, it provided good insight into how the ecosystem has changed from the mid-1800's and why.

Assessment findings showed that while many people are now more aware of how different land and water management actions influence stream habitats and overall watershed health, and are changing their management practices, anthropogenic influences since the mid-1850s have weakened the natural biophysical processes that create and maintain healthy fish and wildlife habitats. Watershed conditions began to change as trappers aggressively removed beaver from subbasin streams. Ranchers, farmers and other settlers of European background followed the trappers, and their practices further modified the landscape.

Information generated during the assessments showed that, as the ecosystems in the semi-arid segments of the subbasin unraveled from changes in land use and watershed health, some fish and wildlife populations became isolated, fragmented or extirpated. The important role that beaver played to maintain valley water tables, instream habitat and riparian and floodplain function grew more evident. It also became evident that as important upland habitat types were converted or lost a number of wildlife species were directly impacted, as were watershed characteristics that influence stream flow and water quality.

The QHA, EDT and the wildlife assessment processes helped to identify key factors that have limited, or are limiting, ecological function and biological performance. For example, a general reduction in summer stream flow combined with a general increase in summer water temperatures appreciably reduced fish and wildlife populations and numbers in some stream drainages. The development of extensive irrigation systems

and hydroelectric projects placed seasonal and permanent barriers in a number of streams. Out-of-stream water use significantly diminished or altered the natural stream flow regimes. Watersheds degraded by western juniper and exotic plant invasions reduced capabilities to retain precipitation, and flashy stream flow regimes were often the result. These shorter duration, higher peak, stream flows contributed to the scouring or incision of a number of stream channels and loss of natural water storage features. The significant reduction, fragmentation or loss of some important upland habitat types associated with land management and development resulted in the extirpation of Columbia sharp-tailed grouse and the ESA-listing of the Greater sage grouse, as well as apparent reductions in numbers of other focal wildlife species.

Assessment results identified several key changes affecting production of the aquatic focal species in the Deschutes subbasin. Several of the changes also affected wildlife.

- Reduced fish distribution and connectivity from artificial obstructions has resulted in fish population fragmentation, isolation or extirpation.

- Conversion of native upland vegetation led to the introduction of exotic plant species and invasion of western juniper, and reduced the watershed's ability to collect, store, and slowly release runoff and maintain soil stability.

- Stream flow extremes, especially seasonally low or intermittent flows, are probably the most significant factors limiting fish production in much of the Deschutes River subbasin today.

- Reduced water quality, including high summer water temperatures, limited focal fish species distribution and productivity. It also reduced connectivity between populations and, in some cases, fragmented populations.

- Loss of riparian and floodplain function reduced habitat complexity, contributed to water quality deficiencies, accelerated erosion, reduced water quantity, lowered water tables, and reduced beaver numbers and distribution.

- Loss of instream habitat diversity and complexity reduced focal fish species carrying capacity. Instream habitat, including large wood, boulders or emergent or aquatic vegetation is important for formation and maintenance of pools, braided channels and backwaters.

- Interactions with hatchery fish from the Upper Columbia River Basin pose potential serious genetic risk to wild summer steelhead in the Deschutes subbasin. These interactions could have a long-term effect on the subbasin steelhead production through reduced resilience to environmental extremes and diverse survival strategies.

- Indigenous focal fish species have been negatively impacted by the introductions of exotic fish species. Brook trout are of special concern where they have displaced indigenous focal fish species, including redband and bull trout.

In addition, comparisons of historic (1860s) and current vegetative types during the wildlife assessment showed a large-scale loss of interior grassland habitat in the

subbasin. This estimated loss or conversion of over 600,000 acres of native grasslands since the mid-1800s created a major shift in wildlife habitat. In addition, large blocks of ponderosa pine, lodgepole pine and shrub-steppe habitats believed to have existed in 1860 have also been fragmented or converted to other habitat types of uses (IBIS 2004).

6. Management Strategies

During the assessment, it became apparent that it will take several decades to achieve the needed level of habitat recovery in many parts of the Deschutes Subbasin. Because the ecosystem's semi-arid nature, geology and vegetation restrict the pace of habitat restoration, remedial measures implemented to restore vegetative diversity and recovery of stream channel stability and diversity will require many years or decades to achieve the desired objective. Consequently, planners selected a twenty-five-year planning horizon for meeting subbasin objectives, instead of the ten to fifteen-year horizon suggested by the Council. This extended recovery period is particularly important for potential restoration of riparian and floodplain function, as well as channel aggradations. In some cases, earlier progress toward recovery of focal fish species will be made. Restoration of fish passage at manmade obstructions or unusual debris jams will frequently produce rapid response when fish begin to access historical fish habitat. The time required to implement these remedial fish passage projects could be substantially less than the time required for stream or upland habitat recovery to produce measurable increases in fish production.

Priority Reaches and Project Areas

During the subbasin assessment process, planners and resource managers concluded that for depressed, fragmented or isolated resident focal fish populations the most effective habitat and population restoration strategy would be to begin with recovery of core populations and core habitat. To provide needed direction, they identified key stream reaches that provide core habitat for focal fish species, including important spawning and rearing habitat, and important habitat for ESA-listed species. These stream reaches were earmarked as high priority reaches during the EDT and QHA analyses. The team determined that these stream reaches deserve high priority protection because of their importance in meeting desired biological objectives during the twenty-five-year planning horizon.

The fish technical team also identified stream reaches with high restoration value to focus future habitat restoration. Restoration of these reaches is needed to meet biological objectives within the planning horizon. These determinations reflected historical focal fish species use and potential for increasing focal fish production, distribution and re-establishing population connectivity. Further, the team identified ten high priority fish habitat restoration projects or scenarios that deserve immediate attention:

1. Trout Creek Fish Habitat Restoration Project
2. Squaw Creek Instream and Riparian Habitat Restoration Project
3. Middle and Upper Deschutes River Instream and Riparian Habitat Restoration Project
4. Lower Crooked River Instream and Riparian Habitat Restoration Project
5. Lake Creek and Link Creek Fish Passage Improvement Project

6. North Fork Crooked River Instream and Riparian Habitat Restoration Project
7. Beaver Creek Instream and Riparian Habitat Restoration Project
8. Tygh and Badger Creek Habitat Restoration Project
9. Lower Deschutes River Instream and Riparian Habitat Restoration Project
10. Pelton Round Butte Fish Passage Restoration Project

Overall Strategy for Habitat Restoration

Conclusions reached during the assessment formed the bases for an overall strategy to direct habitat restoration work in the subbasin. Under this strategy, habitat restoration will center on improving and expanding conditions for focal species in core habitats. The following direction will focus habitat restorations in the subbasin:

- Core habitats will be expanded downstream to build on the benefits of preceeding restoration work.
- In areas where headwater are degraded — or where the system is influenced by flashy or uncontrolled stream flows — habitat restoration for focal fish populations will take place progressively from the upper-most degraded reaches downstream, and restoration projects will include upland restoration work to maintain a ridge top-to-ridge top approach.
- Where headwater areas are in good condition, habitat restoration will begin in at the upper end of a degraded priority reach and work progressively downward.
- In areas where the system is hydrologically stable and habitat restoration is not at risk of loss from an uncontrolled flow situation, the most cost effective habitat restoration opportunities for restoring core fish populations may exist in lower watersheds. In such cases, these projects should be pursued, especially when opportunities become available to work with cooperating landowners.

7. Adaptive Management

The Deschutes Subbasin Plan is a living document. It reflects the current understanding of conditions in the Deschutes watershed. This understanding — as well as the biological objectives, management strategies and actions based on this understanding — will be updated through an adaptive management approach that includes research and evaluation. Under this approach, a structured process is activated to learn from ongoing management and research. Consequently, the subbasin plan contains direction for the development and implementation of a disciplined, and well coordinated, monitoring and evaluation program to help confirm scientific assumptions, resolve key uncertainties and provide the basis for performance tracking and adaptive management. Collecting monitoring data in a way that data can be “rolled-up” to larger scales is essential for information gathered at the scale of watersheds or subbasins to support evaluations at larger geographic scales, such as province or Evolutionarily Significant Unit. Information gained through this process will be used to refine biological objectives and develop new strategies to sustain fish, wildlife and plant communities, as well as provides economic stability for future generations of people in the Deschutes Subbasin.