Owyhee Subbasin Plan

Chapter 1 Executive Summary

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and

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Prepared for:

The Northwest Power and Conservation Council

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Disclaimer:

Final approval by the Northwest Power and Conservation Council is contingent upon a favorable review by the Independent Scientific Review Panel and meeting requirements for adoption as an amendment to the Council's Fish & Wildlife Program.

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Acknowledgements

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- Lisa Jim, Shoshone-Paiute Tribes
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- John Meisinger, Shoshone-Paiute Tribes
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- Lance Phillips, Malheur Co. SWCD
- John Urquidi, Landowner and Idaho Resident
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- Gary Johnson, Nevada department of Wildlife
- Duane LaFayette, Idaho Soil Conservation Commission
- Eric Leitzinger, Isaho department of Fish & Game
- Ray Lister, Bureau of Land Management
- Allyn Meuleman, U.S. Bureau of Reclamation
- Bradley Nishitani, GIS Consultant, BioAnalysts
- Robert Orr, Bureau of Land Management
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- Ray Perkins, Oregon Department of Fish & Wildlife
- Ed Petersen, Natural Resources Conservation Service
- Pat Ryan , Bureau of Land Management
- Chris Salove, Owyhee County Commissioner
- Clint Shock, Owyhee Watershed Council
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- Pamella Smolczynski, Idaho Department of Environmental Quality
- Cynthia Tait, Bureau of Land Management
- Walt Van Dyke, Oregon Department of Fish & Wildlife
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- Randy Wiest, Oregon Department of State Lands
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Citizens and Stakeholders who Attended Public Outreach Meetings:

- Lisa Jim, Shoshone-Paiute Tribal Member – Owyhee, Nyssa and Jordan Valley meetings
- Nancy Jackson, Riddle & Petan Rancher – Owyhee, NV meeting
- John Jackson, Petan Ranch – Owyhee, NV meeting
- Peter Jackson, Riddle & Petan Ranch – Owyhee, NV meeting
- Guy Dodson, Shoshone-Paiute Tribal Member & Rancher – Owyhee, Grand View and Jordan Valley meetings
- John Crum, Shoshone-Paiute Tribal Member – Owyhee, NV meeting
- Stephanie Zody, Shoshone – Paiute News – Owyhee, NV meeting
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- Tim Dykstra, Staff, Shoshone-Paiute Tribes – Owyhee and Grand View meetings
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- Herman Atkinis, Shoshone-Paiute Administration, Tribal Member – Owyhee, NV meeting

- Jennifer Martin, Owyhee Watershed Council, Ontario, OR – Owyhee, Grand View, Nyssa and Jordan Valley meetings
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- Derron Frederick, Landowner and Rancher (Grand View, ID) – Grand View meeting
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- Brian Collett, Landowner and Rancher, Oreana, ID – Grand View meeting
- Jeanette Hemenway, – Landowner, Grand View, ID – Grand View meeting
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- Kathy Pratt, Malheur Watershed Council, Ontario, OR – Nyssa meeting
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- Paul Skeen, Malheur Growers Association, Nyssa, OR – Nyssa meeting
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- Harry Smith, Landowner and Farmer Ontario, OR – Nyssa meeting
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- Lynn Jensen, Malheur County Extension Service, Ontario, OR – Nyssa meeting
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- Jay Chamberlin, Owyhee Irrigation District , Nyssa, OR – Nyssa meeting
- Ryan Martin, Owyhee Watershed Council, Adrian, OR – Nyssa meeting

- Dave Bunker, Landowner and Farmer / Oregon Farm Bureau Federation, Nyssa, OR – Nyssa meeting
- Lawrence Ziemer, Landowner and Farmer , Nyssa, OR – Nyssa meeting
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- Vernon Kershner – Landowner, Jordan Valley, OR – Jordan Valley meeting
- Elias Jaca – Landowner, Murphy, OR – Jordan Valley meeting
- Forest Fretwell – Landowner, Jordan Valley, OR – Jordan Valley meeting
- Jerry Raburn – Landowner, Jordan Valley, OR – Jordan Valley meeting
- Bill Lowry – Landowner, Jordan Valley, OR – Jordan Valley meeting
- Tim Lowry – Landowner, Jordan Valley, OR – Jordan Valley meeting
- Ed Dowell – Owyhee Watershed Council and Landowner, Rome, OR – Jordan Valley meeting
- Robert Corbari – Owyhee Watershed Council and Landowner, Rome, OR – Jordan Valley meeting
- Matthew Bowen – Landowner, Jordan Valley, OR – Jordan Valley meeting
- Martin Andre – Owyhee Watershed Council and Landowner, Arock, OR – Jordan Valley meeting
- Jim Elordi – Landowner, Jordan Valley, OR – Jordan Valley meeting
- Dennis Stanford – Owyhee Watershed Council and Landowner, Jordan Valley, OR – Jordan Valley meeting
- Jayne Collins – Owyhee Watershed Council and Landowner, Jordan Valley, OR – Jordan Valley meeting
- Mike Hanley – Landowner, Jordan Valley, OR – Jordan Valley meeting

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1 Executive Summary – Owyhee Subbasin Plan

The Owyhee Subbasin is a vast and remote area with few people and restricted water sources compared to most of the Columbia Basin. The Owyhee River system has always been the key factor for sustainability of people, fish and wildlife in this region. For millennia, Native Americans along with the fish & wildlife resources they depended on for survival developed lifeways (niches) adapted to the variable natural environment of the high desert. The federal government developed the water resources by building a network irrigation dams and canals -- to provide the infra-structure needed to support the agriculture-based economy of European settlers (Bureau of Reclamation, Owyhee Project). Construction of Owyhee Dam in 1933 eliminated anadromous fish and changed the ecosystem for the foreseeable future. Wildhorse Dam and reservoir was built to provide water to the Shoshone and Northern Paiute tribes and bands of the Duck Valley Indian Reservation – in an attempt by the federal government to change their lifestyle to an agricultural economy. The ecological integrity of the Owyhee Subbasin has been adversely affected by water- and land-management practices and climatic conditions since the immigration of European settlers in the early 1800's.

In 1936, Bob Marshall identified the Owyhee as the second largest roadless desert area in the nation, however, this expansive complex of rivers and sage steppe has not yet been nationally recognized or protected for its unique biological, geological, and cultural values. The Owyhee subbasin supports a diversity of wildlife and plant species. Much of the subbasin has been identified as a "Center of Biodiversity" and rated as having high ecological integrity by ICBEMP (Quigely and Arbelbide 1997). This subbasin supports the largest population of California bighorn sheep in the U.S. as well as being part of the largest contiguous center of shrub-steppe biodiversity in the Interior Columbia River Basin (Quigely and Arbelbide 1997, Schnitzspahn et al. 2000). The Owyhee-Bruneau Canyonlands is nationally recognized as an ecologically significant and unique environment. The purpose of the Owyhee Subbasin Plan is to provide a systematic evaluation of fish, wildlife and habitat within the subbasin and to formulate a management plan based on best science and direct involvement of local stakeholders.

Origin of the name "Owyhee"

In 1818, the Northwest Fur Company sent Donald Mackenzie on an expedition to explore the lower Snake River Country. Several of the expedition's members were from the Hawaiian islands, termed "Owyhees," in another spelling of the European explorers'. Subsequently, three Owyhees went to explore an unchartered river in southwest Idaho, failed to return to the Rendezvous at Fort Boise that spring, and were never seen again. The river and surrounding region were named for the Hawaiians, and Owyhee Subbasin is currently the only topography with that old phonetic spelling (Source: http://www.sierraclub.org/owyhee/natural_history.asp).

1.1 Subbasin Plan Overview

The Owyhee Subbasin summary was produced in 2002 as part of the Northwest Power and Conservation Council's (NPCC's) Rolling Provincial Review Process (Perugini et al. 2002). It was the first attempt to synthesize information from all management and jurisdictional units in order gain a comprehensive understanding of fish and wildlife issues and needs in the subbasin. The Council's purpose for developing subbasin summaries was to provide context for fish & wildlife project proposals during the FY2002 provincial reviews -- until a more extensive subbasin plan could be developed. At this juncture, a more comprehensive Owyhee Subbasin Plan is developed based on the information gathered via the subbasin summary process, a more comprehensive technical analysis, an inventory of existing restoration activities, and the development of a fish & wildlife management plan that incorporates the complete spectrum of stakeholder perspectives obtained from input from the Owyhee planning team and public outreach meetings.

The Northwest Power and Conservation Council designated the Owyhee Coordinating Team — consisting of the Shoshone-Paiute Tribes and the Owyhee Watershed Council — as the lead entity for the Owyhee Subbasin planning effort in June 2003. The primary desired outcomes of this planning effort are:

- A professional, comprehensive, and science-based fish and wildlife assessment / plan of the Owyhee Subbasin, and;
- A comprehensive, locally-supported management plan for fish and wildlife resources within the Owyhee Subbasin.

On October 1st 2003, the Shoshone-Paiute Tribes, as fiscal agent for the Owyhee Coordinating Team contracted with Steven Vigg & Company – to be the coordinator for the development of the Owyhee Subbasin Plan (OSP). Steven Vigg & Company and its subcontractor BioAnalysts, Incorporated – with the direct input from the Owyhee Technical and Planning Teams – has conducted an objective technical assessment and unbiased synthesis of all available information into the contract deliverables and ultimately, the synthesis of the OSP. The deliverables of this contract between the Shoshone-Paiute Tribes and Steven Vigg & Company are to compile, evaluate, edit, and write the:

(1) Owyhee Subbasin Technical Assessment (Chapter 2 of this document);
(2) Owyhee Subbasin Inventory of Existing Restoration Activities (Chapter 3);
(3) Owyhee Subbasin Management Plan (Chapter 4).

During the course of the Owyhee Subbasin Planning Project – from September 15th 2003 through May 28th 2004 – we convened and facilitated twenty-two planning and technical meetings, technical workshops, and public outreach meetings that were open to all team members and interested parties. The following list quantifies the participation of individuals in the Owyhee Subbasin Planning Process (who attended more than one meeting):

• Steven Vigg (Contractor)	Project Coordinator	22
• Tim Dykstra (SPT)	Technical team	20
• Jennifer Martin (OWC)	Planning team	16
• Guy Dodson (SPT)	Planning team	14
• Tom Dayley (NWPPC)	Planning team	14
• Jerry Hoagland (OWC)	Planning team	13
• Pam Druliner (BLM)	Technical team	11
• Lisa Jim (SPT)	Planning team	11
• Pamella Smolczynski (IDEQ)	Technical team	11
• Keith Paul (USFWS)	Technical team	10
• Carl Hill (OWC)	Planning team	10
• Leonard Beitz (Resident)	Planning team	8
• Eric Leitzinger (IDFG)	Technical team	7
• Duane LaFayette (ISCC)	Technical team	7
• Ray Perkins (ODFW)	Technical team	5
• John Urquidi (Resident)	Planning team	5
• Randy Wiest (ODSL)	Technical team	5
• Jim Desmond Owyhee (NRC)	Planning team	4
• Dave Ferguson (ISCC)	Technical team	4
• John Meisinger (SPT)	Planning team	4
• Bradley Nishitani (BioAnalysts)	Technical team	4
• Gayle Batt (IWUA)	Planning team	3
• Bonnie Hunt (BLM)	Technical team	3
• Ed Petersen (NRCS)	Technical team	3
• Lance Phillips (Malheur Co. SWCD)	Planning team	3
• Clint Shock (OWC)	Technical team	3
• Jay Chamberlin (OID)	Planning team	2
• Jeff Fryer (CRITFC/TOAST)	Technical team	2
• Ross Nishihara (Farmer)	Planning team	2
• Chuck Slaughter (U of I / OWC)	Technical team	2
• Jerry Taylor (BLM)	Technical team	2
• Jack Wenderoth (BLM)	Technical team	2

Steven Vigg & Company developed a web site – www.Owyhee.US – to facilitate collaborative input for the development of the Owyhee Technical Assessment, Inventory of Activities and Draft Subbasin Management Plan via a dynamic media. Throughout the course of the Owyhee Subbasin Plan development all activities, meeting agendas and notes, products, and draft documents were available on Owyhee.US for transparent access by all subbasin team members, stakeholders and other interested parties. The web site – www.Owyhee.US – is essentially a living three dimensional document that, in its entirety, is the Owyhee Subbasin Plan.

1.2 Summary of Chapter 2 – Technical Assessment

1.2.1 Subbasin Overview

General Description

The Owyhee subbasin encompasses 11,049 square miles of southwestern Idaho, southeastern Oregon, and north central Nevada (Figure 1.1). The Idaho portion of the subbasin is bordered to the east by the Owyhee Mountains. The Nevada portion of the subbasin is bordered to the east by the Jarbidge, Bull Run, and Independence Mountains; and to the south by the Santa Rosa Range. The Owyhee River originates in north central Nevada and flows in a northwest direction through the southwest corner of Idaho and southeast Oregon. It then turns north to empty into the Snake River near the town of Nyssa, Oregon. The total length of the mainstem is 280 miles.

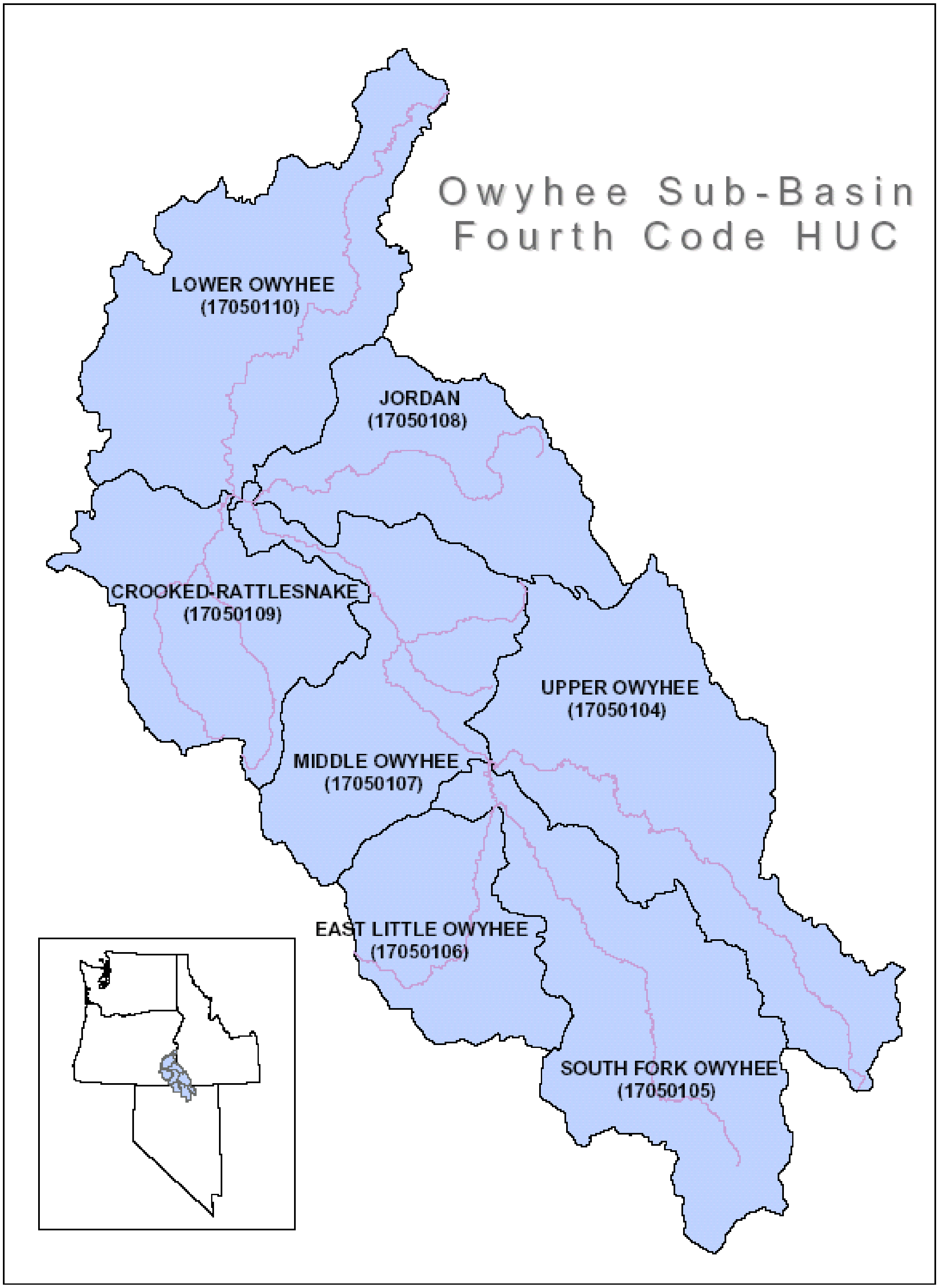

Figure 1.1. Fourth-field hydrologic unit codes (HUCs) in the Owyhee Subbasin.

The Owyhee landscape is diverse, with broken plateaus, barren rocky ridges, cliffs, and deep gulches and ravines that dissect the areas of rugged terrain (Figure 1.2).

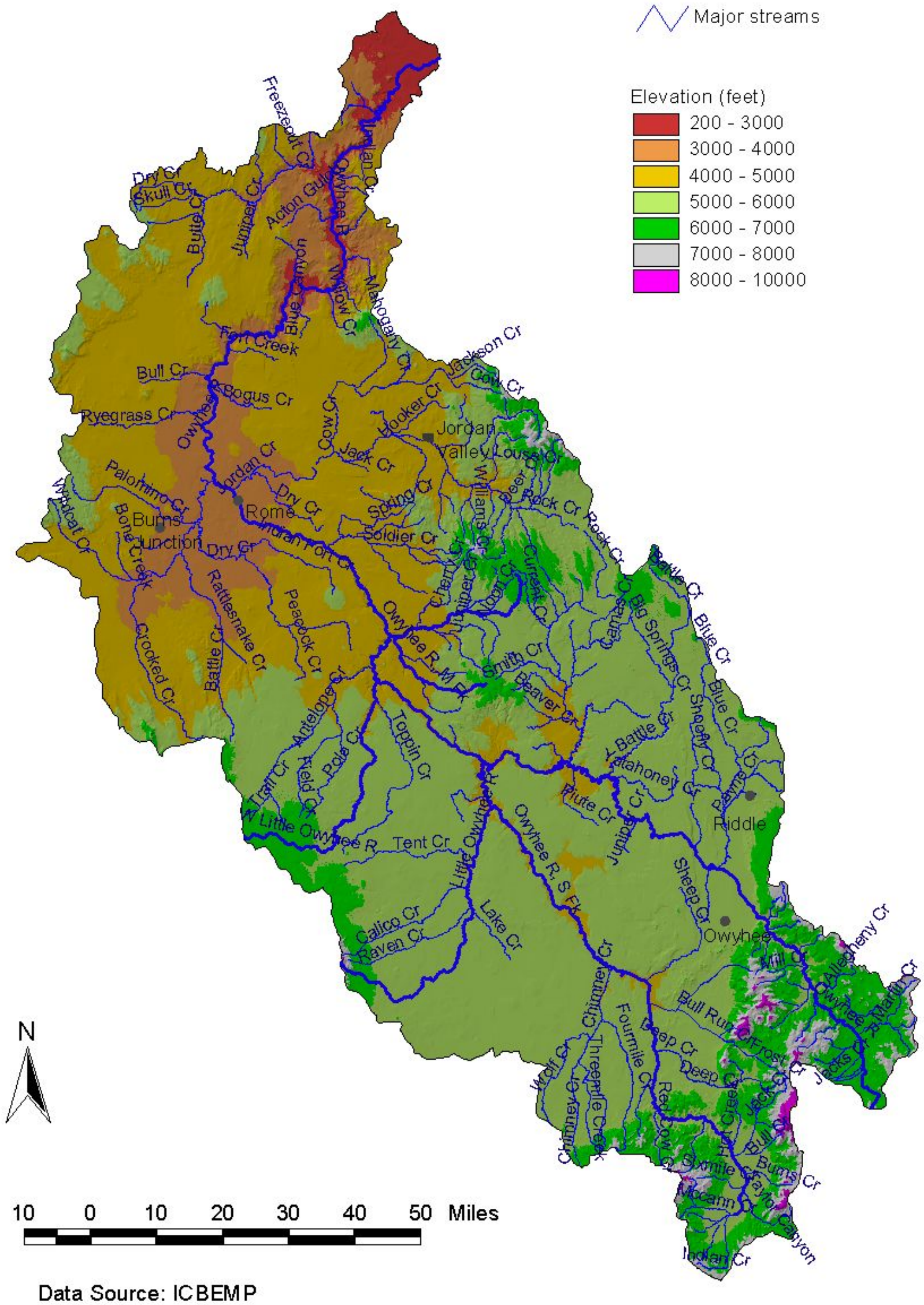

Figure 1.2. Elevation and topography, Owyhee subbasin (Perugini et al. 2002).

Colorful rocks and cliffs, volcanic spires, pinnacles and other formations give the area a stark beauty. Elevations in the Owyhee subbasin range from 2,198 feet at its confluence with the Snake River to 10,348 feet at McAfee peak in the Independence Mountains of Nevada The mean elevation in the subbasin is 5,112 feet. Low relief hills and expansive plateaus characterize the Owyhee Uplands. Downriver from Owyhee Dam, the Owyhee River enters the Snake River Plain, an area that supports irrigated agriculture.

The climate of the area is arid, with hot summers and cool winters. Precipitation falls primarily from November through February. Mean annual precipitation for the subbasin is 13 inches and ranges 8 inches at the Owyhee Dam to 53 inches in the headwaters. The majority (77.8%) of the land in the Owyhee subbasin is federally owned. The remainder is owned by private landowners (13.2%), the state (5.3%), and the Shoshone-Paiute Tribes (3.7%). The predominant current land uses in the subbasin are ranching, irrigated agriculture, and mining. All areas of the subbasin that are accessible to cattle have been grazed historically and most areas continue to be used for grazing. Idaho has a rich mining history that dates back to the 1860s. Once gold was discovered along Jordan Creek, mining activities spread throughout the subbasin. Unlike many placer mining districts, millions of dollars were invested in Owyhee underground mines and mills, assuring a long future for mining in the area.

Instream diversions are common throughout the subbasin, and represent a limiting factor to fish production due to flow reduction and fish entrainment (Perugini et al. 2002). From a flow perspective, diversions reduce the amount of available fish habitat and decrease water quality. Many of the existing diversions in the Owyhee are old and in disrepair. Most lack headgates, and/or monitoring or measuring devices. None of the diversions are screened, which represents a possible source of mortality to game fish that become stranded when a diversion is shut down.

Currently, 49 species of fish inhabit the Owyhee subbasin, including 25 native and 11 sensitive species. Cyprinids are the most abundant family in the subbasin. Salmonids and centrarchids represent common coldwater and warm water families, respectively. The Owyhee subbasin once supported anadromous fish runs of spring and fall Chinook salmon, summer steelhead, and possibly coho salmon, sturgeon and lamprey. These species, which are extinct in the Owyhee, occupied mainstem and/or tributary habitat throughout the majority of the drainage during various portions of the year. Anadromous fish access to the Owyhee River system ended in 1933 with the completion of Owyhee Dam.

The diversity of habitats, plant types, and topographical features in the Owyhee subbasin contributes to a high diversity of wildlife. The subbasin is at the center of the largest contiguous center of shrub-steppe habitat in the Interior Columbia Basin, and only one of several areas identified as having high ecological integrity. The canyon lands contain strongholds for redband trout, sage grouse, and the largest population of California bighorn sheep in the United States. It provides raptor habitat equal in quality to that found in the nationally recognized Snake River Birds of Prey Conservation Area. The area contains more than a dozen endemic or rare plant species.

Riparian areas throughout the subbasin are generally in poor to severely degraded condition. The arid environment and scarcity of water tends to concentrate cattle and wildlife in riparian areas and around seeps and springs. Recent droughts have exacerbated the problems related to restricted availability of water. Species such as redband trout, sage grouse, bald eagle, white-faced ibis, mule deer, Columbia spotted frog and other vertebrate and invertebrate species dependant on riparian areas have been affected by water limitations and reduction of riparian habitats.

1.2.2 Aquatic Focal Species – Redband Trout

1.2.2.1 Environment/Population Relationships

1.2.2.1.1 Redband Trout Distribution

The distribution of redband trout in the Owyhee Subbasin is fragmented (Figure 1.3). Most streams supporting redband trout occur on the east side of the subbasin, primarily in Idaho. Within the Idaho portion of the Owyhee Subbasin, redband trout presently occur in 4,362 miles of streams. They were found in 1,623 miles of streams in the Nevada portion of the subbasin and in only 157 miles of streams in the Oregon portion. The wider distribution of redband trout in the Idaho portion of the subbasin may reflect the true distribution of the trout, or it may be related to sampling intensity. Sampling in the Idaho portion of the subbasin may be more intensive and extensive than in other regions of the subbasin. Nevertheless, redband trout currently exist in mostly isolated patches within the subbasin. There appears to be little connection between headwater demes and those in mainstream reaches.

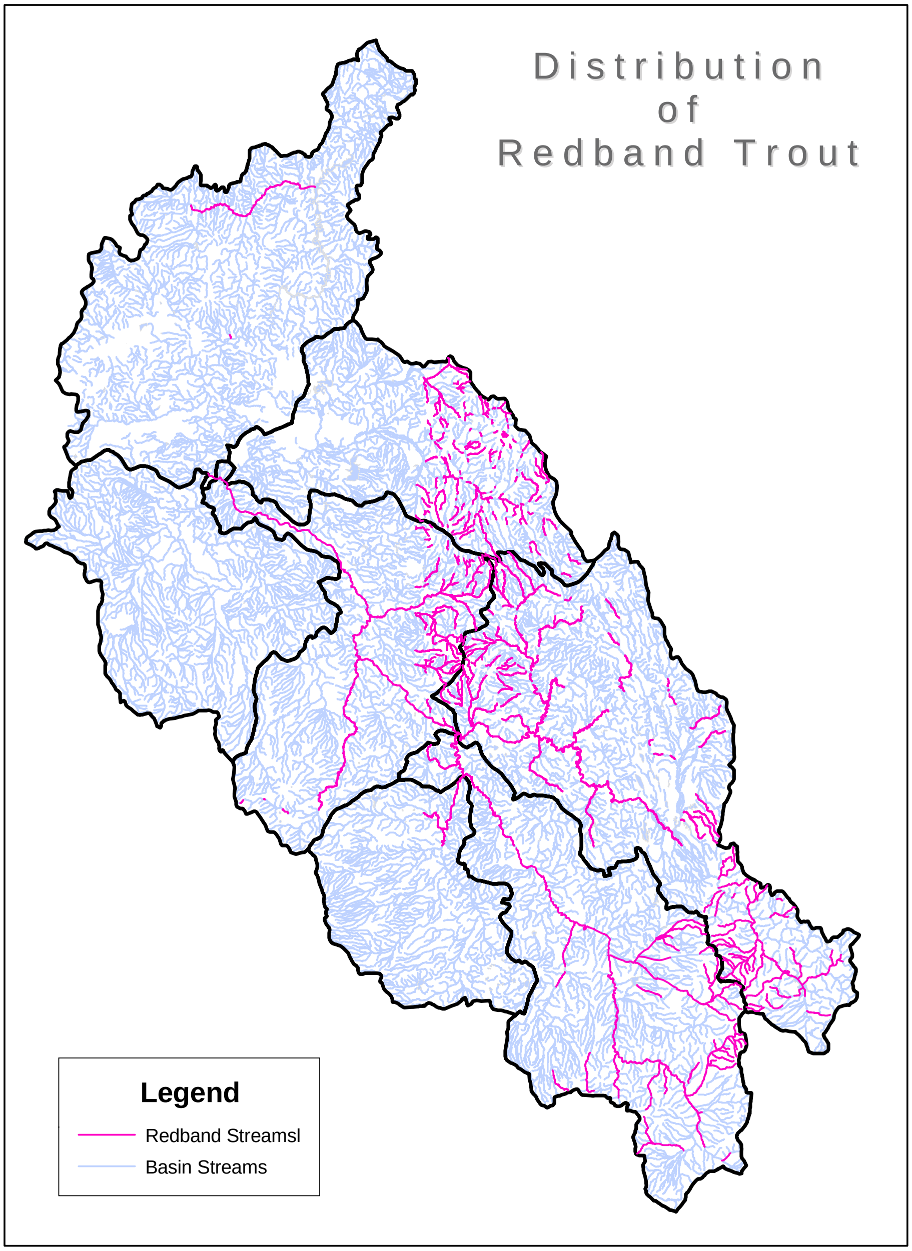

Figure 1.3. Current distribution of redband trout in the Owyhee Subbasin.

1.2.2.1.2 Redband Trout Habitat – Proper Functioning Condition

About 46% of the streams surveyed in the Owyhee Subbasin for Proper Functioning Condition (PFC) are rated as "Proper Functioning" (Table 1.1; Figure 1.4). That is, 54% of the streams surveyed in Oregon, Idaho, and Nevada (combined) are either non-functioning (10%) or are functioning at risk (44%).

Table 1.1. Miles of stream within the Owyhee Subbasin within different categories of Proper Functioning Condition.

Portion of subbasin	Miles of streams				
	Functioning at risk downstream	Functioning at risk upstream	Functioning at risk (no trend)	Non-functioning	Proper functioning
Idaho	8.7	23.2	329.0	78.6	231.4
Oregon	6.2	1.7	65.8	2.8	251.6
Nevada	27.9	7.6	2.8	22.3	6.1
Total	42.8	32.5	397.6	103.7	489.1

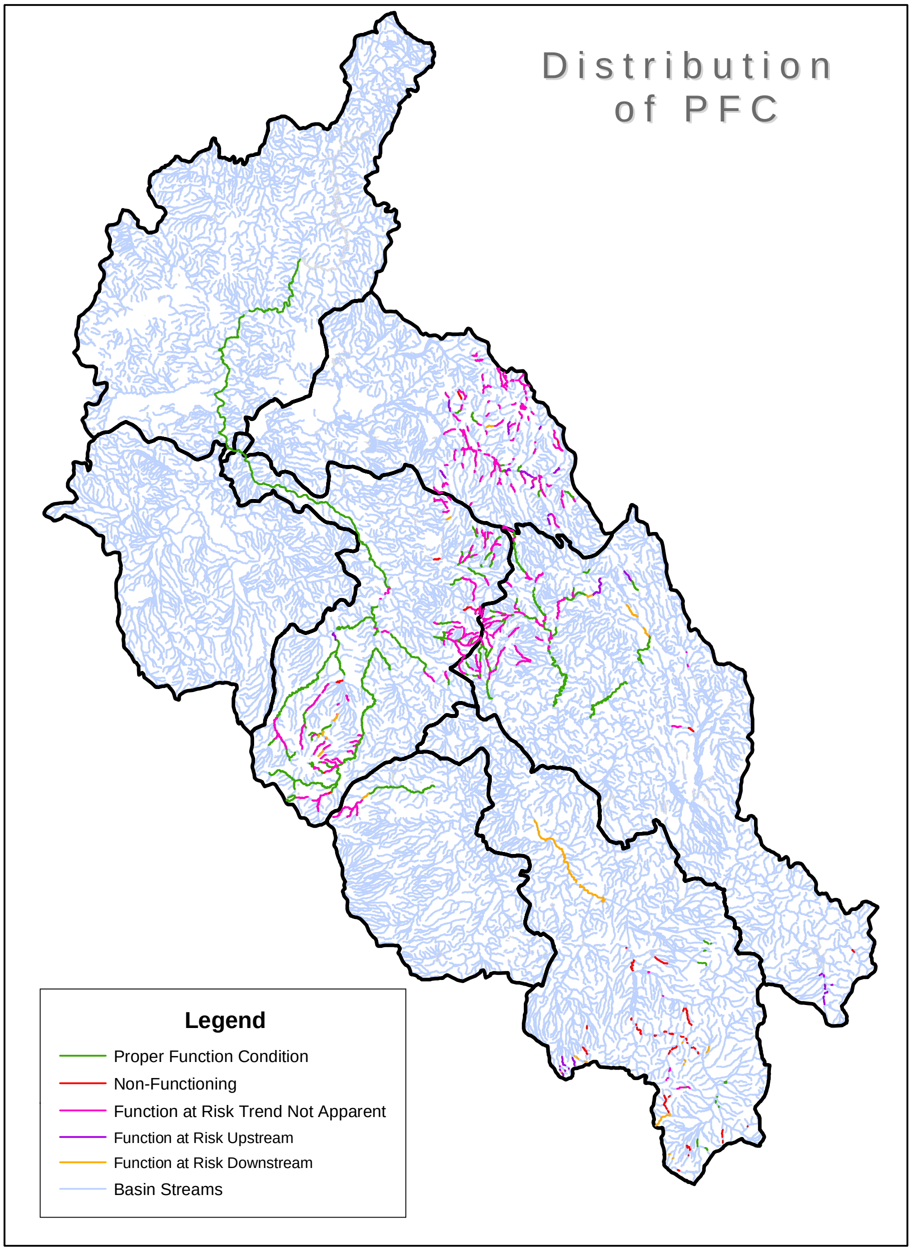

Figure 1.4. Distribution of Properly Functioning Conditions on streams in the Owyhee Subbasin.

1.2.2.1.3 Qualitative Habitat Assessment (QHA) for Redband Trout in the Owyhee Subbasin

The Qualitative Habitat Assessment (QHA) technique was developed as a means to characterize the relationship between a fish population and its aquatic habitat. It was developed principally for resident salmonids, though it could potentially be adapted for use with other species. The QHA is intended for use in stream environments at a watershed or subbasin scale. The QHA facilitates a structured ranking of stream reaches and attributes for subbasin planners. QHA relies on the expert knowledge of subbasin planners to describe physical conditions in the target stream and to create an hypothesis about how the habitat would be used by a focal species. The hypothesis is the "lens" through which physical conditions in the stream are viewed. The hypothesis consists of weights that are assigned to life stages and attributes, as well as a description of how reaches are used by different life stages. These result in a composite weight that is applied to a physical habitat score in each reach. This score is the difference between a rating of physical habitat in a reach under the current condition and the condition of the reach for the attribute in a reference condition. The result is that the current constraints on physical habitat in a stream are weighted and ranked according to how a focal species might use that habitat.

Owyhee QHA Workshops

We conducted a series of QHA Workshops for each portion of the Owyhee Subbasin – Oregon, Idaho and Nevada:

- November 6th 2003 in Vale, Oregon – we set up the initial version of the river reach system for the Oregon Portion of the Owyhee.
- On November 25th 2003 -- we conducted the second QHA workshop at the Vale BLM office, finalized the river reach system for the Oregon portion of the Owyhee, and completed the redband trout habitat ratings.
- January 14th-15th 2004 in Boise, Idaho. – we developed the initial version of the river reach system for the Idaho Portion of the Owyhee.
- January 29th 2004, Boise, ID we began the Redband trout habitat ratings for the Idaho Portion of the Owyhee.
- February 5th 2004, Boise, ID -- we completed the Redband trout habitat ratings for the Idaho Portion of the Owyhee.
- March 9-10th 2004, Elko, NV we set-up River Reach System for Nevada Portion of Owyhee, rated specific stream reaches for redband trout habitat "current" conditions vs. "reference" conditions, and scored species range worksheet "current" vs. "reference"

Owyhee Subbasin QHA Limiting Factors Analysis

The Qualitative Habitat Assessment (QHA) provided a ranking of habitat attributes with respect to redband trout productivity. The factor with the lowest habitat score for the current habitat condition was considered to be the limiting factor for a given reach. The limiting factors by reach are presented in OSP Chapter 2.

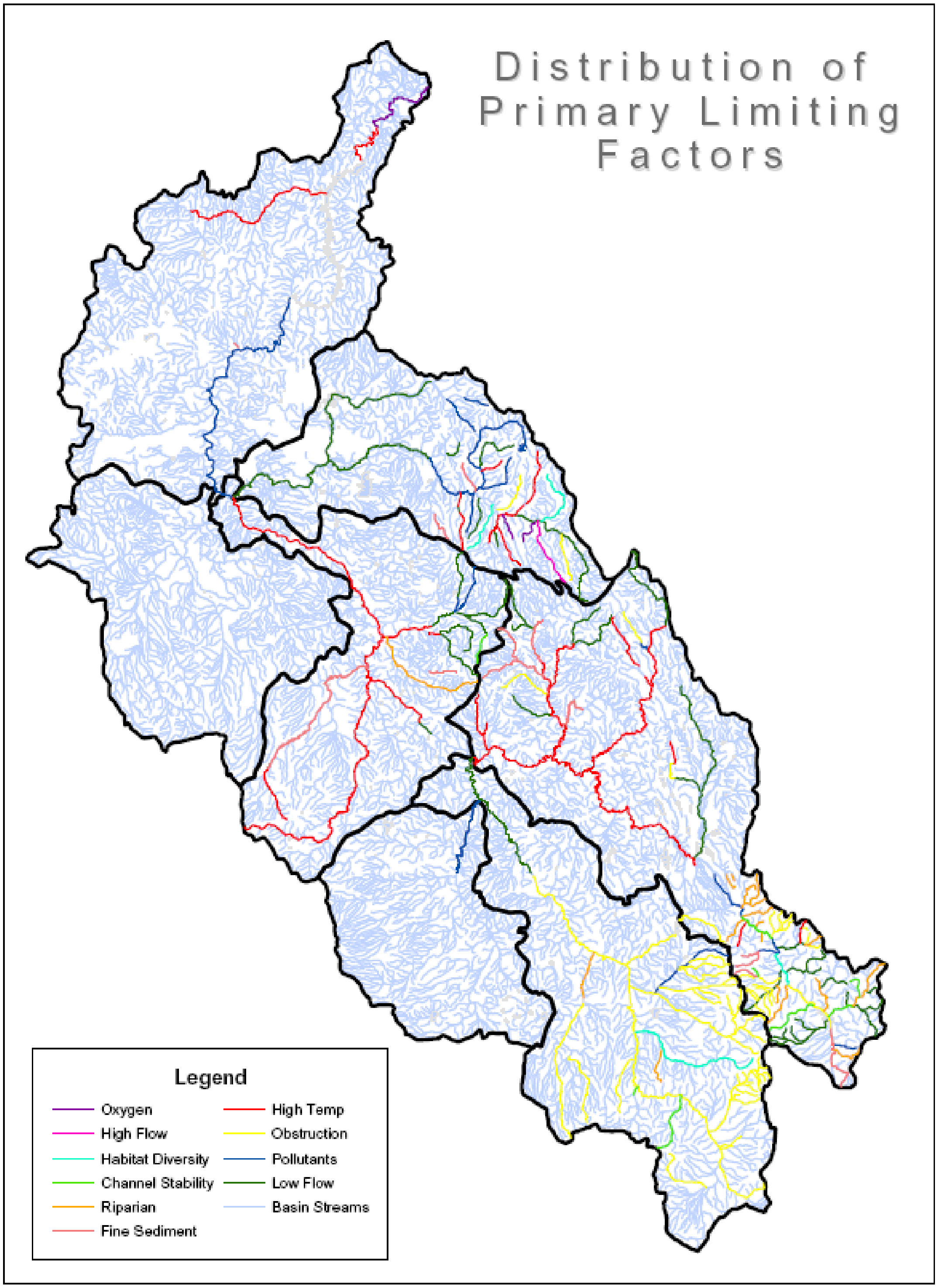

Figure 1.5. Distribution of limiting factors on streams in the Owyhee Subbasin derived from the Qualitative Habitat Analysis.

1.2.2 Terrestrial Focal Habitats and Species

The following focal habitats and corresponding terrestrial focal wildlife species were selected by the Owyhee Subbasin Planning Team. Detailed descriptions of focal species and habitats is presented in Chapter 2.

Upland aspen forest
- Aspen

Pine/Fir/Mixed Conifer Forests
- Rocky Mountain elk

Old Growth western juniper and mountain mahogany woodlands
- Mule deer

Shrub-steppe (including sagebrush steppe and salt-scrub shrublands)
- Sage grouse
- Golden eagle
- Pronghorn antelope

Riparian and wetlands
- Columbia spotted frog
- American Beaver
- Yellow warbler
- Bald eagle
- White-faced ibis

Agricultural Lands
- California quail

Grasslands
- Grasshopper sparrow

Canyon / Gorge
- California Bighorn sheep
- Peregrine falcon

1.2.3 Out-of-Subbasin Effects

From a holistic "big picture" perspective, three "out-of-subbasin" effects have had a major impact on the Owyhee River ecosystem:
(1) Effects on Terrestrial Focal Species;
(2) Dam and reservoir construction to support a an agrarian culture; and,
(3) Climatic Changes and Catastrophic events.

1.2.3.1 Effects on Terrestrial Focal Species

A number of the terrestrial focal species spend a portion of their life cycle outside the Brueau River subbasin's designated boundaries. Although most are nongame avian species, at least one upland game species and several big game species potentially migrate between State jurisdictions. Depending on the extent, location, and timing of seasonal movements, out of subbasin effects may range from limited to potentially substantial. Potentially limiting factors encountered outside the subbasin including hunting, environmental toxins, and habitat degradation may influence species occurrence, annyal survival, reproductive success, and ultimately population growth within the subbasin..

Several of the Owyhee subbasin focal bird species display varying degrees of seasonal movements. Yellow warbler and white faced ibis, are primarily long-distant migrants; wintering south from Mexico to South America (Ryder and Manry 1994, Hughes 1999, Lowther et al. 1999, Sedgwick 2000). In contrast, sage grouse and beaver populations may move relatively short distances or remain resident (Squires and Reynolds 1997, Connelly et al. 2000): although seasonal movement likely includes locations outside the subbasin boundaries. Migration is considered energetically expensive, loss of habitat due to pesticides, herbicides, fragmentation, and decline in extent has been suggested as a potential cause of declining population of North American bird species (Ryder and Manry 1994, Hughes 1999, Connelly et al 2000, Sedqwick 2000). In general, insectivorous birds, birds in western North America, and birds migrating to Mexico and Central and South America are still contaminated with relatively high levels of organochlorines (primarily DDE; DeWeese et al. 1986). Seasonal movements, however, may not be limited to winter, as big game and sage grouse may move outside the subbasin during alternative seasons (Connelly 2000). However, independent of the timing of seasonal movements, the condition of habitats sought likely influences within subbasin population dynamics. For example, reduced sagebrush cover due to herbicide application, fire, and mechanical removal has been shown to be an important predictor of sage grouse occurrence and recruitment (Connely et al 2000). Isolating the causes of population declines requires a full understanding of species ecology in combination with long-term population monitoring data.

Terrestrial focal species identified for the Owyhee subbasin are managed by Oregon, Idaho and Nevada as game animals. Depending on seasonal movements exhibited by populations, State agencies may be managing the same animals from opposite sides of the fence. Proghorn antelope, mule deer, and sage grouse occurring in the subbasin can be hunted in Oregon, Idaho and Nevada, although hunting seasons, limits, and pressure are variable among years and locations. Although seasons primarily overlap, in all three instances there is the potential for individual from populations moving across State boundaries to be exposed to a longer hunting season. Coordination between the State agencies, including an understanding of the migratory ecology of potentially shared populations, is essential for proper management (Connelly et al. 2000)

1.2.3.2 Dam Construction and Elimination of Anadromous Salmonids

When the Pacific Northwest salmon resource was first exploited by European settlers in the late 1800's, the Columbia River Basin was the greatest producer of chinook salmon in the world (Craig and Hacker 1940). Anadromous fish runs in the Columbia River at that time were estimated to range from 10 to 16 million fish annually (NPPC 1996). In contrast, the estimated current average annual run size is about 2.5 million fish (Dauble et al. 2003). Habitat degradation subsequent to European development also had a detrimental impact on anadromous fish runs. Hydroelectric dam construction began in basin the early 1900's and continued through the mid-1980's. Although the exact amount of fish lost as a result of hydropower development is unknown, the development of the hydropower system clearly had a significant impact on anadromous fish abundance in the Columbia River (Dauble et al. 2003).

At least four anadromous salmonid species inhabited the Snake River Basin within the past 50 years – coho salmon, chinook salmon , sockeye salmon, steelhead – and probably historically occurred in the Owyhee River system. In addition to the salmonid species, the white sturgeon (originally anadromous) and the pacific lamprey (catadromous) may have inhabited the Owyhee as well.

Anadromous fish were of particular value to native peoples since they had many uses. For instance, they might be used at the time of catch, processed for the future, or used as a trade commodity. In this discussion of anadromous fish, it should be noted that "**salmon**" was a term used for several species of anadromous fish including chinook and steelhead. Historical evidence indicates that Tribal fishing for anadromous salmonids occurred in the Owyhee River basin. Early diaries, oral histories and newspapers suggest that native people used the upper Owyhee River basin for fishing. Such sources also suggest that this fishing occurred in the headwaters over an extended period each year, and that salmon and steelhead were among the primary species sought.

It is documented that Indian fishing weirs were used in the mainstem Snake River. Certainly Native peoples could have fished the mainstem Owyhee River, as it would have been at least as fishable as the mainstem Snake River. There is a great deal of evidence that fishing the Snake River was a major activity of many tribes. The multi-tribe/band events in the Snake River area between the mouth of the Owyhee River and the mouth of the Weiser River were well known and well attended. This event typically occurred during late summer to late fall, and fishing was a primary activity. At least some of the Duck Valley people, such as the people of the White Knife Band, attended this event. The records confirming the Snake River resource use are more common than other records, as the Snake River plain had many of the major travel routes, and therefore the fisheries there often were observed in this narrow corridor. In the Owyhee basin, we find that native people fished for salmon and steelhead in many places in the watershed, depending upon the season. The following discussion provides several examples.

Spring Season. The spring fishing was likely done in the Owyhee headwaters. Steelhead bones were collected at the Pole Creek site of the upper basin. March, April and May newspaper articles from the 1860s-1880s (Robert McQuivey Collection, 1998) indicate that it was fairly easy to capture large migratory fish during spring in the upper South Fork Owyhee by "raking fish off the shoals" in the large valley areas of the upper basin. Oral histories and similar information published by the Elko County Historical Society indicate the native people typically used Jack Creek in the upper South Fork Owyhee and other locations in the upper basin to fish.

Summer Season. Summer fisheries were also known in the upper basin. In early July of 1828, Mr. McKay, working at the time for Mr. Ogden of the Hudson's Bay Company, went to meet Sylvaille in the Owyhee River basin, and found him at the "Indian Fish Pen." It is unclear if this is in the upper or lower part of the watershed. In 1859, Scholl comments in late July: " The stream runs here through very high precipices; it abounds in large salmon" (Wallen 1860). While it is difficult to identify the precise location in the Owyhee River watershed where Scholl makes his observations, it is somewhere in the eastern part of the basin, some distance upstream from the Jordan Creek confluence (Wallen 1860). Salmon were present at Three Forks in late July of 1876 (Robert McQuivey Collection 1998). Later in the 1800s, there is evidence that salmon or steelhead were available all summer in the upper watershed (Robert McQuivey Collection 1998). In the fall, the Juniper Mountain region was a major rendezvous location for native people (Drew 1865). This is not far from several sites where there is evidence of the use of anadromous fish by native people.

Fall Season. Fall fisheries in the South Fork Owyhee River basin are noted in the newspapers of the mining community. For instance, in September, the salmon in the Independence River are described as follows:

"… the kingly salmon…, forced its passage over every obstacle through the Columbia and its tributary Lewis R [Snake R] to spawn in the cool, limpid waters of the Owyhee. Myriads of them annually fail to return to the ocean, but are incorporated into Indian[s] and now-a-days do and henceforward may help make up prospectors and miners. Splendid fish, three feet long and estimated to exceed the weight of twenty pounds, were seen dashing through water scarcely ankle deep." (Robert McQuivey Collection 1998).

Late spring, summer and fall salmon must have been fairly easy to collect in the upper basin, as miners, who were new to the area, used techniques similar to those of native people. In the 1800s, miners, when "not having nets, tied willows together and using them as a seine, rake out upon the shore salmon weighing fifteen to twenty pounds" (The Robert McQuivey Collection, 1998). The upper meadows were an easy place to catch fish. In 1876, newspapers report the situation as follows: "Where the waters cover the meadows the fish leave the main stream and swim out among the grass and reeds, rendering their capture an easy manner."

1.2.3.2 Climatic and Catastrophic Events

Climate Changes at he the Turn of the Century

Dramatic climatic changes have occurred in the Owyhee Mountains in the last one hundred to one hundred and fifty years. The date of this climatic transition varies slightly depending on the source, but scientists generally agree that it occurred around the 1860s (Great Basin Riparian Ecosystems 2004). The area began to slowly change over time from a high precipitation tall grass area to a low precipitation desert plant community. When the first settlers began to move into the Owyhee Mountains in the 1860s and

1870s, they recorded grasses to their horse's shoulders. Other settlers' journals recorded looking over a sea of tall grass as far as the eye could see, taller than their wagon wheels.

As you review settlers' accounts around 1900, they began telling of drier and drier conditions occurring in the Owyhee Mountains. Heavy snow years did not happen every year, but only one year out of five. The annual precipitation was diminishing and the tall grasses had all but disappeared. The early settlers used the Owyhees to raise horses and sheep. They sold replacement horses to the Army and raised small bands of sheep for wool and meat. Sheep and horses were the primary livestock raised in the Owyhee until the early 1940s.

According to the Black's family journal and Paul Black born in 1908, the Indian bands would use the Antelope Trail and Desert Trail out of the high country of the Owyhee Mountains and the Lonesome Trail between Shoo Fly Creek and Little Jacks Creek in late spring and early summer each year to make their way to the annual encampment at the mouth of the Bruneau River. They would go to the Bruneau encampment to catch and dry their winter supply of salmon. The Indian Trails were used so heavily for so many years that they were beat deep into the earth and can still be seen to this day. There was an abundance of trout in the streams in the Upper Owyhee during the late 1800s.

According to the Black family, the earthquake of 1916 changed the Upper Owyhee country forever. For months after the earthquake, the springs and streams ran murky water and the stream and spring flows dropped off sharply. Many springs dried up, and water had to be hauled in for livestock in areas that always had water previously. As stream and spring flows continued to decrease in the 1920s, many homesteads had to be abandoned. Meadows in Camas Creek, Battle Creek, Big Springs, and Rock Creek no longer produced enough hay for the winter feeding of horses and the settlers were forced to move. Where there were large trout populations, they disappeared. Paul Black remembered how they would catch gunny sacks full of trout in Battle Creek; and Paul Black attributes that to the loss of water flow after the 1916 earthquake. Today, there are only limited populations of trout caught in short sections of streams that have enough water year around in the Owyhee Subbasin. A lawsuit was filed over water rights after the earthquake as the water supply dwindled (Burkhardt vs. Black-1981).

Current Climate

The climate of the Great Basin is semiarid, characterized by an mean annual temperature of 9°C (48.2°F) and between 100 and 200 mm (3.94-7.88 in.) of precipitation annually (Smith et al. 1997). The majority of this precipitation comes during the winter and spring. The current climatic conditions of Rome, OR on the Owyhee River at 3400 feet (1036 m) of elevation best reflect recent climatic conditions of the Owyhee uplands. Average annual precipitation over the last 50 years is 8.21 inches (20.85 cm). The average daily maximum temperature in the hottest month, which is July, is 92.0°F (33.3°C). The average daily minimum temperature for January, the coldest month of the year, is 18.1°F (-7.7°C). Data from further to the south at weather station McDermitt 26N (located 26 miles to the North of the Oregon/Nevada border along US 95) reflects similar conditions at 4500 feet (1371 m) of elevation. Average annual precipitation is 9.43 inches (23.95 cm). The temperature ranges from an average daily maximum of 91.1°F (32.8°C) in the month of July and the average daily minimum for Jan of 18.9°F (-7.3°C). The averages for this station are for the last 45 years (Western Regional Climate Center).

The environment of the Owyhee uplands is comparable to that of the Great Basin (interior drainage). The main difference between the two is hydrological. While the Owyhee uplands have drainage into the Pacific Ocean by way of streams and rivers, the Great Basin has internal drainage. The plant communities which can be found in the two regions are similar in the Owyhee Subbasin and Great Basin (Murphy and Murphy 1986:285). In turn animal communities are similar with the notable exception of different varieties of fish that inhabit the Owyhee River in comparison to inland lakes.

High winds come up in the morning and evening across the plateau regions of the Owyhee uplands. These winds, anabatic and katabatic, are driven by gravity and the heating and cooling associated with morning and evening, respectively (Christopherson 1997). In the evening as layers of the surface cool, the cold surface air is denser and sinks, moving down slope across the mesa. The downward movement is called a katabatic wind. The reverse happens in the morning as the air at lower elevations warms and rises, pushing air the opposite direction across the mesa as an anabatic wind.

1.3 Summary of Chapter 3 – Inventory of Existing Activities

1.3.1 Existing and Imminent legal protection (source: GAO 2004)

1.3.1.1 Federal Agencies Conducting Fish & Wildlife Restoration Activities

Numerous federal agencies, including the following, conduct activities within the basin that affect fish and wildlife, as well as the Columbia River Basin Indian tribes. Many of these agencies are responsible for managing water resources, the power generated by hydroelectric projects, or land resources, such as forests, grazing lands, and wildlife refuges.

- Bonneville Power Administration (Bonneville) provides power transmission services and markets the electricity generated by the 31 Corps and Reclamation dams comprising the Federal Columbia River Power System (FCRPS).
- U.S. Army Corps of Engineers (Corps) designs, builds, and operates civil works projects to provide electric power, navigation, flood control, and environmental protection.
- Bureau of Reclamation (Reclamation) designs, constructs, and operates water projects for multiple purposes, including irrigation, hydropower production, municipal and industrial water supply, flood control, recreation, and fish and wildlife.
- U.S. Forest Service (Forest Service) manages national forests and grasslands under the principles of multiple use and sustained yield, and ensures that lands will be available for future generations.

- Bureau of Land Management (BLM) administers public lands and subsurface mineral resources, and sustains the health, diversity, and productivity of public lands for the use and enjoyment of future generations.
- U.S. Fish and Wildlife Service (FWS) conserves, protects, and enhances fish, wildlife, and plants, and implements the ESA for terrestrial species, migratory birds, certain marine mammals, and certain fish.
- Bureau of Indian Affairs (BIA) encourages and assists American Indians to manage their own affairs under the trust relationship with the federal government.

In addition to the water, power and land resource management agencies, several other federal agencies have regulatory, resource protection, and research responsibilities in the basin.

- NOAA Fisheries (formerly National Marine Fisheries Service, NMFS) conserves, protects, and manages living marine resources so as to ensure their continuation as functioning components of marine ecosystems, and to afford economic opportunities. NOAA Fisheries also implements the ESA for marine and anadromous (migratory fish such as salmon and steelhead) species.
- Environmental Protection Agency (EPA) protects human health and safeguards the natural environment by protecting the air, water, and land. It administers the Clean Water Act and Clean Air Act.
- Natural Resources Conservation Service (NRCS) assists farmers, ranchers, and other landowners in developing and carrying out voluntary efforts to protect the nation's natural resources.
- U.S. Geological Survey (USGS) conducts objective scientific studies and provides information to address problems dealing with natural resources, geologic hazards, and the effects of environmental conditions on human and wildlife health.

Along with their primary water, power, resource and other management and regulatory responsibilities, these agencies are responsible under various laws, treaties, executive orders, and court decisions for protecting, mitigating and enhancing fish and wildlife resources in the basin, as well as involving the tribes in the process.

1.3.1.2 Federal Acts and Laws Guiding Fish & Wildlife Restoration Activities

One of the main drivers of Columbia Basin fish & wildlife activities is the **Pacific Northwest Electric Power Planning and Conservation Act** (Northwest Power Act) – which provided for the establishment of the Northwest Power and Conservation Council (Council). The Northwest Power Act also directs the Council to develop a program to protect, mitigate, and enhance the fish and wildlife of the Columbia River Basin. The Act requires Bonneville's Administrator to use Bonneville's funding authorities to protect, mitigate, and enhance fish and wildlife affected by the development and operation of the FCRPS and to do so in a manner consistent with the Council's program while ensuring the Pacific Northwest an adequate, efficient, economical, and reliable power supply.

Federal environmental and fish and wildlife protection laws create broad responsibilities for federal agencies. The following nationwide laws guide the fish and wildlife activities of federal agencies throughout the United States, in some cases under the oversight and enforcement authority of regulatory agencies such as EPA and NOAA Fisheries.

- **Clean Water Act** — Authorizes EPA to establish effluent limitations and requires permits for the discharge of pollutants from a point source to navigable waters.
- **Endangered Species Act (ESA)** — Provides for the conservation and recovery of species of plants and animals that FWS and NMFS determine to be in danger or soon to become in danger of extinction.
- **National Environmental Policy Act** — Requires federal agencies to examine the impacts of proposed major federal actions significantly affecting the environment.
- **Fisheries Restoration and Irrigation Mitigation Act of 2000** — Directs the Secretary of the Interior to establish a program to implement projects, such as installation offish screens and fish passage devices, to mitigate impacts on fisheries associated with irrigation systems in Idaho, Montana, Oregon, and Washington.
- **Mitchell Act** — Directs the Secretary of Commerce to carry on activities for the conservation of fishery resources in the Columbia River Basin.

At the mission level, many agencies that operate within the basin have fish and wildlife responsibilities under laws that are unique to their activities. These laws guide the fish and wildlife activities of agencies such as the Forest Service, BLM, FWS, and BIA that are to be conducted in conjunction with their resource management responsibilities. The following laws were among the numerous mission-specific laws that federal agencies identified as guiding their fish and wildlife activities (GAO 2003):

  - National Forest Management Act — Mandates multiple-uses for lands managed by the Forest Service to include outdoor recreation, range, timber, watershed, wildlife and fish, and wilderness purposes.
  - Federal Land Policy and Management Act of 1976 — Directs the Secretary of the Interior to develop and maintain land use plans using a systematic interdisciplinary approach to achieve the integrated consideration of physical, biological, and economic factors.
  - National Wildlife Refuge System Administration Act of 1966 — Establishes the National Wildlife Refuge System and directs the Secretary of the Interior in the overall management of the refuge system to maintain the biological integrity, diversity and environmental health of the system, and prepare a comprehensive conservation plan for each refuge.

1.3.2 Existing plans and management programs

Descriptions of plans and programs implemented by federal agencies to manage Columbia River Basin fish and wildlife activities are summarized in Table 1.2 -- including the directives driving the plans and programs and the lead agencies.

Table 1.2. Plans and programs that guide Federal fish and wildlife activities in the Columbia River Basin (GAO 2003).

Plan/program	Lead agency	Description
Northwest Power Act-driven plans and programs:		
Columbia River Basin Fish Bonneville, and Wildlife Program	The Council	Program to protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries. Developed by the Council, funded by Bonneville, and implemented by a number of agencies and other organizations.
Northwest Power and Conservation Council Subbasin Planning Process	The Council	Process to incorporate local-level planning for the 50+ subbasins in the Columbia River Basin into the development and implementation of the Columbia River Basin Fish and Wildlife Program.
Northwest Power and Conservation Council Provincial Review	The Council	Program developed by the Council, and operated on a three-year cycle, to improve the technical review and approval of projects funded by the Columbia River Basin Fish and Wildlife Program.
Endangered Species Act-driven plans and programs:		
Biological Opinions for the FCRPS	FWS and NMFS	Plans that set forth reasonable and prudent measures/alternatives for operation by the Corps,

Plan/program	Lead agency	Description
		Reclamation, and Bonneville of the FCRPS, in order to minimize impacts to fish and wildlife. Created as a result of consultation with FWS and NMFS under Section 7 of ESA.
Biological Opinion Implementation Plans for the FCRPS	Bonneville, the Corps, Reclamation	Frameworks developed by the agencies managing the FCRPS for complying with Biological Opinions for the FCRPS.
Bull Trout Recovery Plan	FWS	Plan designed to organize, coordinate, and prioritize recovery actions for bull trout, and to outline objective measurable criteria that will be used to determine when bull trout no longer need the protection of the ESA.
recovery plans for salmon (under development)	NMFS	Plans designed to organize, coordinate, and prioritize recovery actions for endangered and threatened salmon and steelhead, and to outline objective measurable criteria that will be used to determine when salmon and steelhead no longer need the protection of the ESA.
Basin-wide Salmon Recovery Strategy (AII-H Paper)	All agencies in the Federal Caucus	A strategy and accompanying suite of actions to be used as a blueprint to guide federal actions towards recovery of threatened and endangered salmon and steelhead in the Columbia River Basin.
Clean Water Act-driven plans and programs:		

Plan/program	Lead agency	Description
Clean Water Act Section 319Grant Program	EPA	Program to provide funding to states and Indian tribes for a wide variety of nonpoint source activities including technical and financial assistance, education, training, technology transfer, demonstration projects, and monitoring.
Clean Water Act General Assistance Grant Program to Tribes	EPA	Program to provide assistance grants to Indian tribal governments and intertribal consortia t o build capacity to administer regulatory and multimedia programs addressing environmental issues on Indian lands.
Clean Water Act Section 104(b)(3) Support to TMDLs	EPA	Program to provide assistance to state water pollution control agencies, interstate agencies, and other nonprofit institutions, organizations, and individuals to promote the coordination of environmentally beneficial activities, including storm water control, sludge management, and pretreatment of wastewater.
Clean Water Act Section 106 Grant Program	EPA	Program to provide assistance to Indian tribes in carrying out effective water pollution control programs, including water quality planning and assessments, developing water quality standards and total maximum daily loads, and ambient monitoring.

Plan/program	Lead agency	Description
Clean Water State Revolving Fund	EPA	A loan program to fund water quality protection projects for wastewater treatment, nonpoint source pollution control, and watershed and estuary management.
Lower Columbia Estuary Partnership	EPA	Program under Clean Water Act Section 320 to improve the quality of the Lower Columbia Estuary, and provide the basis for estuarine salmon recovery efforts. Key activities include habitat monitoring, volunteering monitoring, and species recovery.
Court-driven plans and programs:		
US v Oregon Management Plans/Agreements	FWS, NMFS	Plans that address tribal allocation of annual fish harvest, as well as hatchery and supplementation measures designed to help rebuild depressed fish stocks.
Mission-driven plans and programs:		
Gas Abatement Project at Chief Joseph Dam	The Corps	Project to install spillway deflectors and implement operational changes at Chief Joseph Dam in order to reduce total dissolved gas levels.
Army Corps Anadromous Fish Evaluation Program	The Corps	Program to develop and evaluate anadromous fish passage facilities Corps at dams on the Columbia and lower Snake Rivers. Includes monitoring, research, and evaluation studies conducted in collaboration with other federal, state, and tribal

Plan/program	Lead agency	Description
		agencies.
Project Management Plans	The Corps	Internal management plans developed in parallel with any Corps project. Designed to ensure that proper internal procedures are followed to protect and mitigate barriers to fish passage.
District Resource Management Plans	BLM	Internal management plans for all BLM activities. Developed via the National Environmental Policy Act process, they include specific management guidelines for protection of fish and wildlife.
Wild and Scenic River Plans	BLM	Management plans developed to ensure that agency activities protect identified "outstandingly remarkable values," including fish and wildlife, recognized in Wild and Scenic River Areas.
Upper Salmon Basin Project	NRCS	Project designed to provide a basis of coordination and cooperation between local, private, state, tribal, and federal fish and land managers, land users, land owners and other affected entities. Goal is to manage the biological, social, and economic resources to protect, restore, and enhance anadromous and resident fish habitat.
General Investigations	Reclamation	Projects funded by special Congressional appropriations, some of

Plan/program	Lead agency	Description
		which address fish and wildlife enhancement or mitigation. Also typically involve partnerships with other groups, such as states, interest groups, and tribes.
Research and Monitoring Programs	Reclamation	Internal Reclamation programs funded by the Commissioner's office that focus on a range of discretionary activities, including research and monitoring efforts for fish and wildlife.
Resource Management Plans	Reclamation	Management plans required for all reservoirs managed by the agency. Plans address management of recreational activities, as well conservation of fish and wildlife.
Hungry Horse Mitigation Implementation Plan	Reclamation	Specific project at Hungry Horse Dam to control water withdrawals at the reservoir that were causing harm to fish, and to mitigate for impacts of constructing a water control system.
Lower Snake River Compensation Plan	Bonneville, FWS	Specific project to mitigate impacts to fish and wildlife from construction of last four FCRPS dams on the Lower Snake River. Project preceded mitigation requirements set forth under the Power Act.
Recreational Fishery Resources Conservation Plan	FWS	Internal agency plan to incorporate conservation planning into the management of

Plan/program	Lead agency	Description
		recreational fisheries.
Land and Resource Management Plans (Forest Plans)	Forest Service	Internal agency plans that incorporate specific conservation measures for fish, wildlife, plants, and other natural resources, into management of National Forests.
Lynx Conservation Strategy and Agreement	Forest Service	Strategy to address the needs of lynx and lynx habitat in the context of forest management, and to foster cooperation and interaction between foresters and wildlife biologists.
PACFISH & INFISH	Forest Service, BLM	Interim standards and guidelines for addressing, and incorporating measures for, the recovery of endangered and threatened fish in the development of Land and Resource Management Plans.
Northwest Forest Plan	Forest Service, BLM	An interagency approach to developing and implementing measures for the long-term health of forests, wildlife, and waterways on federal lands.
Environmental Quality Incentive Program	NRCS	Cost-share program, operated collaboratively with tribes, to benefit fish and wildlife through environmental improvements to irrigation, erosion, water quality, and agriculture.
State-driven plans and programs:		
"Extinction Is Not an Option" Washington	: State of Washington	Long-term strategy for the recovery of salmon in

Plan/program	Lead agency	Description
Statewide Strategy to Recover Salmon		Washington state Primary goals of the strategy are to restore salmon, steelhead, and trout populations to healthy and harvestable levels and improve the habitats on which fish
Fish and Forest Agreement in Washington	State of Washington	Collaborative agreement between Washington state, tribes, federal agencies, timber interests, and environmental groups to address timber practices so as to minimize impacts to fish populations.
Oregon Plan for Salmons Watersheds	State of Oregon	A statewide approach to natural resource management in Oregon that focuses on restoring Coho salmon through the Coastal Salmon Restoration Initiative and improving water quality through the Healthy Streams Partnership.
Tribally-driven plans and programs:		
Wy-Kan-Ush-Mi Wa-Kish- Wit (Spirit of the Salmon")	Nez Perce, Umatilla, Warm Springs, Yakama Tribes	A framework for restoring salmon in the Columbia River that outlines the cultural context for the tribes' salmon restoration efforts, as well as technical and institutional recommendations and watershed restoration activities
Warm Springs National Fish Hatchery Operational and Implementation Plan	Warm Springs Tribe	Plan outlining management measures and operational procedures for the Warm Springs National Fish Hatchery, which is cooperatively managed by FWS and the Warm

Plan/program	Lead agency	Description
		Springs tribe.

The following is a brief review of species plans and resource area management plans that are directly relevant to the Owyhee Subbasin. More detailed information is contained in OSP Chapter 3 and Appendix 4.4.

1.3.2.1 State Fish Management Plans – Trout

Each of the three states overlapping the Owyhee Subbasin has draft management plans for resident salmonids that pertain to redband trout in the Owyhee River system:

- Idaho Department of Fish & Game – Trout Management Plan
- Nevada Department of Wildlife – Trout Management Plan (Gary Johnson, Elko Office)
- Oregon Department of Fish & Wildlife – Trout Management Plan (Ray Perkins, Vale Office)

1.3.2.1 State Water Quality Management Plans

Idaho TMDLs and Water Quality Management in the Owyhee Subbasin

The Idaho Department of Environmental Quality (IDEQ) recently completed its latest Integrated 303(d)/305(b) Report for 2002-03 (IDEQ 2003). (IDEQ) has also completed the following water quality management recovery plans:

- **Upper Owyhee (IDEQ 2003)**
- **North Fork and Middle Fork Owyhee (IDEQ 2003)**
- **South Fork Owyhee (IDEQ 2003)**
- **2002-03 Integrated 303(d)/305(b) Report (IDEQ 2003)**

These plans are available for review at the Idaho Department of Environmental Quality web site.

Nevada TMDLs and Water Quality Management in the Owyhee Subbasin

The Nevada Division of Environmental Protection (NDEP) first listed the East Fork Owyhee River (Wildhorse Reservoir to Mill Creek) on the 1996 303(d) list for total phosphorus, total dissolved solids (TDS), total suspended solids (TSS), turbidity and iron. In 1998, the lower reach of the East Fork Owyhee River (Mill Creek to Duck Valley Reservation) was added to the list for the same pollutants. The decision to include these water bodies on the 1996 and 1998 303(d) Lists were based upon data and information collected by NDEP. In 2002, the listing for the upper reach of the East Fork Owyhee River (Wildhorse Reservoir to Mill Creek) was expanded (based upon NDEP data) to include temperature. In 2002, Mill Creek was added to the 303(d) List due to exceedence of the cadmium (total), copper (dissolved and total), dissolved oxygen, iron (total), phosphorus, total dissolved solids, total suspended solids, temperature, turbidity and pH standards. Data collected by NDEP and corroborated by RTWG supported inclusion of these constituents into the 303(d) List for Mill Creek.

In January 2004, a Total Maximum Daily Loads for the East Fork Owyhee River and Mill Creek was completed as a review draft:

- **East Fork Owyhee River and Mill Creek TMDL (NDEP 2004).**

This TMDL is available for review at the Nevada Division of Environmental Protection web site.

Oregon TMDLs and Water Quality Management in the Owyhee Subbasin

The Oregon Department of Environmental Protection (ODEQ) has completed a state-wide Water Quality Management 305(b) Report (ODEQ 2000). ODEQ has not yet conducted TMDLs for the Oregon portion of the Owyhee Subbasin. The following water quality management plans are scheduled for completion by ODEQ in year 2009:

- **Upper Owyhee**
- **Middle Owyhee**
- **Crooked Rattlesnake**
- **Jordan**
- **Lower Owyhee**

1.3.2.2 Federal Species Recovery Plans

Currently, US Fish & Wildlife Service recovery plans are in place for these ESA-listed species. The following ESA recovery plans can be accessed at the US Fish & Wildlife Service ESA web site.

- the bald eagle (no recovery plan available on the FWS web site)
- the gray wolf (no recovery plan available on the FWS web site)
- the grizzly bear: http://ecos.fws.gov/docs/recovery_plans/1993/930910.pdf
- the lynx (no recovery plan available on the FWS web site)

1.3.2.3 Federal Resource Management Plans

The Bureau of Land Management (BLM) Resource Management Plans (RMPs) are prepared to provide the BLM with a comprehensive framework for managing public lands administered by the various Resource Areas that overlap the Owyhee Subbasin. The purpose of the RMPs is to ensure public land use is planned for and managed on the basis of multiple-use and sustained yield in accordance with the Federal Land Policy and Management Act of 1976 (FLPMA). The following BLM-RMPs are relevant to the Owyhee Subbasin:

- Southeastern Oregon Resource Management Plan
- Owyhee Resource Area – Resource Management Plan

- Bruneau Resource Area – Resource Management Plan
- Proposed Elko/Wells Resource Management Plans – Fire Management Amendment and Final Assessment

In addition, the US Forest Service administers land and resource management in the Humboldt-Toiyabe National Forest. The Humboldt and Toiyabe Forest Plans were last developed in 1986 – both forest plans are currently being revised. Humboldt National Forest Plan overlaps the Owyhee Subbasin.

1.3.3 Existing restoration and conservation projects

1.3.3.1 BPA-Funded Projects and other Projects Recommended by the ISRP

BPA-funded mitigation within the Owyhee Subbasin has occurred primarily through implementation efforts by the Shoshone-Paiute Tribe as off-site protection, mitigation, enhancement and compensation activities called for under Section 4(h) of the Pacific Northwest Electric Power Planning and Conservation Act and the Northwest Power Planning Council Fish and Wildlife Program (Table 1.3). These activities provide partial mitigation for the extirpation of anadromous fish resources from usual and accustomed harvest areas and Reservation lands. Additional mitigation is also occurring to address impacts to resident fish and wildlife populations and habitats attributable to development of the Federal Columbia River Power System. This includes the implementation of wildlife mitigation efforts through off-site mitigation intended to address the wildlife construction and inundation ledger for Middle Snake Province Dams – none of which are in the Owyhee Subbasin. Three hydroelectric projects, Anderson Ranch, Black Canyon and Deadwood were constructed in the Middle Snake Province. The Shoshone-Paiute wildlife mitigation project[1] addresses mitigation opportunities for those projects.

[1] Southern Idaho Wildlife Mitigation Program, Middle Snake Province – Shoshone-Paiute Tribes (Project 199505703)

Table 1.3. Summary of ongoing and proposed BPA projects sponsored by the Shoshone-Paiute Tribes.

PROJECT
ONGOING BPA-FUNDED PROJECTS
200302600 Wildlife Inventory and Habitat Evaluation of Duck Valley Indian Reservation
199701100 Enhance and Protect Habitat and Riparian Areas on the DVIR
199505703 Southern Idaho Wildlife Mitigation - Shoshone-Paiute Tribes
199501500 Lake Billy Shaw Operations and Maintenance and Evaluation (O&M, M&E)
198815600 Implement Fishery Stocking Program Consistent With Native Fish Conservation
2000079 Assess Resident Fish, E. Fork Owyhee Subasin
PREVIOUSLY PROPOSED AND RECOMMENDED BY THE ISRP, BUT UNFUNDED BPA PROJECTS
20040 Develop a Fish & Wildlife Management Plan for the Owyhee Basin, DVIR
20041 Develop a Fish & Wildlife Conservation Law Enforcement Plan, DVIR
20094 Assess Resident Fish Stocks Of The Owyhee Basin, DVIR
20093 Evaluate the Feasibility for Anadromous Fish Reintroduction in the Owyhee
Project 200007900 Assess Resident Fish Stocks Of The Owyhee/Bruneau Basin, D.V.I.R.
Project 32001 - Evaluate the Feasibility Artificial Production Facility DVIR

1.3.3.2 Actual Expenditures for Past Projects and Estimated Budgets of Ongoing BPA Funded Projects

1.3.3.2.1 Budgets for Past BPA Funded Projects for the Owyhee Subbasin

The Shoshone-Paiute Tribe has received relatively little mitigation and enhancement funding from BPA to date, i.e., about $4.0 million from 1984 to 2002. About half of the total (2.0 million) has been obligated during the most recent five years. From 1984 to 1998 the Duck Valley Resident Fish Project (198815600) was the central fish mitigation activity. The strategy was simple -- purchase rainbow trout from the U.S. Fish & Wildlife Service and stock them into two productive reservoirs (Sheep Creek and Mountain View reservoirs) to sustain a put-and-take fisheries for tribal members and non-tribal fishers. Beginning in 1995, the strategy of developing productive reservoir fisheries was elaborated on – with the feasibility study of the construction of another dam and reservoir – expressly for native trout fisheries. The Lake Billy Shaw dam and reservoir construction project was completed in 1998. The development of the Lake Billy Shaw fishery is ongoing to present.

Projects based on fish & wildlife habitat restoration strategies were initiated in 1996. The need for concurrent research, monitoring and evaluation (RM&E) of DVIR fish populations, wildlife populations and their habitats is now apparent. A RM&E strategy for DVIR was recently funded by BPA as a prerequisite for ongoing funding of habitat restoration projects. Concurrently, we are developing a RM&E plan for the Owyhee Subbasin Plan which is consistent with the DVIR habitat M&E Plan.

During 1999-2000 the Shoshone-Paiute Tribes began to develop a more comprehensive and integrated approach for enhancement and mitigation projects. This integrated approach was supported by the Independent Scientific Review Panel (ISRP); however, funding limitations in year 2000 forestalled its implementation. The current year (FY2004) budget estimate for BPA-funded Shoshone-Paiute Projects is summarized in Table 1.4.

Table 1.4. FY 2004 budget estimate for Shoshone-Paiute fish & wildlife projects on the Duck Valley Indian Reservation funded by Bonneville Power Administration.

PROJECT	FY2004
200302600 Wildlife Inventory and Habitat Evaluation of Duck Valley Indian Reservation	**$120,010**
199701100 Enhance and Protect Habitat and Riparian Areas on the DVIR	**$360,000**
199505703 Southern Idaho Wildlife Mitigation - Shoshone-Paiute Tribes	**$831,347**
199501500 Lake Billy Shaw Operations and Maintenance and Evaluation (O&M, M&E)	**$244,000**
198815600 Implement Fishery Stocking Program Consistent With Native Fish Conservation	**$209,000**
TOTAL FY2004 budget for five ongoing projects:	**$1,764,357**

The only other BPA-funded project in the Owyhee Subbasin is the Idaho Department of Fish & Game Snake River native fish stock assessment (Project# 199800200) which has an estimated budget of about $360,000 for FY 2004. Thus the total budget for fish & wildlife projects implemented in the Owyhee Subbasin for FY2004 is about $2.12 million. A summary of non-BPA funded restoration projects is summarized in Chapter 3, §3.3.5.

1.3.4 Gap assessment of existing protections, plans, programs and projects.

The Technical Guide for Subbasin Planners says that the inventory sections of subbasin plans should identify the gaps between actions that have already been taken or are underway and additional actions that are needed. This perspective can help determine whether ongoing activities are appropriate or should be modified and leading to new management activity considerations.

Summary tables were developed listing the recent projects that have been implemented in the Subbasin. Projects were coded for the limiting factors that were addressed, and the strategies that were employed. Corresponding objectives and strategies that address these needs are referenced in Chapter 4.

1.3.4.1 Analysis of Existing and Ongoing Actions Taken

Most of the BPA-funded fish & wildlife restoration projects in the Owyhee Subbasin since early 1980's have been sponsored by the Shoshone-Paiute Tribes and implemented on the Duck Valley Indian Reservation (DVIR). For the past two decades of the Council's Fish & Wildlife Program, no projects in the Owyhee Subbasin have been sponsored and implemented by the state agencies in Oregon or Nevada. Only one (regional) project has been implemented by IDFG in the Owyhee Subbasin, i.e., native fish assessment in the Snake River Basin. Corresponding objectives and strategies from the management plan that address these needs are referenced. The main focus in the Owyhee Subbasin at this time should be on native fish & wildlife assessment, riparian habitat improvement work, and Adaptive Management via monitoring & evaluation.

In the Owyhee Subbasin, outside the DVIR, many habitat restoration projects have already been implemented by non-BPA funding sources. While these projects have been beneficial for fish and wildlife, they have been mostly small projects not directly targeting fish & wildlife objectives and strategies.

A large unmet need for basic scientific information needed to manage fish & wildlife populations. Starting in 2004, a comprehensive M&E Plan is being implemented for the riparian restoration projects sponsored by Shoshone-Paiute Tribes on the Duck Valley Indian reservation. A parallel M&E framework plan has been developed for the Owyhee Subbasin Plan. Funding is also needed for restoration efforts to conserve and enhance vulnerable redband trout populations and habitats. There are numerous objectives and strategies in the management plan that address the need for habitat evaluation, protection, and restoration.

1.3.4.2 Gaps Between Actions Taken and Actions Needed

One of the most serious fish and wildlife management issues in the Owyhee Subbasin is the lack of basic information needed to scientifically manage the fish & wildlife resources. A critical need exists to implement a comprehensive Monitoring & Evaluation Plan for the Owyhee Subbasin (refer to Chapter 4, § 4.6). Additional fish and wildlife assessments are needed; including assessments on private lands if voluntary participation by landowners can be achieved. Once adequate fundamental scientific monitoring information is gathered, projects can be developed with a more valid basis and then implemented with ongoing monitoring of specific project effectiveness. At present, there are disconnects between identification of problems, prioritization of strategies, design and development of projects, implementation, and evaluation of effectiveness; however a comprehensive M&E plan is being developed for Shoshone-Paiute Projects on the Duck Valley Indian Reservation (refer to Appendix 4.5) – that will be implemented during the spring-summer of 2004.

During the Qualitative Habitat Assessment (QHA), it became apparent that:

(1) little was known about the redband trout habitat in many river reaches due to the nature of the remote country and lack of easy access,
(2) although most of the land area of the Owyhee Subbasin is in public ownership, a significant proportion of the prime stream/riparian habitat is under private ownership and/or control via access, and
(3) much of the stream and riparian habitats with little or no assessment data are on the privately controlled stream reaches.

1.4 Summary of Chapter 4 – Owyhee Subbasin Management Plan

1.4.1 Vision, Mission and Guiding Principles for the Owyhee Subbasin

1.4.1.1 Vision

The Owyhee Subbasin planning and technical teams established the following **Vision** for the Owyhee Subbasin Plan:

> **We envision the Owyhee Subbasin being comprised of and supporting naturally-sustainable, diverse fish and wildlife populations and their habitats, that contribute to the social, cultural, and economic well-being of the subbasin and society.**

1.4.1.2 Mission

The Owyhee Subbasin planning and technical teams established the following **Mission** of the Owyhee Subbasin Plan.

> **The Owyhee Subbasin Plan will serve as the conceptual and strategic basis for future implementation of the Northwest Power and Conservation Council's Columbia Basin Fish and Wildlife Program in the Owyhee Subbasin.**

1.4.1.3 Guiding Principles

The Owyhee Subbasin planning and technical teams established the following **Guiding Principles** for the development of the Owyhee Subbasin Plan.

1. Respect, recognize, and honor the legal authority, jurisdiction, tribal rights, and rights of all parties;
2. Protect, maintain, enhance, and restore habitats in a way that will sustain and recover aquatic and terrestrial species diversity and abundance with emphasis on the recovery of native, sensitive, and Endangered Species Act listed species;
3. Foster stewardship of natural resources through conservation, protection, enhancement, and restoration recognizing all components of the ecosystem, including the human component;
4. Provide information to residents of the Owyhee subbasin to promote understanding and appreciation of the need to maintain, enhance, and/or restore a healthy and properly functioning ecosystem;
5. Provide opportunities for sustainable, natural resource-based economies to thrive, while accomplishing the fish and wildlife goals in the plan;
6. Promote, enhance, and recognize local participation in natural resource problem solving and subbasin-wide conservation efforts;
7. Coordinate efforts to implement the Pacific Northwest Electric Power Planning and Conservation Act, the Endangered Species Act, the Clean Water Act, tribal rights, and other local, state, federal, and tribal programs, obligations, and authorities;
8. Include monitoring and evaluation in the design of all fish and wildlife projects – to facilitate review and adjustments to the projects – thus incorporating Adaptive Management[2] principles;
9. Enhance native fish and wildlife populations to a healthy and sustainable abundance to support tribal and public harvest goals.

1.4.2 Human Use of the Environment

1.4.2.1 Native American Use of Anadromous Fish and Traditional Food Resources – Before and During European Settlement

The following summary information has been abstracted from Appendix 1.2 which is incorporated herein in reference.

[2] The Council's Fish & Wildlife Program (2000) defines "Adaptive Management" as: "A scientific policy that seeks to improve management of biological resources, particularly in areas of scientific uncertainty, by viewing program actions as vehicles for learning. Projects are designed and implemented as experiments so that even if they fail, they provide useful information for future actions. Monitoring and evaluation are emphasized so that the interaction of different elements of the system are better understood."

An important goal of federal Indian policy has been to establish self-sufficient reservation communities. This has been interpreted by the Shoshone-Paiute as well as by various government agents to require development of various enterprises such as irrigated farming and cattle and horse ranching. Despite various projects and efforts by the federal government, there have been frequent failures in Duck Valley Indian Reservation history due to lack of investment and development of the reservations' water resources by the federal government. These failures have made the importance of various traditional food resources critical for survival in the domestic economy of many Shoshone-Paiute families who live in economic poverty. A principal impact on such families has been the blockading of anadromous fish passage to the Owyhee, Bruneau, as well as the Boise-Payette-Weiser and Middle and Upper Snake River drainages. These losses must be taken into account in any subbasin planning effort, especially in view of the previous failure to compensate or otherwise mitigate damages done to the Shoshone-Paiute by the loss of these important resources.

Research by Dr. Walker has established a baseline for determination of the extent of these losses. For example, Dr. Walker determined that before the blockading of the fish passage the Shoshone-Paiute of the Duck Valley Indian Reservation enjoyed three annual salmon runs of about ten days each. Dr. Walker determined from interviews of elders as well as from recorded interviews of tribal members born in the 19th century that these three annual salmon runs could be expected, in normal years, to last about ten days each. The research also demonstrates that the location of the Duck Valley Indian Reservation was chosen in part because of the abundant fisheries available in the region. For example, in an interview with Federal Agent Levi Gheen, the *Territorial Enterprise* (1-3-1878) quoted saying, "The country abounds in deer, grouse, prairie chickens and other wild game, while the creeks and river[s] literally swarm with excellent fish. All in all Duck Valley is a veritable Indian paradise." Again, it was at this time that Captain Sam first mentioned Duck Valley to Gheen as a "place . . . about seventy or eighty miles northeast of [Elko] where [the Indians] say there is plenty of game and fish and a good farming country as near as they can judge with plenty of timber [and in the mountains] water and grass" (Gheen 1875).

Using information gained from tribal fishermen as well as from comparative catch records from other related tribes (Walker 1967, 1992, 1993b), Dr. Walker estimates catches to have been about 200 fish per day, averaging 15 pounds each (for each of ten separate weirs), yielding a potential average annual catch of 90,000 pounds, or about 6,000 fish. As further verification of these numbers estimates have been derived for other important fisheries (the Boise-Payette-Weiser Valley and the Hagerman-Shoshone Falls sites) which the Shoshone-Paiute shared with other tribes of southern Idaho. It is estimated that this large area contained at least 25 traditional weir sites, and based on tribal accounts each site could produce significant catches for about ten days, three times per year. For 25 weirs the catches are estimated to have been 200 fish per day, per weir, averaging 15 pounds each, yielding an average annual catch of 2,250,000 pounds or about 150,000 fish. Of course, some of these fisheries were destroyed early by mining and agriculture as other were later destroyed by damming of the Columbia, Snake, and many of their tributaries. While these 19th century salmon catch estimates are large when compared to contemporary catches in the Columbia-Snake system, they are supported by the evidence discovered in Dr. Walkers research.

Beginning in the late 19th century, the destruction of these fisheries has been a significant blow for the Shoshone-Paiute. They have suffered not only economic and subsistence shortfalls because of it, but also have experienced declines in the quality of their diet which in various serious health problems such as diabetes that are becoming extremely common. The loss of this significant source of easily obtained protein and related nutrients cannot be disregarded in subbasin planning; neither can the fact that the Shoshone-Paiute have never been compensated for their losses. Despite such losses, Tribal members have continued to fish for both anadromous and non-anadromous species – often traveling long distances to other Columbia, Salmon and Snake fisheries.

1.4.2.2 Current Social, Economic & Cultural Use

Currently very little infrastructure exists in the Owyhee Subbasin for commerce, with the exception of agriculture. The infrastructure with respect to power generation, municipal and industrial water supply, sewage treatment, production of goods and services, and transportation is at minimal levels within the subbasin.

1.4.2.2.1 Water Use

Irrigation accounted for the greatest use of surface and ground water throughout the Owyhee Subbasin. Maximum water use for irrigation occurs in the Lower Owyhee, Jordan and South Fork Owyhee HUCs. Surface water is the source of most of the water used in the subbasin.

1.4.2.2.2 Current land use

Predominant current land uses in the subbasin are ranching and irrigated agriculture (Table 1.5).

Table 1.5. Land uses in the Owyhee subbasin (USGS data; Perugini et al. 2002)

Description	Acres	Kilometers^2	Miles^2	Percent
Open Water	26,300	106	41	0.373
Perennial Ice/Snow	13	0	0	0.000
Low Intensity Residential	176	1	0	0.002
High Intensity Residential	6	0	0	0.000
Commercial/Industrial/Transportation	5,503	22	9	0.078
Bare Rock/Sand/Clay	48,995	198	77	0.696
Quarries/Strip Mines/Gravel Pits	193	1	0	0.003
Transitional	129	1	0	0.002
Deciduous Forest	12,969	52	20	0.184
Evergreen Forest	243,839	987	381	3.462
Mixed Forest	306	1	0	0.004
Shrubland	5,806,647	23,499	9,073	82.439
Grasslands/Herbaceous	686,788	2,779	1,073	9.751
Pasture/Hay	188,049	761	294	2.670
Row Crops	3,934	16	6	0.056
Small Grains	14,259	58	22	0.202
Urban/Recreational Grasses	60	0	0	0.001
Woody Wetlands	5,441	22	9	0.077
Totals	7,043,605	28,505	11,006	100.000

Agriculture and BLM Grazing Allotments

Agriculture is confined primarily to the Duck Valley Indian Reservation, the area around the confluence of the Owyhee and Snake Rivers, Jordan Valley and Jordan Creek Basin (Perugini et al. 2002). Irrigated hay farming for cattle feed is the dominant crop. Row crop farming occurs in the northern portion of the subbasin near the confluence with the Snake River (Perkins and Bowers 2000).

Water uses within the Owyhee Irrigation District are 100% for irrigated agriculture (Owyhee Irrigation District Water Management/Conservation Plan 2002). Benefits of fertile lands and favorable climate, combined with a good supply of irrigation water, make possible the production of abundant crops on the Owyhee Project – principally grain, hay, and pasture, sugar beets, potatoes, onions, sweet corn, and alfalfa seed. Livestock and dairy products contribute to the returns from the land.

BLM Grazing Assessments/Allotments

The Bureau of Land Management (BLM) conducts assessments of rangeland health for individual grazing allotments. In 1997, the BLM in Idaho adopted rangeland health standards. There are eight standards, not all of which apply to a given parcel of land:

- **Standard 1: Functioning Watersheds**
- **Standard 2: Functioning Riparian Areas and Wetlands**
- **Standard 3: Functioning Stream Channel/Floodplain**
- **Standard 4: Healthy Native Plant Communities**
- **Standard 5: Functioning Rangeland Seeding**
- **Standard 6: Control of Exotic Plant Communities**
- **Standard 7: Water Quality Compliance with Standards**
- **Standard 8: Healthy Habitats for Threatened and Endangered Species**

Standards of rangeland health are expressions of the level of physical and biological condition or degree of function required for healthy, sustainable rangelands. Rangelands should meet applicable standards or be making significant progress. If the standards are met, there should be proper nutrient and hydrologic cycling, and energy flow. Current livestock grazing management is evaluated in these Assessments to determine if it maintains standards or promotes significant progress toward meeting the standards. For each standard, indicators are typical physical and biological factors and processes that can be measured or observed. These Assessments examine the indicators for each standard and use quantitative and qualitative information including inventory data, monitoring data, health assessment information or other observations to evaluate the current status of each indicator for each standard. Conclusions as to whether or not allotments are meeting or making significant progress toward meeting the standards is provided in separate determination documents based on information in the Assessments. Final determinations are based on all available information.

1.4.3 Approach for the Developing the Management Plan's Objectives & Strategies

The Owyhee Subbasin Planning process has a dual purpose, i.e., the successful completion of this process will result in two integrated outcomes:

1. A professional, comprehensive, and science-based fish and wildlife assessment and restoration plan for the Owyhee Subbasin; and
2. A comprehensive, locally-supported management plan for fish and wildlife resources within the Owyhee Subbasin.

The Owyhee Subbasin Plan (OSP) will serve as the conceptual and strategic basis for future implementation of the Northwest Power and Conservation Council's Columbia Basin Fish and Wildlife Program in the Owyhee Subbasin. Simply stated, the OSP is a Fish & Wildlife Plan for the Owyhee Subbasin. The OSP has the following desired attributes; it is:

- Consistent with all (62) Subbasin Plans being developed in the Columbia Basin.
- Based on scientific F&W assessment integrated with stakeholder input – to produce a locally supported F&W management plan.

- A basis for including Owyhee F&W restoration priorities into an amendment to the Council's Fish & Wildlife Program.
- Focused on actions to mitigate for F&W losses caused by federal dams.

Some local stakeholders have concerns that the Subbasin Planning process will regulate natural resources in the Owyhee Subbasin and thus restrict their local economy. The simple fact is that the Northwest Power and Conservation Council is not a regulatory entity and the provisions of Fish & Wildlife Plan, and the Subbasin Plans it subsumes, are not enforceable. Thus the OSP will not regulate the use of natural resources in the Owyhee Subbasin – it will not regulate or enforce: air quality; water or quantity (storage reservoirs, irrigation or water rights); land management; forestry; or grazing. In short, it will not regulate land owners activities on private lands

Similarly, state and federal agency representatives should not view the Subbasin Plans as a competing or duplicative planning process relative to their management plans for species or land areas under their jurisdiction. The OSP

- is not an ESA recovery plan,
  - it does not displace the authority or responsibilities of USFWS or NMFS;
- is not a Hydro Operations plan,
  - it does not displace the authority or responsibilities of IPC, BOR or FERC;
- is not a Federal Land mgt. plan,
  - It does not displace the authority or responsibilities of BLM or USFS.

1.4.3.1 The Vision Drives the Strategic Plan for the Owyhee Subbasin Management Plan

The planning elements (i.e., vision, goals, objectives, strategies, action plans) comprise the structure or "framework" built on the foundation of scientific knowledge. Under the unifying Columbia Basin Vision of the Council's Fish & Wildlife Program, the Owyhee subbasin Planning Team has developed a consistent subbasin-specific Vision. The Owyhee Subbasin Plan Vision statement:

"We envision the Owyhee Subbasin being comprised of and supporting naturally-sustainable, diverse fish and wildlife populations and their habitats, that contribute to the social, cultural, and economic well-being of the subbasin and society."

Under the Vision are multiple goals, e.g., for fish, wildlife and their habitats. Likewise, under each goal, there are several measurable Objectives, and under each objective a set of numerous Strategies, etc. – thus the pyramidal shape of the framework illustrated in Figure 1.6.

Figure 1.6. -- Hierarchical strategic planning framework with a scientific foundation -- with Monitoring & Evaluation to provide for Adaptive Management.

During the development of the OSP fish & wildlife management plan it is important to have a common understanding of definitions and linkages of the strategic elements. The strategic planning elements of the Owyhee Subbasin Management Plan are described as follows:

⇒ VISION -- Clearly describes the desired future for fish & wildlife within the Owyhee Subbasin
⇒ OBJECTIVES – Explicit, quantifiable and achievable F&W targets
⇒ STRATEGIES -- Clear problem-solving approaches to restoration and protection

The Management Plan integrates the limiting factors analysis from the Assessment with current status of fish & wildlife restoration from Inventory. The following graphic illustrates how the Assessment & Inventory are integrated with the Management Plan (Figure 1.7).

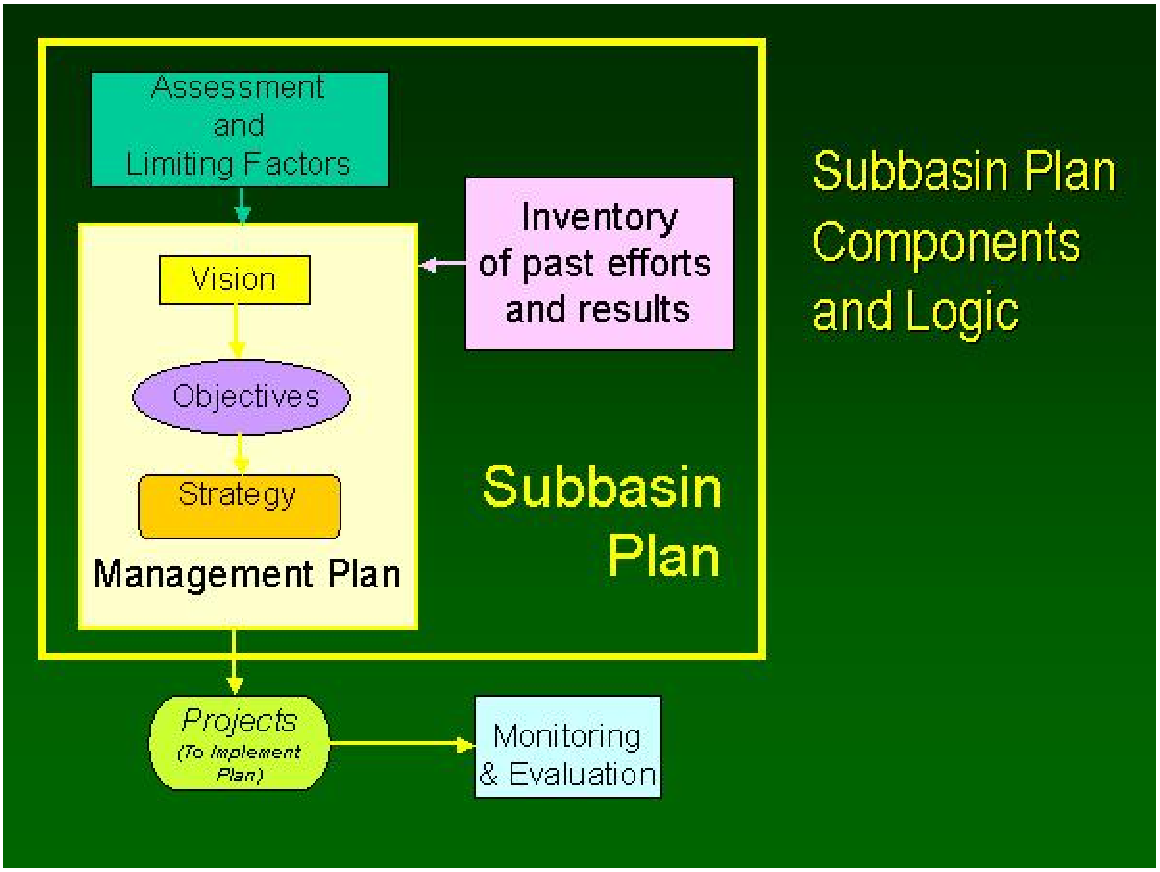

Figure 1.7. Flow chart of the logical connection between the components of the Owyhee Subbasin Plan (source: ISRP (2004) presentation).

1.4.3.2 Developing the Objectives and Strategies for the Owyhee Subbasin Plan

For the short-term implementation of this plan, the project sponsor will coordinate with all individuals / entities affected on a project specific basis. The following global near-term strategic initiatives outline the implementation approach for the Owyhee Subbasin Management Plan:

1. **Continue implementation of ongoing project's objectives, strategies, actions.**
2. **Begin implementation of the Owyhee Subbasin M&E Plan.**

These two strategic initiatives are explained in more detail in the following section:

1. **Continue implementation of ongoing projects.**
   - 1.1. Build on the strength of the objectives, strategies and actions incorporated into successful ongoing projects (2005-2007).
   - 1.2. Refine or terminate projects shown to be ineffective based on the OSP M&E.
   - 1.3. Build integral M&E components into revised or new projects that are compatible with the Global OSP M&E Approach.

2. Begin implementation of the Owyhee Subbasin M&E Plan

2.1. The Owyhee Subbasin Plan will recommend funding of the Subbasin M&E Plan in the near future (2005-2007)

2.2. The M&E Plan will be the basis for Adaptive Management of the OSP Implementation

2.3. The M&E Plan will be updated and revised as more specifics are developed on the Objectives and Strategies over the long term

1.4.3.4 Approach for Long Term – the next 10 years (2008-2017)

- Adaptive Management – Evaluate continued funding of ongoing projects based on results quantified via the Owyhee Subbasin M&E Plan – update OSP every 5-years
- Move more & more towards implementing science-based objectives & strategies based on cause-effect Hypothesis testing, measurable performance standards and integration with TMDLs, RMPs & ESA.

The desired future for the implementation of the Owyhee Subbasin Plan is one of cooperation, successful restoration actions, and benefits to all stakeholders. We are working towards a "win-win" solution for Fish & Wildlife Restoration in the Owyhee Subbasin that results in the following outcomes:

- Fish, Wildlife and Habitat are restored to naturally sustainable levels;
- The Rights & Responsibilities of all entities and stakeholders are respected; and,
- Local people and society benefit.

1.4.3.5 Development of a Budget Estimate for implementing the Owyhee Subbasin Management Plan

The short-term (3 year) BPA-funded budget – for fiscal years 2005, 2006, and 2007 – needed to implement the Owyhee Subbasin Plan is presented in Table 1.6. Additional detail including a long-term budget is presented in Chapter 4, §4.3.4.

Table 1.6. Outyear (2005-2007) budget projections for Shoshone-Paiute fish & wildlife projects on the Duck Valley Indian Reservation funded by Bonneville Power Administration.

PROJECT	3-YEAR TOTAL 2005-2007
200302600 Wildlife Inventory and Habitat Evaluation of Duck Valley Indian Reservation	**$23,869**
199701100 Enhance and Protect Habitat and Riparian Areas on the DVIR	**$1,175,000**
199505703 Southern Idaho Wildlife Mitigation - Shoshone-Paiute Tribes	**$5,038,071**
199501500 Lake Billy Shaw Operations and Maintenance and Evaluation (O&M, M&E)	**$789,000**
198815600 Implement Fishery Stocking Program Consistent With Native Fish Conservation	**$682,000**
ONGOING SHOSHONE-PAIUTE TRIBES PROJECTS (SUBTOTAL)	**$7,707,940**
IDFG NATIVE TROUT ASSESSMENT 199800200	**$1,171,000**
OWYHEE SUBBASIN PLAN M&E	**$1,650,000**
TOTAL 3-year budget for seven ongoing & proposed projects:	**$10,528,940**

1.4.4 Biological Objectives and Prioritized Strategies

1.4.4.1 Aquatic Objectives and Strategies

Goals represent broad policy direction; e.g., improve stream habitat conditions and the survival conditions of target fish species. Management objectives should (a) describe the direction and purpose of fish and wildlife recovery efforts, (b) address the question of why restoration programs consist of a given set of strategies and actions, and (c) describe the desired biological state for the subbasin in regard to ecosystem characteristics, defining species and management actions (Science Review Team 1996). Different management objectives and ecological relationships can be accommodated by simply moving up or down levels from the Basin to the subbasin levels. Development of management objectives is an iterative process that cycles between what is desired for watersheds and what is possible given ecological, social and economic constraints. Biological objectives are measurable objectives that are adopted by the Northwest Power and Conservation Council and incorporated into its Fish & Wildlife Program.

Strategies are the methods to achieve goals and objectives. Overall, fisheries management has relatively few major methods available to protect and enhance fish populations or alter fish communities. Fish managers in the upper-Columbia Basin have eight global categories of tools at their disposal (Table 1.7). Not all of these strategies are deemed appropriate by all members of the Owyhee Subbasin Planning Team. The Council's subbasin planning process is focused mainly on habitat restoration strategies.

Table 1.7. Major tools available to Columbia Basin fish managers -- to achieve goals and objectives.

Major Tool	Subsets	Use
1. Planning & Modeling	Planning	Program implementation
	Models: individual / population / community / system	Test research hypotheses
2. Research, M&E	Genetic	Species / population diversity
	Biological	Understand processes
	Stock Assessment	Status / population dynamics
	Ecological	Test cause / effect
	Monitoring & Evaluation	Test management actions
3. Habitat / Watershed	Reserves	Conservation
Restoration	Alterations	Restoration / Nat. Production
4. Artificial Production	Wild Brood Stock	Genetic Conservation
	Hatchery stock	Production / harvest
5. Species Alteration (+/-)	Removal	Reduce predation, competition
	Introductions	Restoration, mitigation
	Habitat restoration	Favor native assemblages
6. River System Changes	River / reservoir operations	Normative river
	Dam alterations	Solve specific problems
7. Enforcement	Fisheries regulations	Protect / exploit / alter
	Habitat & environmental laws	Protect
8. Public Awareness	Inform / Involve	Long term societal solutions

In the planning phase, fish & wildlife management objectives are developed from the Council's vision of a healthy Columbia River and basin-wide viable fish & wildlife populations, and the specific Owyhee Subbasin Vision of naturally-sustainable, diverse fish and wildlife populations and their habitats within the subbasin. During the implementation phase, specific measurable biological/ecological objectives and performance standards are formulated. Fisheries management tools are then used to transfer these objectives into actions -- specific strategies that are implemented as restoration projects (Figure 4.4). Statements of Work incorporate specific "Action Plans" that are detailed descriptions of how strategies will be implemented on an operational basis.

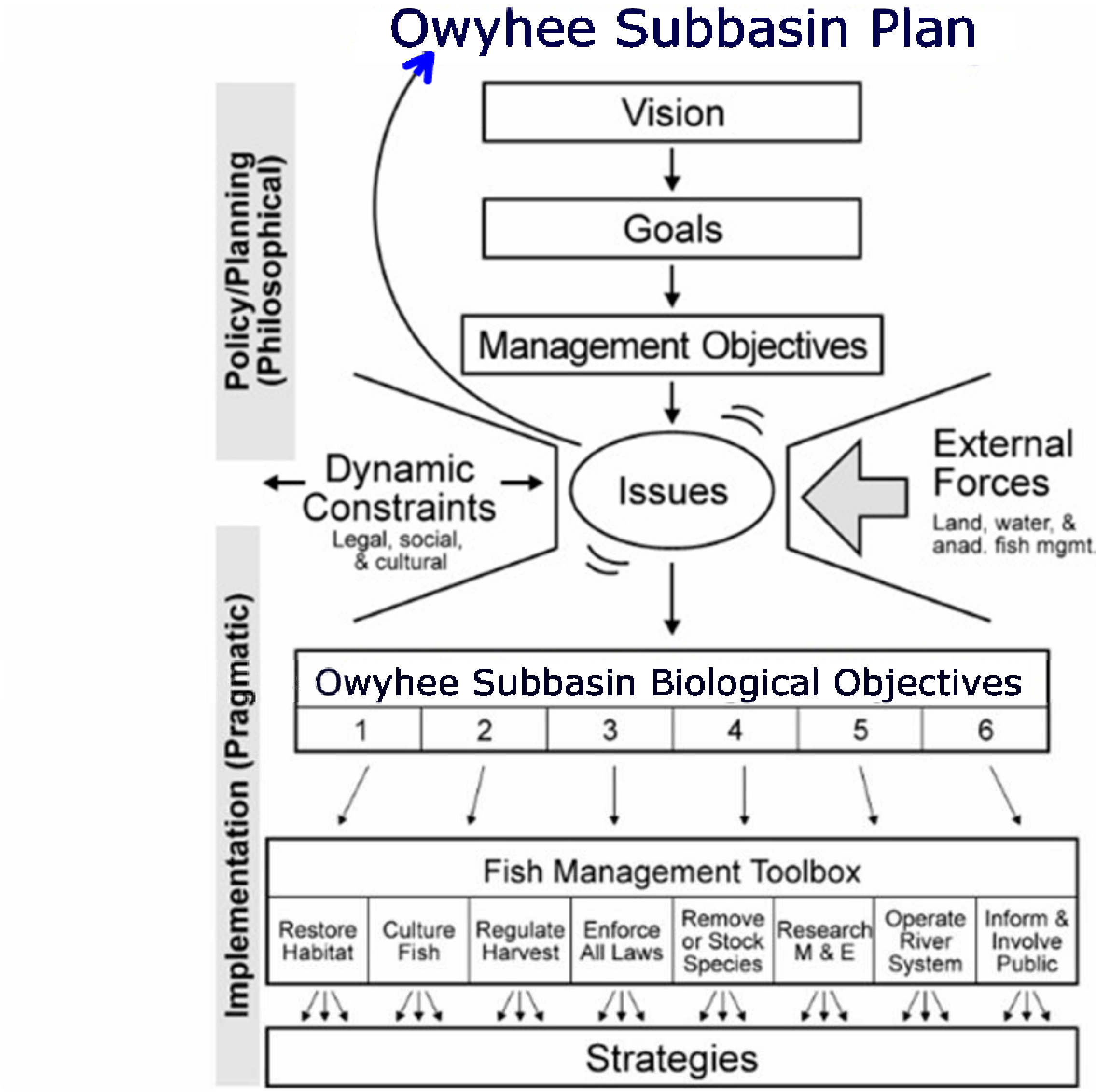

Figure 1.8. A simplified flow diagram of the implementation process showing the development of specific strategies -- from policy & planning through the filter of available management tools.

1.4.4.2 Aquatic – Short-term Objectives and Strategies

The ongoing projects sponsored by the Shoshone-Paiute Tribes form the nucleus of goals, objectives, and strategies for aquatic habitat restoration and enhancement – for the short term (i.e., next three years). This foundation will provide a starting point for the development of a more comprehensive and diverse strategic plan for the Owyhee Subbasin for the long term (i.e., the following decade and beyond). The ongoing near-term Owyhee Subbasin Plan fish and aquatic habitat restoration objectives and strategies are summarized in Table 1.8.

Table 1.8. Summary of biological objectives and strategies for ongoing and proposed BPA-funded fish and aquatic habitat projects in the Owyhee Subbasin.

PROJECT/OBJECTIVES	STRATEGIES
Enhancement and Protection of Habitat and Riparian Areas	
1. Protect specific springs from livestock impacts – based on revision of list of springs in proposal. 2. Protect specific streams from livestock impacts –In coordination with Project 2000-079 and field observations. 3. Conduct fishery and habitat surveys	a. Cooperative management/Research – identify, prioritize and locate springs in need of protection (priority to suspected redband trout streams), b. Habitat Restoration – implement protective measures of springs (minimum of 6 springs per year); implement protective measures (fencing riparian areas/fixing road crossings) on streams and/or headwaters (appr. 6-10 miles of fence, troughs, culverts, etc). c. Research, Monitoring & Evaluation (RM&E) – implement PFC assessment; conduct population estimates, size structure, condition, locations (GPS) in coordination with Project 2000-079.
DEVELOPMENT AND ENHANCEMENT OF RESERVOIR FISHERIES	
1. Protect shoreline and inlet streams from degradation. 2. Disseminate information to public. 3. Work with Owyhee Schools on volunteer projects. 5. Stock Lake Billy Shaw with Sterile rainbow trout 6. Update and review Operations and Maintenance and Monitoring and Evaluation Plan	a. Habitat restoration – plant native trees/willows and grasses along shoreline and tributaries to Lake Billy Shaw b. Control grazing impacts – install water troughs/stock ponds to keep stock away from reservoir/fences c. Education & public outreach – monthly newspaper articles/quarterly to city paper; update & maintain signs to alert public to new fishing facility; have students aid in planting trees/willows/grasses. d. Fishery Management – manage put-and-take fishery in Lake Billy Shaw – stock fish in reservoir during spring and fall as temperatures and conditions warrant and set fishery seasons. e. Monitor & evaluate – collect and summarize data on biological and economic aspects of Lake Billy Shaw fishery.
Implement Artificial Production and Selective Fish Stocking Consistent With Native Fish Conservation	

PROJECT/OBJECTIVES	STRATEGIES
1. Provide subsistence put-and-take trout fisheries for tribal and sport fishery for non-tribal members at various reservoirs on the Duck Valley Indian Reservation.	a. Fishery Management – manage put-and-take fisheries at suitable times & reservoirs (Mountain View Reservoir, Lake Billy Shaw, and Sheep Creek Reservoir) on the Duck Valley Indian Reservation to maximize survival and harvestable production (within one year) and minimize the impact on native resident fish populations. b. Monitor and Evaluation (M&E) – monitor seasonal reservoir conditions such as temperature and dissolved oxygen – to schedule trout stocking in order to optimize growth rates, catch rates, and harvest rates of hatchery trout. c. Monitor and Evaluation (M&E) – monitor native redband trout populations (presence/absence in reservoirs and influent/effluent streams – to minimize impact by hatchery trout. c. Monitor and Evaluation (M&E) – monitor cost & benefits of put-and–take fisheries.
Conduct Assessments of Resident Fish in the Owyhee Subbasin	
1. Conduct resident fish assessment, including genetic survey of redband trout	a. Research, Monitoring & Evaluation (RM&E) quanytitative assessment of fish population species composition, distribution and abundance. (b) genetic survey of redband trout
Conduct a systematic resident fish species inventory & genetic stock assessment in the Owyhee/Bruneau River Basin, DVIR component.	Research, Monitoring & Evaluation (RM&E) of fish populations,
Province-wide Native Salmonid Assessment	Assess the current status of native salmonids in the Middle and Upper Snake Provinces in Idaho (Phase I), identify factors limiting populations (Phase II), and develop and implement recovery strategies and plans (Phase III)/ Middle and Upper Snake Provinces in ID

1.4.4.3 Aquatic species – Long-term Strategies for Redband Trout

Linking Technical Analysis (QHA) with Restoration Objectives and Strategies.

The following global objectives and strategies were developed by Owyhee Technical team members based on the on linkage between Qualitative Habitat Assessment and corresponding objectives and strategies from state and federal agency resource management plans. A summary of strategies and objectives contained in state and federal agency resource management plans is presented in Appendix 4.4.

Objective 1. Improve streamside riparian habitat and bank stability.

Strategies:

1.1. Implement State and BLM riparian, fisheries and water resources Management Actions and Allocations standards and objectives from the Owyhee Resource Management Plan and Bruneau Management Framework Plan on watersheds with redband trout habitat.

1.2. Implement State and BLM Standards and Guides, grazing management objectives and guidelines on watersheds with redband trout spawning and rearing habitats.

1.3. Work with private landowners to improve riparian habitat.

1.4. Improve livestock management program to improve riparian habitat on Tribal lands.

1.5. Implement USFS livestock utilization standards from Forest Plan revision on watershed with redband trout priority spawning and rearing habitats.

1.6. Implement grazing management appropriate for riparian pastures.

Objective 2. Control pollution from mining activities.

Strategies:

2.1 Use Best Management Practices to mine tailings and polluted areas to remediate pollution.[3]

Objective 3. Restore redband trout connectivity.

Strategies:

3.1. Add fish screens to diversion structures to prevent downstream migration of redband trout into diversion ditches.

3.2. Replace impassable culverts with suitable redband trout passage structures.

3.3. Construct and operate a fish ladder over dam.

3.4. Preserve and enhance native Redband trout habitat and connectivity by seeking innovative and voluntary methods to improve stream flows where it is feasible and consistent with State water laws and Tribal sovereignty.

Objective: 4. Improve instream flows to achieve levels needed for redband trout survival and productivity.

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[3] Use Best Management Practices to Rio Tinto Mine tailings to remediate pollution of East Fork Owyhee River.

Strategy:
4.1. Improve instream flow on public lands by increasing riparian vegetation.

Objective: 5. Remove nonnative fish population in order to enhance redband trout survival and productivity. (Restoration only)

Strategy:
5.1. Remove nonnative fish population using most appropriate site-specific methods.

1.4.4.4 Terrestrial species

To address and mitigate the impacts of the federal hydropower system, Congress passed the Pacific Northwest Electric Power Planning and Conservation Act (Public Law 96-501) and the Northwest Power Planning Council was created. The NWPPC, through its Columbia River Basin Fish and Wildlife Program, address and mitigate the impacts of the hydrosystem in the Columbia River Basin. The vision of the program is "a Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife, mitigating across the basin for the adverse effects to fish and wildlife caused by the development and operation of the hydrosystem and providing benefits from fish and wildlife valued by the people of the region"(NWPPC 2000). Early versions of the program directed regional fish and wildlife managers to systematically assess wildlife habitat losses for all federal hydropower projects in the basin – in order to provide for equitable mitigation.

The Owyhee subbasin supports a diversity of wildlife and plant species. Much of the subbasin has been identified as a "Center of Biodiversity" and rated as having high ecological integrity by ICBEMP (Quigely and Arbelbide 1997). This subbasin supports the largest population of California bighorn sheep in the U.S. as well as being part of the largest contiguous center of shrub-steppe biodiversity in the Interior Columbia River Basin (Quigely and Arbelbide 1997, Schnitzspahn et al. 2000). The Owyhee-Bruneau Canyonlands (3.2 million acres encompassing portions of the Owyhee and Bruneau subbasins) was recently under consideration for a national monument designation, and a subset is currently under consideration for wilderness designation (Owyhee Initiative Web Site, accessed April 2004). The purpose of the Owyhee Subbasin Management Plan is to provide a systematic basis to prioritize Objectives and Strategies based on best science and direct involvement of local stakeholders.

1.4.4.4.1 Terrestrial – Short-term Objectives and Strategies

The ongoing projects sponsored by the Shoshone-Paiute Tribes form the nucleus of goals, objectives, and strategies for terrestrial habitat restoration and enhancement in the Owyhee Subbasin – for the short term (i.e., next three years). This foundation will provide a starting point for the development of a more comprehensive and diverse strategic plan for the Owyhee Subbasin for the long term (i.e, the following decade, and beyond). A number of conservation efforts are in progress in the Owyhee Subbasin (refer to the Chapter 3 Inventory). The following section provides a summary of the goals, objectives and strategies – listed by co-management entity – that were put forth in the Owyhee Subbasin summary (Perugini et al. 2002):

Entity – Shoshone-Paiute Tribes

Goal: Work cooperatively with federal, state, county and private entities throughout the subbasin to enhance, protect and/or restore fish and wildlife habitat

Objective: Protect, enhance, and/or acquire wildlife mitigation properties in the Middle Snake Province, with emphasis on the Owyhee and Bruneau subbasins.

- Work with local landowners to discus habitat enhancement/protection/ acquisition opportunities.
- Develop method to evaluate habitat enhancement/protection/ acquisition opportunities in the subbasin
- Work collaboratively with interested entities in the subbasins, including, but not limited to: the Nature Conservancy, IDFG, NDOW, local sage grouse working groups, Owyhee Initiative Work Group, BLM, USFS, and NRCS.
- Explore opportunities to develop "grass banks" in Owyhee and Bruneau subbasins

Objective: Coordinate subbasin-wide land acquisitions, conservation easements and riparian habitat improvements.

- Fund and facilitate coordinator position and activities in subbasins where the Shoshone-Paiute Tribes have historical natural resource and cultural interests and rights.
- Facilitate development of cooperative funding and implementation of habitat protection and restoration across state and jurisdictional boundaries

Objective: Protect streams, associated wetlands and riparian areas on Duck Valley Indian Reservation

Entity – The Nature Conservancy

Goals:

- Shrub-steppe habitat – Identify and protect the existing high quality shrub-steppe habitat (late seral condition areas), while moving the fair quality shrub-steppe (mid seral areas) into late seral conditions.
- Springs, spring creek systems, and wetlands: Maintain or improve the ecological conditions of all springs, spring creek systems, and wetlands so as to be rated in Proper Functioning Condition.
- River terrace communities: Maintain the existing condition and quality of all A and B ranked big basin sagebrush/basin wildrye river terrace communities along the South Fork of the Owyhee, and identify and protect similar river terrace communities throughout the Owyhee Canyonlands.

Strategies:

- Develop community supported plans for conservation of key ecological values that also take into account economic and cultural values.
- Direct resources to highest priority projects within the subbasin as identified using a science-driven ecoregional planning process.
- Emphasize protection of existing high quality habitats for a wide range of species and maintain existing areas of undisturbed shrub-steppe habitat.
- Work with willing landowners and land managers to protect priority conservation lands through acquisitions, conservation easements, land exchanges, and management agreements.

Entity – Owyhee County Sage Grouse Working Group (selected goals & objectives)

Goal: Preserve and increase sage grouse populations in Owyhee County.

- Develop maps that identify sage grouse habitat for high priority protection from wildfire.
- Implement sagebrush restoration projects in historic sage grouse habitat.
- Prioritize sites for juniper control activities.

Entity - USDA Natural Resources Conservation Service

Goal: Enhance natural resource productivity to enable a strong agricultural and natural resource sector.

- Maintain, restore, or enhance wetland ecosystems and fish and wildlife habitat.
- Deliver high quality services to the public to enable natural resource stewardship.

1.4.4.4.1.1 Overview of Short-term Terrestrial Objectives & Strategies

The ongoing Shoshone-Paiute Tribes projects form the nucleus of wildlife and terrestrial habitat restoration objectives and strategies for the Owyhee Subbasin Plan (Table 1.9); refer to the Project Inventory (Chapter 3) for more detail.

Table 1.9. Summary of terrestrial biological objectives and strategies for ongoing BPA-funded fish & wildlife projectsrecommended in the Owyhee Subbasin Plan.

PROJECT/OBJECTIVES	STRATEGIES
Wildlife Inventory and Habitat Evaluation Projects	

PROJECT/OBJECTIVES	STRATEGIES
1. Develop and implement terrestrial habitat and wildlife monitoring plan for the Duck Valley Indian Reservation.	a. Research, Monitoring &Evaluation (RM&E) – develop a terrestrial habitat and wildlife monitoring plan; conduct habitat Analysis of DVIR using Landsat Thematic Mapper satellite image taken of reservation; groundtruthing; and delineation of habitat types and area extent. Incorporate habitat data into monitoring plan in subsequent iteration of plan; conduct habitat evaluation (HEP methodology), b. Conduct wildlife monitoring: (1). Spotted frog presence/absence surveys; (2). Sage grouse lek surveys; (3). Waterfowl production surveys; (4). Bat surveys; (5) Raptor surveys; (6). Point counts for avian species; (7). Small mammal surveys; (8). Amphibian and reptile surveys; (9). Big game surveys; (10). White-faced ibis surveys; (11). Pygmy rabbit survey.
Riparian Habitat Enhancement and Restoration	
1. Protect specific springs from livestock impacts – based on revision of list of springs in proposal. 2. Protect specific streams from livestock impacts –In coordination with Project 2000-079 and field observations. 3. Conduct fishery and habitat surveys	a. Cooperative management/Research – identify, prioritize and locate springs in need of protection (priority to suspected redband trout streams), b. Habitat Restoration – implement protective measures of springs (minimum of 6 springs per year); implement protective measures (fencing riparian areas/fixing road crossings) on streams and/or headwaters (appr. 6-10 miles of fence, troughs, culverts, etc). c. Research, Monitoring & Evaluation (RM&E) – implement PFC assessment; conduct population estimates, size structure, condition, locations (GPS) in coordination with Project 2000-079.
Land Acquisition -- Southern Idaho Wildlife Mitigation	
1. Identify parcels for acquisition or conservation easement 2. Identify sites for habitat enhancement activities 3. Protect 2500 HUs of wildlife habitat and associated aquatic habitat through fee-title acquisition or conservation easement 4. Protect 500 HUs of wildlife habitat and associated aquatic habitat through habitat enhancement activities	a. Research, Monitoring &Evaluation (RM&E) – perform broadscale habitat analysis of province using GIS data from ICDC, NNHP, NRCS, GAP Analysis; conduct baseline HEP treatment/enhancement areas; conduct baseline survey of property (GPS fences, habitat extents, aerial photos, noxious weed survey); conduct baseline aquatic resources evaluation (PFC at minimum); conduct baseline wildlife surveys b. draft property management plan that details O&M and M&E. c. Coordinate enhancement efforts -- consult with state and federal agency biologists, the Nature Conservancy, USFS, IDFG, Nature Conservancy, Northeastern Nevada Stewardship Group, Owyhee Initiative work group, local sage grouse work groups to identify high priority species/areas. d. Land/easement acquisition – negotiate with willing land owners to buy easements and/or fee-titles. e. Cooperative Co-management -- Identify cost-sharing

PROJECT/OBJECTIVES	STRATEGIES
	opportunities, develop enhancement plan, conduct NEPA compliance, and develop necessary MOUs – with cooperating agency(ies) f. Land/easement Acquisition – acquire fee title or easement to appropriate parcels of land. g. Habitat Restoration – control noxious weeds;construct/repair/maintain fencing; conduct stream protection activities (water troughs, etc.); rehabilitate/restore habitat by planting native seed stock or by transplanting native plants; manipulate vegetation (seeding, prescribed burns, chaining) to achieve enhancement objectives.
Reservoir Riparian Habitat Enhancement	
1. Protect shoreline and inlet streams from degradation. 2. Disseminate information to public. 3. Work with Owyhee Schools on volunteer projects. 5. Update and review Operations and Maintenance and Monitoring and Evaluation Plan	a. Habitat restoration – plant native trees/willows and grasses along shoreline and tributaries to Lake Billy Shaw b. Control grazing impacts – install water troughs/stock ponds to keep stock away from reservoir/fences c. Education & public outreach – monthly newspaper articles/quarterly to city paper; update & maintain signs to alert public to new fishing facility; have students aid in planting trees/willows/grasses. d. Monitor & evaluate – collect and summarize data on biological and economic aspects of the Lake Billy Shaw Project.

1.4.4.4.1.2 Wildlife Mitigation in the Mid-Snake Province and Owyhee Subbasin

Three hydroelectric projects, Anderson Ranch, Black Canyon and Deadwood were constructed in the Middle Snake Province. The Shoshone-Paiute wildlife mitigation project[4] addresses mitigation opportunities for those projects.

Anderson Ranch

The Anderson Ranch Dam is located in the Payette subbasin and was completed in 1950, inundating and/or impacting 6,516 acres of wildlife habitat along the South Fork Boise River (Chaney and Sather-Blair 1985a). Losses totaling 9,619 HUs were assessed for target species. Eight cover types were identified in the study area and all except the lacustrine open water habitat were reduced as a result of construction of the dam.

Black Canyon

[4] Southern Idaho Wildlife Mitigation Program, Middle Snake Province – Shoshone-Paiute Tribes (Project 199505703)

Black Canyon Dam is located in the Payette subbasin and was completed in 1924, impacting 1,100 acres of wildlife habitat along the Payette River (Chaney and Sather-Blair 1985b). The impact assessment revealed losses of 2,230 HUs (Meuleman et al. 1986). The mitigation plan, completed in 1987 (Meuleman et al. 1987), identified potential mitigation sites which included areas within the Bruneau subbasin.

Deadwood Dam

Deadwood Dam was authorized for construction in 1928 and was completed in 1931. Approximately 3,094 acres of habitat were impacted with losses assessed at 7,413 HUs (Meuleman et al. 1986).

The Northwest Power Planning Council's current Fish and Wildlife Program's primary wildlife strategy is to "*complete the current mitigation program for construction and inundation losses….(NWPPC 2000).*" To achieve this goal, the Shoshone-Paiute Tribes developed projects to protect, enhance/restore and maintain native riparian, wetland, forest and shrub-steppe habitats (2500 habitat units (HUs) of habitat protection, 500 HUs of habitat enhancements in FY2003) at suitable sites in the Middle Snake Province as mitigation for the construction of Anderson Ranch, Deadwood, and Black Canyon hydroelectric projects. The Tribes, in coordination with the Shoshone-Bannock Tribes and the Idaho Department of Fish and Game, plan to fully mitigate construction losses by 2013. Identified losses at Anderson Ranch, Black Canyon, and Deadwood total 19,270 habitat units (HUs), of which only 57 (.3%) have been mitigated for to-date (this is based on a 1:1 crediting ratio pending resolution of crediting issues surrounding the Council's 2000 Fish and Wildlife Program).

Potential acquisition/easement/enhancement sites will be identified using a number of tools, including, but not limited to: geospatial data, GAP Analysis information, and regional wildlife data. The Shoshone-Paiute Tribes will work extensively with entities interested in protecting fish and wildlife resources in the province, including: the Nature Conservancy, Owyhee Initiative Working Group, IDFG, Shoshone-Bannock Tribes, BLM Resource Area biologists, USFWS, USFS and private land owners. Projects will be reviewed for consistency with the Council's 2000 program by IDFG and the Shoshone-Bannock Tribes.

Progress towards long-term habitat protection goals will be measured using Habitat Evaluation Procedures (HEP) (USFWS 1981), by conducting Proper Functioning Condition (PFC) assessments (Prichard 1998) and by monitoring fish and wildlife populations. Wherever possible, passive restoration techniques will be employed.

The "Southern Idaho Wildlife Mitigation Program, Middle Snake Province – Shoshone-Paiute Tribes" is an ongoing programmatic project that originated from the Southern Idaho Wildlife Mitigation (SIWM) program[5]. The original SIWM was a regionally

[5] Southern Idaho Wildlife Mitigation (SIWM) – Shoshone-Bannock Tribes and Idaho Department of Fish and Game (BPA Project #9505700) was the umbrella wildlife mitigation program previously in place that provided funding for mitigation activities in the Middle and Upper Snake Provinces. In addition to the

focused program that mitigated for construction and inundation losses across the southern portion of Idaho. Due to the change in the Council's Fish and Wildlife Program (2000), the SIWM is now split between two provinces (Middle Snake and Upper Snake Provinces) and among three fish and wildlife management entities (Shoshone-Paiute Tribes, Shoshone-Bannock Tribes and IDFG).

The Southern Idaho Wildlife Mitigation Program, Middle Snake Province – Shoshone-Paiute Tribes (Project 199505703) is consistent with the Council's 2000 Fish and Wildlife Program and has significance in the context of regional planning activities being undertaken in both the Owyhee and Bruneau subbasins. The following excerpts, taken from the NWPPC 2000 Program, illustrates project consistency with the Council's Fish & Wildlife Program:

- The extent of the wildlife mitigation is of particular importance to agencies and tribes in the so-called "blocked" areas, where anadromous fish runs once existed but were blocked by the development of the hydrosystem. While there are limited opportunities for improving resident fish in those areas, resident fish substitution alone seldom is adequate mitigation.
- Wildlife mitigation should emphasize addressing areas of the basin with the highest proportion of unmitigated losses (losses in Middle Snake Province only .3% mitigated to-date)
- Habitat Strategies -…The Northwest Power Act allows off-site mitigation for fish and wildlife populations affected by the hydrosystem. Because some of the greatest opportunities for improvement lie outside the immediate area of the hydrosystem—in the tributaries and subbasins off the mainstem of the Columbia and Snake Rivers—this program seeks habitat improvements outside the hydrosystem as a means of off-setting some of the impacts of the hydrosystem.
- The program directs significant attention to rebuilding healthy, naturally producing fish and wildlife populations by protecting and restoring habitats and the biological systems within them.
- Wherever feasible, this program will be accomplished by protecting and restoring the natural ecological functions, habitats, and biological diversity of the Columbia River Basin.
- There is an obligation to provide fish and wildlife mitigation where habitat has been permanently lost due to hydroelectric development.
- (regarding) Eliminated Habitat:…In the case of wildlife, where the habitat is inundated, substitute habitat would include setting aside and protecting land elsewhere that is home to a similar ecological community.

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hydroelectric projects identified in this document, the SIWM conducts mitigation activities for Palisades and Minidoka Dams. At the conclusion of FY2002, this program will be dissolved and each entity will propose projects on an individual basis.

- Build from Strength – Efforts to improve the status of fish and wildlife populations in the basin should protect habitat that supports existing populations that are relatively healthy and productive.
- Habitat units identified in Table 11-4 must be acquired in the subbasin in which the lost units were located unless otherwise agreed by the fish and wildlife agencies and tribes in the subbasin.

1.4.4.2.2 Terrestrial – Long-term Objectives and Strategies[6]

1.4.4.2.2.1 Overview of Terrestrial Focal Habitats

The Owyhee Subbasin Planning Team identified the following habitat types as focal habitat types (January 28, 2004 consensus):

- Riparian and wetlands
- Shrub-steppe (including sagebrush steppe and salt-scrub shrublands)
- Old Growth western juniper and mountain mahogany woodlands
- Upland aspen forest
- Grasslands
- Pine/Fir/Mixed Conifer Forests
- Canyon / Gorge
- Agricultural Lands

The Owyhee Subbasin Planning/Technical Team used the Terrestrial Habitat Problem Statements, Objectives, and Strategies from the draft Bruneau Subbasin Plan (Accessed from the Eco-Vista web site, April 2004) as a “strawman” or model because the landscape and resource management issues are very similar to the Owyhee (Tim Dykstra, Shoshone-Paiute Tribes, Personal Communication). Furthermore, the Bruneau Subbasin Planning Team had spent a great deal of time and inter-agency technical effort in the developing their initial draft, and the Owyhee Subbasin Team did not have the resources to duplicate this level of effort. Additional Problem Statements, Objectives, and Strategies were derived from the draft Boise/Weiser/Payette Subbasin Plan and the Owyhee Initiative. The summary of problems and objectives in relation to the terrestrial wildlife habitat limiting factors within Owyhee Subbasin is presented in Table 1.10. The formatting of the problem statements, objectives and strategies is generally consistent with guidance in the Technical Guide (NPCC 2001).

[6] This section is adapted from the draft Bruneau Subbasin Plan (Riparian and wetlands, Shrub-steppe (including sagebrush steppe and salt-scrub shrublands), Old Growth western juniper and mountain mahogany woodlands and Upland aspen forest); the draft Boise/Payette Weiser (Pine/Fir/Mixed Conifer Forests) Subbasin Plan; and the Owyhee Initiative Proposal (Canyon/Gorge).

Table 1.10. Problems and objectives addressing factors limiting wildlife habitats and species in the Owyhee Subbasin. (The Owyhee Subbasin Planning Team adapted these from the Draft Bruneau, Draft Mid-Snake, and the Draft Boise/ Weiser/ Payette Subbasin Plans, April 2004)

Terrestrial Wildlife Habitat	
Problem Statement	**Objective**
1. The loss and degradation of **wetland and riparian** areas has negative effects on fish and wildlife species that utilize these habitats.	1.1. Minimize grazing effects in riparian and wetland habitats
	1.2. Minimize adverse effects of roads in riparian and wetland habitats
	1.3. Maintain and restore hydrologic regime in riparian and wetland habitats. Restore natural nutrient cycles or mitigate for damages to aquatic and terrestrial populations due to the loss of marine-derived nutrients.
2. Degradation, fragmentation, and loss of native **shrub-steppe** habitat adversely affects associated terrestrial species.	2.1. Minimize impacts of livestock grazing to native shrub-steppe habitat and terrestrial species
	2.2. Reduce the intensity, frequency, and size of wildfire in shrub-steppe habitats
	2.3. Limit noise disturbance to shrub-steppe wildlife species
	2.4. Reduce the prevalence of crested wheatgrass in shrub-steppe habitats
	2.5. Protect existing high quality shrub-steppe plant communities from nonnative invasive plant species and noxious weeds
3. Habitat condition of **old growth western juniper and mountain mahogany woodland habitats** is degraded by the presence of nonnative invasive plants and noxious weeds.	3.1. Provide habitat for big game and other wildlife species.
4. Changes in species composition and structure of **aspen habitats** have had negative effects on wildlife species. Fire suppression, insect infestation, and grazing have been identified as factors limiting the quality of this habitat type in the subbasin.	4.1. Reduce the impacts of livestock grazing on aspen habitats
	4.2. Maintain viable stands of aspen by through management practices encouraging and/or emulating natural fire processes
	4.3. Retain viable stands of aspen for native terrestrial species associated with upland aspen habitats
5. The loss and degradation of the **grassland** habitats of the subbasin have negatively impacted numerous native plant and animal species dependent on these habitats.	5.1. Protect existing good condition grasslands (see discussion section below for description of how the management agencies of the subbasin define this).
	5.2. Restore degraded grasslands to good condition. Increase the coverage of native perennials, e.g., bluebunch wheatgrass and/or Idaho fescue.
6. Alterations of forest structure is limiting **pine/fir/mixed conifer forest** habitats in some areas of the Owyhee subbasin.	6.1. Protect mature pine/fir/mixed conifer forest habitats by promoting ecological processes (i.e. natural fire regime) that lead to late seral stages while protecting meadow habitats from pine/fir/mixed conifer encroachment. This includes processes that lead to

Terrestrial Wildlife Habitat	
Problem Statement	**Objective**
	forest stability in this habitat type.
7. Some cross-country dirt roads have served as "gateway roads" – allowing dirt bikes and off-road vehicles to carve new routes across remote landscape to **Canyon and Gorge** habitats	Objective 7.1. Restrict illegal roads, and manage cross-country motorized travel to ensure that the ecological integrity of Canyon and Gorge habitats of the Owyhee Subbasin is maintained.
8. Road construction has altered the size, quality, distribution, and spatial relationships in and between habitat patches in the subbasin (**agriculture**).	8.1. Reduce the impact of the transportation system on wildlife and fish populations and habitats.

As the Owyhee Subbasin Plan goes through additional iterations (e.g., on the three-year Provincial Review cycle) new research, monitoring & evaluation information should be incorporated into the objectives and strategies listed in Table 1.9 – via the adaptive management process.

1.4.5 Consistency with ESA/CWA Requirements

In recent years, two federal laws have had a major impact on protection of water quality and aquatic life -- and have resulted in significantly increased watershed protection efforts in the Columbia Basin. These federal laws are the Endangered Species Act (ESA) and the Clean Water Act (CWA). The Endangered Species Act is administered by the National Marine Fisheries Service (NMFS) for marine and anadromous species, and the U.S. Fish and Wildlife Service (USFWS) for resident fish & wildlife. The ESA is intended to protect species that are threatened or endangered of extinction. Major activities carried out under the ESA include:

- Evaluation of scientific data and listing of threatened and endangered species;
- Designation of critical habitat areas for threatened or endangered species;
- Consultation with other federal agencies, to insure that federal agency actions do not damage listed species;
- Development and/or review of restoration plans to restore listed species; and,
- Enforcement of the ESA where actions directly or indirectly are harming listed species.

While the ESA focuses on listed species, the CWA focuses mostly on water quality. The overall goal of the Clean Water Act is for all waters in the U.S. to be "fishable and swimmable". States are required to develop protective instream standards. Where those standards are not consistently met, a recovery plan must be developed and implemented. These recovery plans are referred to as Total Maximum Daily Loads (TMDL's) and the implementation plans (Water Quality Management Plans) that accompany the TMDL reports. TMDL's and the resulting implementation and improvement of water quality are important mechanisms to support the regional effort to restore healthy populations of salmon, resident fish & wildlife throughout the Columbia Basin.

The Northwest Power Planning Council is aware that a large number of watershed and subbasin level activities are ongoing, throughout the Columbia Basin, that incorporate technical assessments and planning. The Council intends to rely on the information gathered in those activities as much as possible and does not intend for the Subbasin Planning process to undermine or displace these ongoing efforts. However, for purposes of the Council's Fish & Wildlife Program, it is important to compile this information in a consistent format and to develop a comprehensive knowledge base that permits the coordination of Bonneville-funded activities and planning under the Endangered Species Act and Clean Water Act.

1.4.5.1 Endangered Species Act Requirements

In general, the NMFS and the USFWS intend to use the Northwest Power and Conservation Council's subbasin plans as building blocks at the local watershed level – to help formulate recovery planning for threatened and endangered species within the Columbia Basin. However, since anadromous fish have been completely extirpated from the Owyhee Subbasin for decades, the NMFS anadromous fish recovery efforts are not relevant to the Owyhee Subbasin Plan. At present four species of wildlife inhabit the Owyhee Subbasin that are listed at threatened (T) or endangered (E) under the Endangered Species Act:

(1) the bald eagle (T);
(2) the gray wolf (E);
(3) the grizzly bear (T), and
(4) the lynx (T).

The USFWS has recovery plans in place for all these ESA-listed species. Currently; the USFWS is not developing any new Recovery Plans for resident fish & wildlife in the Owyhee Subbasin. Thus there is no direct link between the Owyhee Subbasin Plan and the development of ESA recovery plans at this time.

The only native salmonid species that is currently known to have self-sustaining populations in the Owyhee Subbasin is the redband trout (*Oncorhynchus mykiss gairdneri*). This sub-species is currently not listed under the ESA. Redband trout belongs to the same biological species as the anadromous steelhead (*Oncorhynchus mykiss*) which was extirpated from the Owyhee Subbasin in 1933. Bull trout (*Salvelinus confluentus*) – listed under the ESA as "threatened" – is found in adjacent river systems (such as the Bruneau); however, self-sustaining populations of this species are not known to exist in the Owyhee Subbasin.

Currently two species of birds and three species of mammals that inhabit the Owyhee Subbasin are listed as threatened or endangered species under the Federal ESA (Table 1.11).

Table 1.11. Summary of animal species inhabiting the Middle Snake Ecological Province that are listed as "threatened" or "endangered" by state and federal management agencies {Source: IBIS on (11/5/2003) www.nwhi.org/ibis }.

Common Name	Scientific Name	State Status	Federal Status
Columbia Spotted Frog	*Rana luteiventris*	**ID:** Species of Concern	Candidate
	Listed Amphibians:	**0**	**0**
Bald Eagle	*Haliaeetus leucocephalus*	**ID:** Endangered	Threatened
		OR: Threatened	Threatened
Peregrine Falcon	*Falco peregrinus*	**ID:** Endangered	
		OR: Endangered	
Yellow-billed Cuckoo	*Coccyzus americanus*	**ID:** Species of Concern	Candidate
		OR: Candidate Species	Candidate
	Listed Birds:	**3**	**2**
Gray Wolf	*Canis lupus*	**ID:** Endangered	Endangered
		OR: Endangered	
Kit Fox	*Vulpes velox*	**OR:** Threatened	
Grizzly Bear	*Ursus arctos*	**ID:** Threatened	Threatened
Wolverine	*Gulo gulo*	**OR:** Threatened	
Lynx	*Lynx canadensis*	**ID:** Species of Concern	Threatened
	Listed Mammals:	**4**	**3**
	Listed Reptiles:	**0**	**0**
	Total Listed Species:	**7**	**5**

At this time no amphibians or reptiles inhabiting the Owyhee subbasin are listed under the Federal ESA. The Columbia spotted frog, however, is a candidate species that will be evaluated for possible listing.

The bald eagle and the snowy plover are listed under the ESA as threatened species; in addition the peregrine falcon is listed by Oregon and Idaho as endangered. Federally listed mammals are the gray wolf (endangered), grizzly bear (threatened), and the lynx (threatened). In addition, Oregon lists the kit fox and the wolverine as threatened.

Two populations of sage grouse were recently (2003-2004) considered as candidates for listing under the ESA – “western” sage grouse and “eastern” sage grouse. The U.S. Fish and Wildlife Service determined, however, that the petitions to list these subgroups of sage grouse failed to show that “western” or “eastern” sage grouse are genetically distinct – either as a subspecies or a distinct population segment – from each other or from the greater sage-grouse populations. Therefore, USFWS decided that they are not eligible for listing under the ESA.

The pygmy rabbit (*Brachylagus idahoensis*) is patchily distributed in the sagebrush-dominated areas of Oregon, California, Nevada, Utah, Idaho, Montana, Wyoming, and Washington. It is a state-listed species in Washington, but not in the three states encompassing the Owyhee Subbasin. It may be considered an indicator species for sagebrush habitats since it is found only in productive, dense sage habitat with deep soil and it is uniquely dependent upon sagebrush, which comprises up to 99% of its winter diet. The Pygmy Rabbit was not selected as a focal species by the Owyhee Subbasin Planning Team, partially due to the concern among stakeholders that the next step in the process would be to develop restoration and/or recovery plans for the species – and the ultimate outcome would be a restriction of human activity – that in turn would produce an adverse economic impact.

The USFWS and the Bureau of Land Management (BLM) are the primary federal agencies responsible for the management of species such as sage grouse and pygmy rabbit – that inhabit the sage brush dominated regions of the Columbia Basin.

1.4.5.2 Clean Water Act Requirements

1.4.5.2.1 Water Quality Standards and Designated Uses

In general, State and Tribal water quality standards are established in cooperation with the US Environmental Protection Agency (EPA) – this facilitates their subsequent approval by EPA. These water quality standards – required under the Clean Water Act – are designed to protect, restore and preserve water quality in areas designated for specific uses. Designated uses include:

- drinking water;
- various water contact activities, including swimming;
- various types of water-based recreation, including fishing; and
- cold, cool, or warm water fish habitat.

"Designated uses" have been identified for most, but not all, water bodies within Idaho, Oregon, and Nevada portions of the Owyhee Subbasin. For those water bodies not yet designated, the presumed existing uses are cold water aquatic life and primary contact recreation. One important use of waters in the Owyhee subbasin is to provide trout habitat that supports fisheries for both naturally-produced native redband trout and hatchery raised fish. Each "designated use" has narrative and numeric criteria that describe the level of water quality necessary to support that use. When a lake, river or stream fails to meet the water quality criteria that support its "designated use," it is considered to be an impaired water body. Specific actions are required under state and federal law to ensure that the "impaired" water body is restored to a healthy fishable, swimmable condition.

The "CWA 303(d) impaired waters list" provides a way for states to identify and prioritize water quality problems. The list also serves as a guide for developing and implementing watershed recovery plans to protect beneficial uses while achieving federal and state water quality standards. Section 305(b) of the federal Clean Water Act (CWA) requires each state to prepare a water quality assessment report every two years. The U.S. Environmental Protection Agency (EPA) compiles the information from the individual state reports and prepares a summary report for Congress on the status of the nation's waters. EPA gives the states guidelines for preparation of 305(b) reports (USEPA 1997). Oftentimes much of the data required in the 305(b) report comes from the assessments done while developing the list of streams that do not meet stream standards as required by Section 303(d) of the CWA – therefore states may choose integrate the reporting requirements of Section 303(d) and 305(b) into one comprehensive report.

The CWA 303(d) list is meant only as a means of identifying water quality problems — not evaluating the causes of water quality problems. Causes of water quality problems are determined when water quality management plans are developed for the watersheds in which the listed segments are located. These plans are often referred to as a *Total Maximum Daily Load* or *TMDL*. A TMDL identifies allowable pollutant loads to a waterbody from both *point* (end of pipe) and *non-point sources* (runoff) that will prevent a violation of water quality standards. A TMDL should also include a margin of safety to ensure protection of the waters.

1.4.5.2.2 Total Maximum Daily Load (TMDL)

The states together with EPA have a legal, court ordered responsibility to ensure that these impaired waters be dealt with in a timely manner. In practice, this means that a "TMDL" (Total Maximum Daily Load) document must be developed for each impaired water body.

Each TMDL contains the following elements:

- A description of the geographic area to which the TMDL applies;
- Specification of the applicable water quality standards;
- An assessment of the problem, including the extent of deviation of ambient conditions from water quality standards;

- Development of a loading capacity for each pollutant, including those based on surrogate measures (for example, riparian cover) and including flow assumptions used in developing the TMDL;
- Identification of point sources and nonpoint sources;
- Development of Waste Load Allocations for point sources and Load Allocations for nonpoint sources;
- Development of a margin of safety;
- Evaluation of seasonal variations.

The goal of a TMDL is to reduce pollution and attain state water quality standards for each pollutant impairing the water body. A TMDL is both a technical and legal document. – i.e., a written, quantitative assessment of water quality problems and contributing pollutant sources. The TMDL specifies the amount of pollution reduction necessary to meet water quality standards, allocates the necessary pollutant limits among the various sources in the watershed and provides a basis for taking actions needed to restore the water body.

Within the Owyhee Subbasin, several TMDLs (Total Maximum Daily Loads) and 305(b) assessments have been developed or are planned by the three states – Idaho, Oregon and Nevada – that have CWA responsibilities in the Owyhee Subbasin.:

Idaho	• Upper Owyhee (IDEQ 2003) • North Fork and Middle Fork Owyhee (IDEQ 2003) • South Fork Owyhee (IDEQ 2003) • 2002-03 Integrated 303(d)/305(b) Report (IDEQ 2003)
Nevada	• East Fork Owyhee River and Mill Creek (NDEP 2004).
Oregon	• Upper Owyhee (ODEQ planned for 2009) • Middle Owyhee (ODEQ planned for 2009) • Crooked Rattlesnake (ODEQ planned for 2009) • Jordan (ODEQ planned for 2009) • Lower Owyhee (ODEQ planned for 2009) • 2000 Water Quality Management 305(b) Report (ODEQ 2000)

Since the TMDL is a legal, as well as a technical document it must include:

⇒ A description of applicable water quality standards
⇒ An identification of existing sources of pollution
⇒ A technical assessment of the impairment
⇒ The loading capacity for each pollutant
⇒ Load allocations for point sources and waste load allocations for nonpoint sources
⇒ A margin of safety that takes into account the uncertainty of the data collected, the seasonal variation, and unknowns factors
⇒ An analysis of future water quality standards attainment
⇒ Public participation and documentation EPA has the responsibility to approve or disapprove TMDLs on the basis of the above elements.

1.4.6 Research, Monitoring and Evaluation

The Owyhee Subbasin Plan monitoring and evaluation framework is presented in more detail in Chapter 4, § 4.6. The draft Shoshone-Paiute Tribes evaluation plan for the Duck Valley Indian Reservation is presented in Appendix 4.5.

1.4.6.1 Introduction

Understanding the effects of management actions implemented within the Owyhee Subbasin requires replicated observational studies or intensive research-level experiments conducted at different spatial scales over long time periods. Few programs have monitored at such spatial and temporal scales (Bayley 2002; Currens 2002). Recently, however, several groups have drafted integrated monitoring strategies that address many of the concerns associated with spatial and temporal scales.

One program, developed by the Independent Scientific Advisory Board (ISAB) of the Northwest Power Planning Council, outlines a monitoring and evaluation plan for assessing recovery of tributary habitat (ISAB 2003). This program describes a three-tiered monitoring approach that includes trend or routine monitoring (Tier 1), statistical (status) monitoring (Tier 2), and experimental research (effectiveness) monitoring (Tier 3). Trend monitoring obtains repeated measurements, usually representing a single spatial unit over a period of time, with a view to quantifying changes over time. Changes must be distinguished from background noise. This type of monitoring does not establish cause-and-effect relationships and does not provide inductive inferences to larger areas or time periods. Statistical monitoring, on the other hand, provides statistical inferences that extend to larger areas and longer time periods than the sample. This type of monitoring requires probabilistic selection of study sites and repeated visits over time. Experimental research monitoring is often required to establish cause-and-effect relationships between management actions and population/habitat response. This requires the use of experimental designs incorporating “treatments” and “controls” randomly assigned to study sites.

According to the ISAB (2003), the value of monitoring is greatly enhanced if the different types of monitoring are integrated. For example, trend and statistical monitoring will help define the issues that should be addressed with more intensive, experimental research monitoring. The latter will identify which habitat attributes are most informative and will provide conclusive information about the efficacy of various restoration approaches. Implementing experimental research in the absence of trend and statistical monitoring would increase uncertainty about the generalization of results beyond the sampling locations. The ISAB (2003) identified the following essential elements of a valid monitoring program.

- Develop a trend monitoring program based on remotely-sensed data obtained from sources such as aerial photography or satellite imagery or both.

- Develop and implement a long-term statistical monitoring program to evaluate the status of fish populations and habitat. This requires probabilistic (statistical) site selection procedures and establishment of common (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.

Another strategy drafted by the Bonneville Power Administration, the U.S. Army Corps of Engineers, the Bureau of Reclamation (collectively referred to as the Action Agencies), and NOAA Fisheries responds to the Federal Columbia River Power System (FCRPS) Biological Opinion issued by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. Although the Action Agencies/NOAA Fisheries Draft Research, Monitoring, and Evaluation (RME) Program was developed before the release of the ISAB (2003) report, it is in many respects consistent with ISAB recommendations. For example, the draft RME Program calls for the classification of all watersheds that have listed fish populations and receive restoration actions. Classification is hierarchical and captures physical/environmental differences spanning from the largest scale (regional setting) down to the channel segment. This component of the draft RME Program comports with Tier 1 Trend Monitoring in the ISAB (2003) plan. Status Monitoring (similar to Tier 2 Statistical Monitoring) and Action Effectiveness Research (similar to Tier 3 Experimental Research) are also included in the RME Program.

Bonneville Power Administration is funding a program to test the Action Agencies/NOAA Fisheries Plan within three subbasins in the Columbia Basin. This program has resulted in the development of a detailed monitoring strategy for the Wenatchee Subbasin. That strategy, referred to as the Upper Columbia Basin Monitoring Strategy (Hillman 2004), includes status-trend monitoring, effectiveness monitoring, and landscape classification of the subbasin. The strategy describes statistical designs, sampling designs, landscape classification, indicators, measuring protocols, and a framework for implementation. Subbasin planners in the upper Columbia Basin are incorporating this strategy into their monitoring and evaluation programs.

About the time the Action Agencies/NOAA Fisheries released their draft program, the Washington Salmon Recovery Funding Board (SRFB) released a draft monitoring and evaluation strategy for habitat restoration and acquisition projects. The document identified implementation, effectiveness, and validation monitoring as key components of their program. The monitoring program is scaled to capture factors operating at different hierarchical levels. At the lowest level (Level 0), the program determines if the action was implemented (implementation monitoring). Level 1 monitoring determines if projects meet the specified engineering and design criteria. Level 2 and 3 monitoring assess the effectiveness of projects on habitat and fish abundance, respectively. Levels 1-3 constitute effectiveness monitoring. Finally, level 4 (validation) monitoring addresses how management and habitat restoration actions, and their cumulative effects, affect fish production within a watershed. This type of monitoring is the most complex and technically rigorous.

The Pacific Northwest Aquatic Monitoring Partnership (PNAMP) is currently preparing a draft document that provides recommendations for monitoring in subbasin plans. The recommendations draw heavily from the Upper Columbia Basin Monitoring Strategy (Hillman 2004) and the ISAB (2003). PNAMP recommends a five-step process for designing monitoring and evaluation plans for subbasin plans. Those steps include:

1. Adopt elements of an ecological management framework.
2. Define monitoring objectives.
3. Establish monitoring needs.
4. Data and information archive.
5. Evalution.

The Owyhee Monitoring and Evaluation Program follows the five-step process recommended by PNAMP and includes much of the information contained in the Upper Columbia Basin Monitoring Strategy (Hillman 2004) [7].

1.4.6.2 STEP 1—Ecological Management Framework

The ecological management framework for the Owyhee Subbasin centers on the vision for the basin:

> *"The Owyhee Subbasin will be comprised of and support naturally-sustainable, diverse fish and wildlife populations and their habitats, that contribute to the social, cultural, and economic well-being of the subbasin and society."*

The M&E plan will be based on the objectives and strategies specified in the Owyhee Subbasin Management Plan.

1.4.6.3 STEP 2—Monitoring Objectives

Although this plan will not monitor all management actions for effectiveness, status/trend monitoring will assess cumulative effects of all actions within the subbasin. This will provide planners and decision makers with information necessary to determine if management actions are contributing to the overall vision for the subbasin.

Based on the vision for the subbasin, this monitoring and evaluation plan uses a three-pronged approach, which is based on the following monitoring goals:

1. Describe the ecologic, geologic, and geomorphic setting in the Owyhee Subbasin (Landscape Classification).

[7] This strategy is also the strategy being used by subbasin planners in the Wenatchee, Entiat, Methow, and Okanogan subbasins. Therefore the Monitoring and Evaluation Strategy within the Owyhee Subbasin Plan will be consistent with other subbasin plans.

2. Assess the status and trend of fish and wildlife and their habitats in the Owyhee Subbasin (Status/Trend Monitoring).
3. Assess the effectiveness of management actions within the Owyhee Subbasin (Effectiveness Monitoring).

1.4.6.4 STEP 3—Monitoring Needs

This section of the monitoring and evaluation plan describes the types of monitoring that will occur within the Owyhee Subbasin. Each type of monitoring will provide subbasin planners with the information they need to determine if the management actions implemented meet the vision and stated goals of the program.

Landscape Classification

Landscape classification describes the ecologic, geologic, and geomorphic setting in the Owyhee Subbasin. As noted earlier, the entire subbasin will be classified according to ecologic, geologic, and geomorphic criteria. The classification work relies heavily on remote-sensed data and GIS.

Status/Tend Monitoring

Because the intent of status/trend monitoring is to describe existing conditions and document changes in conditions over time, it requires temporal and spatial replication and probabilistic sampling. Monitoring the status and trends of populations and habitat characteristics in the Owyhee Subbasin will follow the methods described in the Upper Columbia Basin Monitoring Strategy (Hillman 2004). This approach calls for the implementation of the U.S. Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) design, a spatially-balanced, site-selection process developed for aquatic systems.

Implementation Monitoring

Implementation monitoring is concerned with whether or not the project was implemented properly. This is related to Tier 4 monitoring under the Action Agencies/NOAA Fisheries RME Program and Levels 0 and 1 monitoring under the SRFB Program. Implementation monitoring addresses the types of actions implemented, how many were implemented, where they were implemented, and how much area or stream length was affected by the action.

Effectiveness Monitoring

Because effectiveness monitoring attempts to explain cause-and-effect relationships (e.g., effect of a tributary project on fish abundance), it is important to include as many elements of valid statistical design as possible. An appropriate design recommended by the Action Agencies/NOAA Fisheries (2003), ISAB (2003), WSRFB (2003), and the

Upper Columbia Basin Monitoring Strategy (Hillman 2004) is the Before-After-Control-Impact or BACI design (Stewart-Oaten et al. 1986, 1992; Smith et al. 1993).

Pilot Project

A pilot status/trend and effectiveness monitoring program will be implemented on the Duck Valley Reservation within the Owyhee Subbasin. This monitoring program will begin in 2004 and will use the same statistical and sampling designs, indicators, and protocols as the program designed for the Owyhee Subbasin.

1.4.6.5 STEP 4—Data and Information Archive

Because the indicators and protocols used in this plan are consistent with the Upper Columbia Basin Monitoring Strategy (Hillman 2004), this plan will incorporate the data dictionary and infrastructure being developed for that program and the other pilot projects. The data dictionary and infrastructure are intended to be used throughout the entire Columbia Basin. Subbasin planners in the upper Columbia Basin intend to use this data management program.

The data management program, called the Columbia Basin Coordinated Information System (CBCIS), is being developed by the Bureau of Reclamation, Spatial Dynamics, Inc., and Commonthread, Inc., with consultation from State, Federal, and Tribal agencies and consultants. The data dictionary is a data management tool that provides a comprehensive conceptual framework based on the monitoring indicators and data collection protocols.

1.4.6.6 STEP 5—Evaluation

This plan recognizes three essential elements for evaluation (Figure 2):

1. **Scientific Evaluation**—An evaluation of available information by objective and independent scientists to assess the strengths and weaknesses of the program.

2. **Decision-Making Evaluation**—An evaluation of available information by decision makers, who determine what alternatives and management actions are needed when triggers are reached.

3. **Public Evaluation**—An evaluation of available information by the public to assess economic and societal needs.

The purpose for evaluation is to interpret information gathered from monitoring, assess deviations from goals or anticipated results, and recommend changes in policies or management actions where appropriate. The Owyhee Subbasin planners believe this requires input from both objective, independent scientists and the general public. Both groups will annually provide feedback to decision makers, who have the responsibility to change policies or management actions.

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Owyhee Subbasin Plan

Chapter 2 Technical Assessment

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2 Owyhee Subbasin Technical Assessment

2.1 Subbasin Overview

The following picture captures the essence of the Owyhee Subbasin (Image 2.1).

Image 2.1. Owyhee Subbasin perspective (source: BLM Southeast Oregon Record of Decision 2002).

The Owyhee subbasin is a vast and remote area with few people compared to most other areas in the Columbia Basin. Water is scarce and has always been the key factor for survival, sustainability, and utilization of the surrounding landscape – for people and fish & wildlife.

2.1.1 Subbasin Description

General Description

The Owyhee subbasin encompasses 11,049 square miles (7.07 million acres) of southwestern Idaho, southeastern Oregon, and north central Nevada. The Idaho portion of the subbasin is bordered to the northeast by the Owyhee Mountains. The Sheeps head Mountains in the west define the Oregon portion of the subbasin. The Nevada portion of the subbasin is bordered to the east by the Jarbidge, Bull Run, and Independence Mountains, and to the south by the Santa Rosa Range. These mountains separate the

Owyhee subbasin from the Great Basin Hydrologic Province to the south. The entire Owyhee subbasin lies in the Intermountain Semi desert Ecological Province, as defined by Bailey (1995).

The Owyhee River originates in north central Nevada. It flows in a northwest direction through the southwest corner of Idaho and southeast Oregon. It then turns north to empty into the Snake River at river mile (RM) 394, near the town of Nyssa, Oregon. The total length of the mainstem is 280 miles (Bureau of Reclamation 1958). The Owyhee Dam impounds the Owyhee River at RM 28. Seven fourth-field hydrologic units (HUC's) make up the subbasin (Figure 2.1).

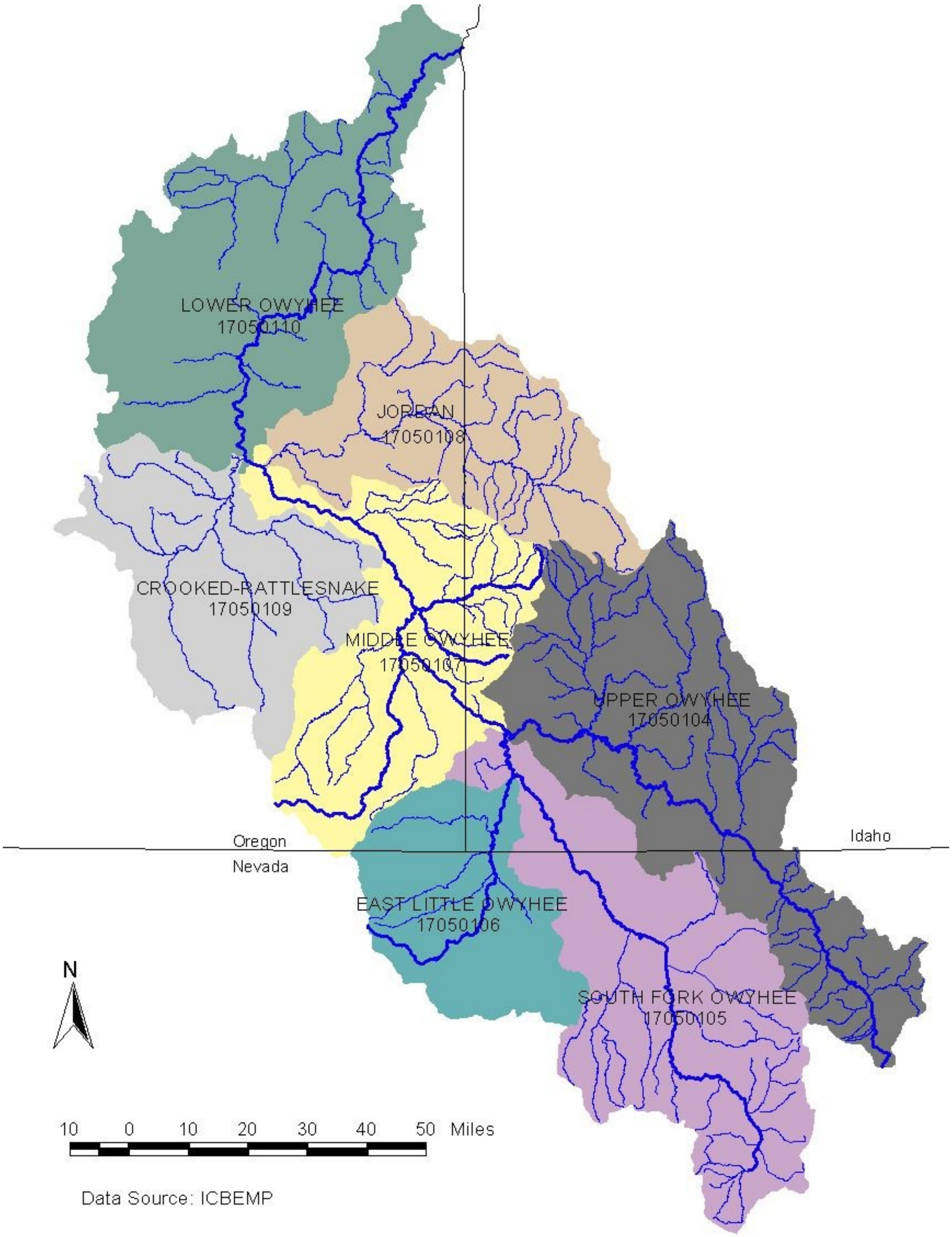


Figure 2.1. Fourth-field hydrologic unit codes (HUCs) in the Owyhee subbasin (Perugini et al. 2002)

Topography

The Owyhee landscape is topographically diverse, with broken plateaus, barren rocky ridges, cliffs, and deep gulches and ravines that dissect the areas of rugged terrain. Elevations in the Owyhee subbasin range from 2,198 feet at its confluence with the Snake River to 10,348 feet at McAfee Peak in the Independence Mountains of Nevada (Figure 2.2). The mean elevation in the subbasin is 5,112 feet.

Low relief rolling hills and expansive plateaus characterize the Owyhee Uplands, which expands on the south side of the Snake River from the area near Twin Falls, Idaho into Oregon (Franklin and Dyrness 1984 cited in Perkins and Bowers 2000). This region exhibits erosional features common to dry climates such as arroyos and coarse sediment deposition. The Owyhee River and tributaries cut deep canyons (in some places over 1,000 feet deep) through the Owyhee Plateau, many of which have near vertical walls. The Owyhee Plateau is characterized by gradually sloping terrain, canyons, arroyos, and basalt butte remnants of extinct volcanoes (Figure 2.2).

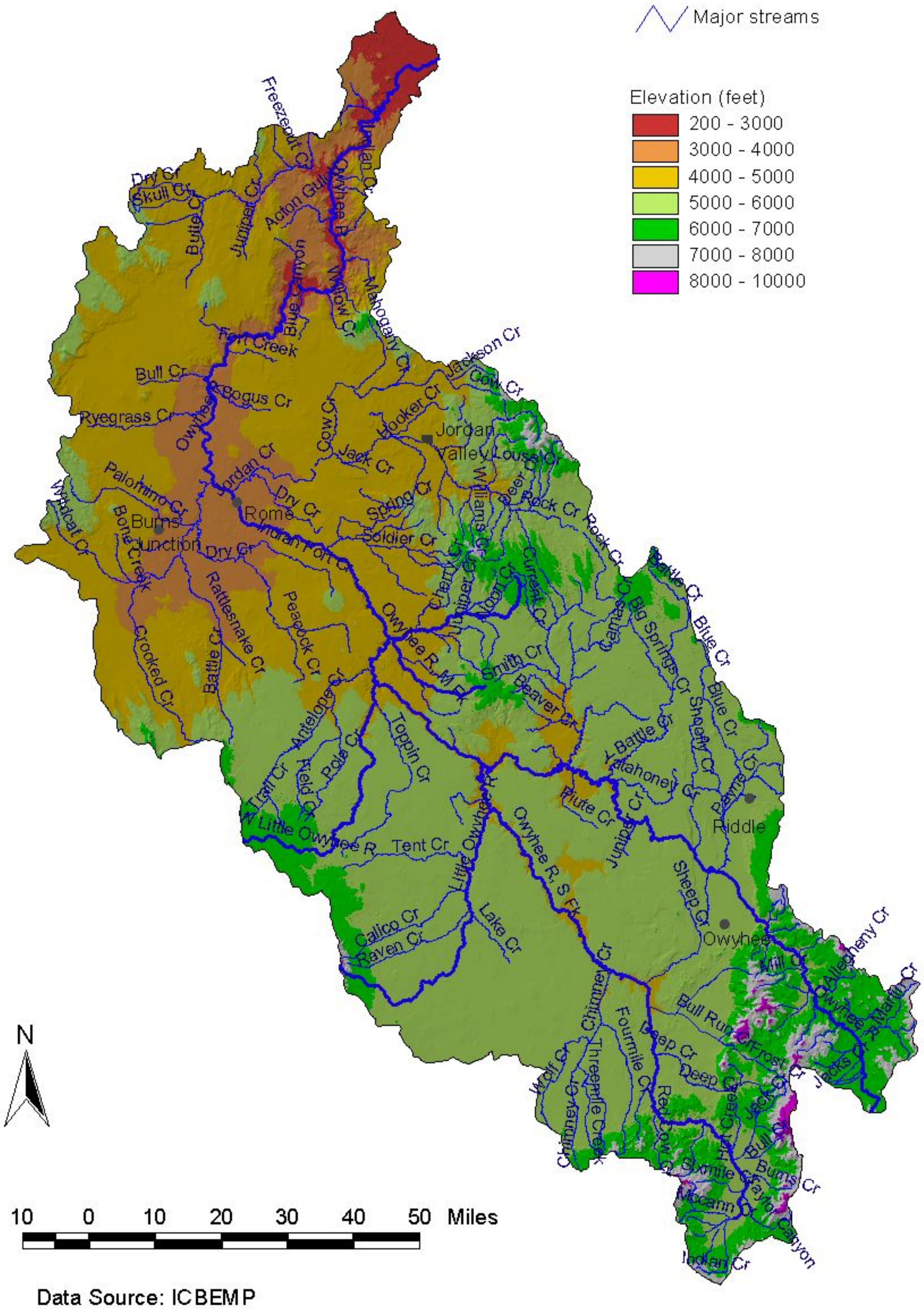


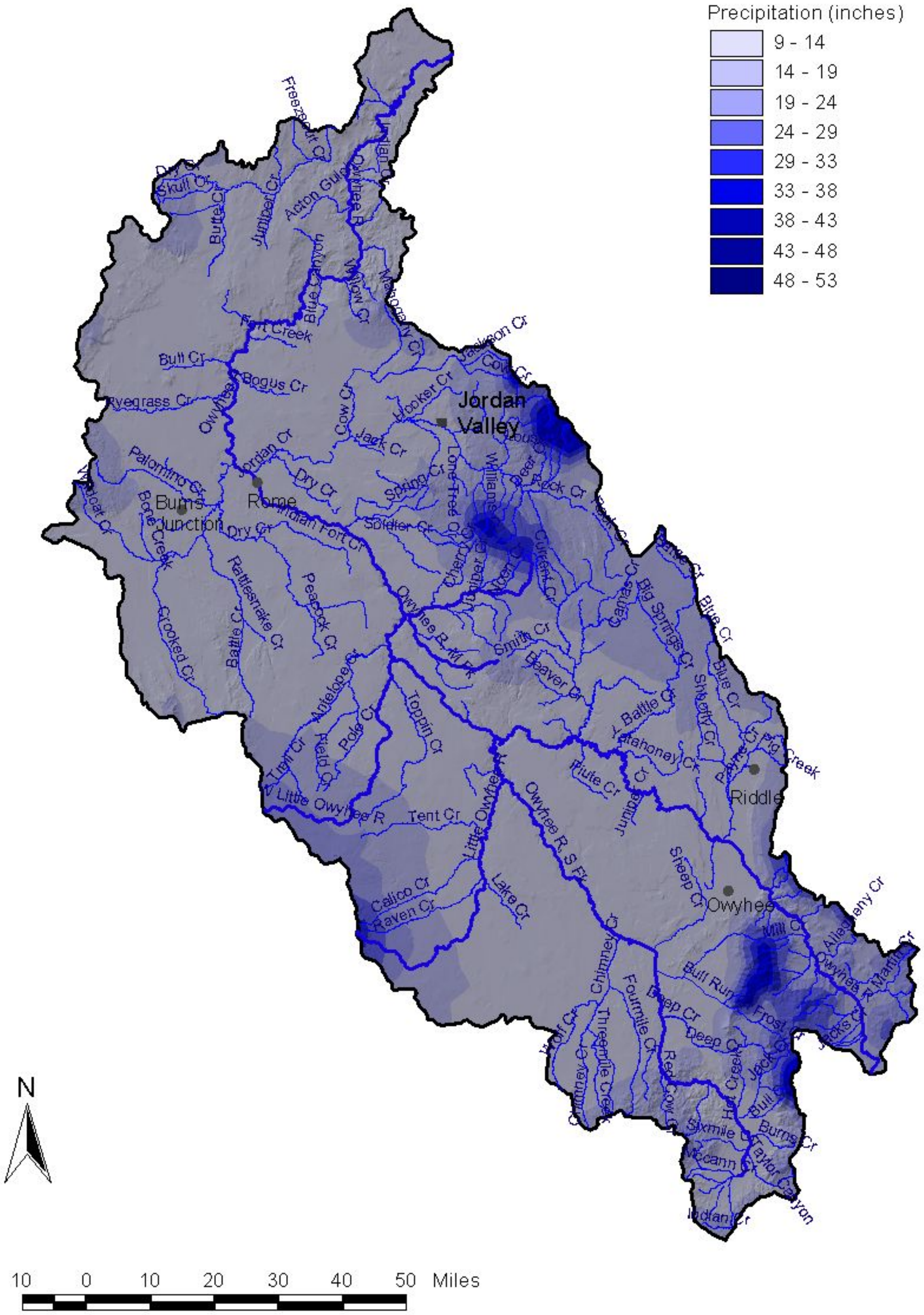
Figure 2.2. Elevation and topography, Owyhee subbasin (Perugini et al. 2002)

In the lower portion of the subbasin, the Owyhee Reservoir occupies a deep, narrow and winding canyon cut into a series of gently to steeply tilted layers of volcanic tuff, sediments, lava flows and dikes (USBR 1993). Downriver from Owyhee Dam, the Owyhee River enters the Snake River Plain. Topographical relief in this portion of the subbasin is greatly reduced and this area supports irrigated agriculture.

Climate

The climate of the area is arid, with hot summers and cool winters (Bailey 1995). The arid climate is due in part to a rain shadow affect from the Cascade and Sierra Mountains to the west (USDI 1999). Precipitation falls primarily from November through February. High-intensity thunderstorms occur between April and September; storms during June or July are typically drier than those in August or September (USDI 1999). Mean annual precipitation for the subbasin is 13 inches and ranges 8 inches at the Owyhee Dam to 53 inches in the headwaters (Figure 2., Daly et al. 1997). Flood events are generated by spring runoff or convective summer storms. Recent dry periods include 1966, 1968, 1977, 1987-88, 1990-92 and 1994. Years with heavy snow pack and subsequent flooding occurred in 1965, 1982-84, and 1993 (Perkins and Bowers 2000).

Temperatures at Owyhee Dam (RM 28.5) range from a maximum of 107˚F in the summer to a minimum of -16˚F in the winter (USBR 1993). On an average, 64 days each year have temperatures of 90˚F or above.



Data source: PRISM

Figure 2.3. Precipitation patterns in the Owyhee subbasin (Perugini et al. 2002)

Geology

The mainstem of the Owyhee River originates in the Basin and Range Geologic Province in Nevada and flows in a northwest direction until entering the Snake River Plain. Most of the Owyhee subbasin lies within large volcanic fields characteristic of the Snake River Plain and southeastern Oregon (Orr and Orr 1996).

The Basin and Range Province began to evolve around 18 million years ago as a result of a regional east-west extension (USDI 1998). This was accompanied by large-volume basaltic lava flows. About 15.5 million years ago, similar caldera-forming eruptions occurred in the Owyhee Reservoir area. Catastrophic rhyolite eruptions covered and smoothed over the landscape, filling and plugging canyons, and periodically impounding water in large natural reservoirs (Orr and Orr 1996). Individual rhyolite flows were typically 300 feet thick and as deep as 800 feet (USBR 1993) (Figure 2.; Orr and Orr 1996). During a second phase of volcanism, fluid basalt flows welled up from cracks to fill low spots in the landscape and create a vast volcanic plateau (Orr and Orr 1996).

Towards the end of the basalt eruptions in the Snake River Plain, a graben began to form. Lava flows dammed the Snake River at the narrows of Hells Canyon on the Oregon-Idaho border (about 13 million years ago) and Lake Idaho formed. Lake Idaho filled the structural subsidence of the Snake River Plain in a lake -- 150 miles long and 50 miles wide -- from the Oregon border to near Twin Falls (Orr and Orr 1996). Sediments deposited during this time period (Idaho Group Sediments) exist at lower elevations where the Owyhee subbasin enters the Snake River Plain (Orr and Orr 1996).

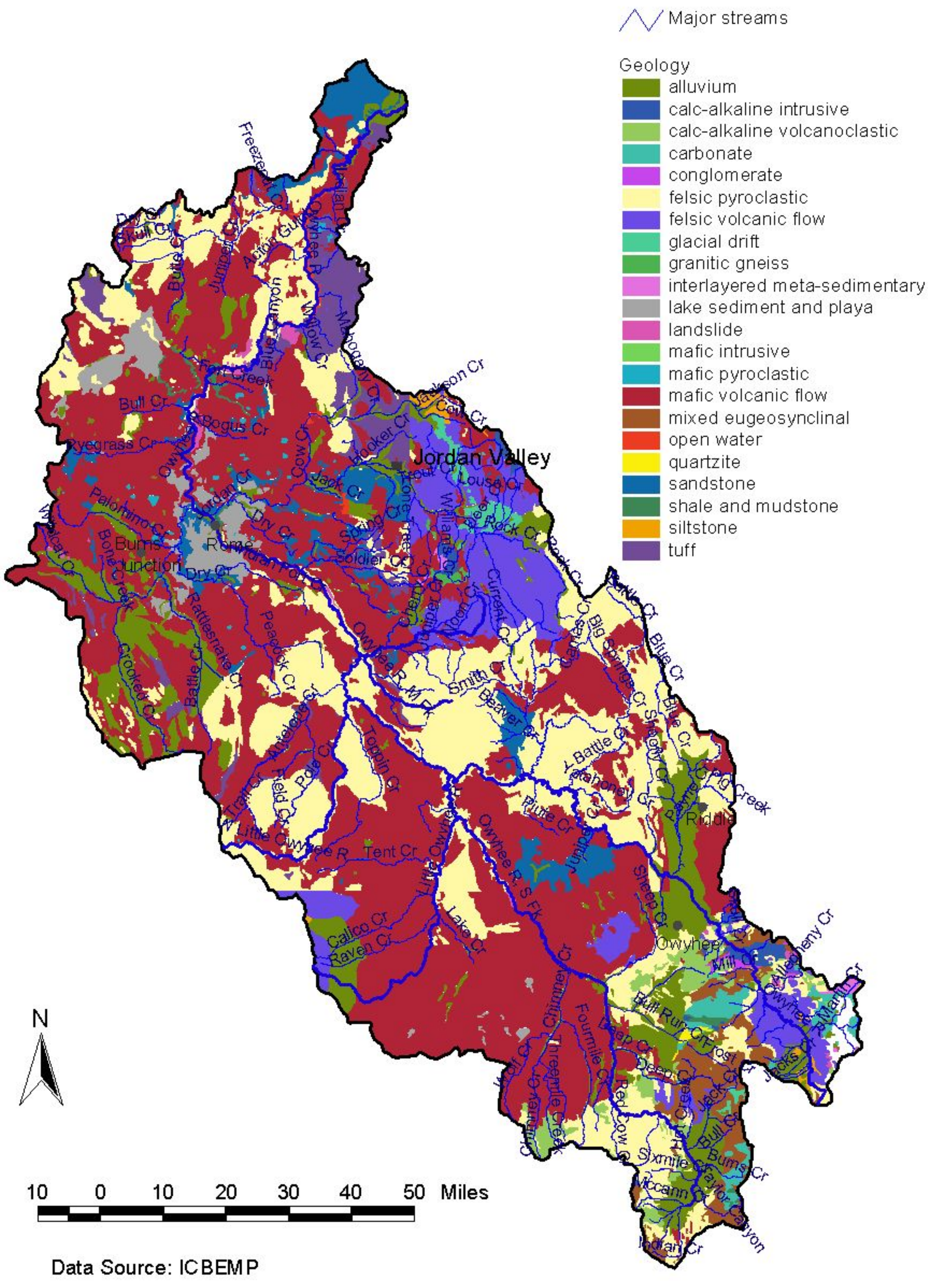


Figure 2.4. Geologic patterns of the Owyhee subbasin (Perugini et al. 2002)

About 1.5 million years ago, Lake Idaho cut through what is now Hells Canyon, connecting the Snake River Basin to the Columbia River Basin. Once this happened, the Snake River, Owyhee River, and other major tributaries in the Snake River Province, cut their current valleys. About 14,500 years ago, the Bonneville Flood flushed a final veneer of sand and gravel into the lower subbasin (Orr and Orr 1996). This flood deepened and widened the Snake River Canyon, which in turn led to further downcutting of the tributary canyons. Most recently, stream alluvium have been deposited in river and stream bottoms and lake sediments have been deposited by wind and water in depressions in the basalt flows (DAF 1998). Volcanism has continued into recent times as evidenced by basalt flows at Jordan Craters that date back 4,000 years (USDI 1998) (Table 2.1).

Table 2.1. Owyhee subbasin geology (ICBEMP).

Lithology	Acres	Kilometers^2	Miles^2	Percent
Mafic volcanic flow	3,172,360	12,838	4,957	44.99
Alluvium	669,772	2,711	1,047	9.50
Sandstone	262,071	1,061	409	3.72
Felsic pyroclastic	1,657,665	6,708	2,590	23.51
Tuff	236,833	958	370	3.36
Open water	15,601	63	24	0.22
Mafic intrusive	617	2	1	0.01
Mafic pyroclastic	10,725	43	17	0.15
Felsic volcanic flow	419,791	1,699	656	5.95
Calc-alkaline intrusive	35,383	143	55	0.50
Lake sediment and playa	146,612	593	229	2.08
Landslide	22,060	89	34	0.31
Shale and mudstone	17,708	72	28	0.25
Siltstone	16,924	68	26	0.24
Glacial drift	37,266	151	58	0.53
Carbonate	54,972	222	86	0.78
Granitic gneiss	6,578	27	10	0.09
Interlayered meta-sedimentary	8,450	34	13	0.12
Calc-alkaline volcanoclastic	92,721	375	145	1.31
Mixed eugeosynclinal	157,001	635	245	2.23
Conglomerate	5,693	23	9	0.08
Quartzite	5,197	21	8	0.07
Totals	7,052,001	28,539	11,019	100.00

Soils

Most soils in the subbasin are young and poorly developed because soil-building processes, such as rock weathering, decomposition of plant materials, accumulation of organic matter, and nutrient cycling, proceed slowly in arid environments (USDI 1998). The predominant soil types in the subbasin are of volcanic origin, with lacustrine and alluvial deposits common in low elevation areas (Franklin and Dyrness 1984 cited in Perkins and Bowers 2000). Land use, prolonged drought, and catastrophic storms have contributed to various processes of upland soil erosion. Many of the ephemeral stream channels exhibit signs of gully erosion, as measured by their degree of channel incision (USDI 1998). Gully erosion has plagued these pinnate drainages for over 30 years by entraining soils following high magnitude storm events (USDI 1998). Severe overland erosion has decreased soil productivity in many areas of the Owyhee subbasin. These areas are often coincident with areas where intensive land use has, and still, occurs. The reduction in soil productivity is reflected by the lack of continued succession beyond early seral stage plant communities (USDI 1998).

In higher elevation portions of the Owyhee, such as the Owyhee Mountains and high plateaus of the upper subbasin, processes of upland erosion are most common on soils with a sedimentary and/or granitic parent material (USDI 1999[1]). Many of these soils occur on steep, poorly vegetated slopes, which convey sediment to stream channels (USDI 1999). Rill and gully erosion are low in most of these areas, except for the portions of the Snake River Uplands dominated by sedimentary or granitic-derived soils (USDI 1999).

In Oregon and Idaho microbiotic soil crusts, which protect the soils from erosion, have experienced widespread disturbance from livestock trampling, and in some areas from OHMV use (USDI 1999). The accordant soil compaction has stunted plant growth and increased erosion (USDI 1999). This is considered a widespread problem throughout the subbasin in areas with rangeland crusts (USDI 1998; USDI 1999).

Vegetation

Historically, two major vegetation types dominated the lower elevation desert upland communities: big sagebrush (*Artemisia* spp.)/bunchgrass communities and salt desert communities. These assemblages are still common throughout the subbasin, but have been replaced by exotics or agricultural species in some areas (Figure 2.5).

Shrub-steppe is the predominant vegetative community across the subbasin (Kuchler 1964). Canyons with intermittent streams contain riparian and desert shrub plant communities. Perennial rivers and streams, low lying areas, springs, and irrigation ditches support riparian and wetland plant communities (Figure 2.5). In the western part

[1] This document is being contested by the Owyhee Watershed Council.

of the subbasin and in areas near the mouth of the Owyhee River, saltbush-greasewood plant communities occur (Kuchler 1964).

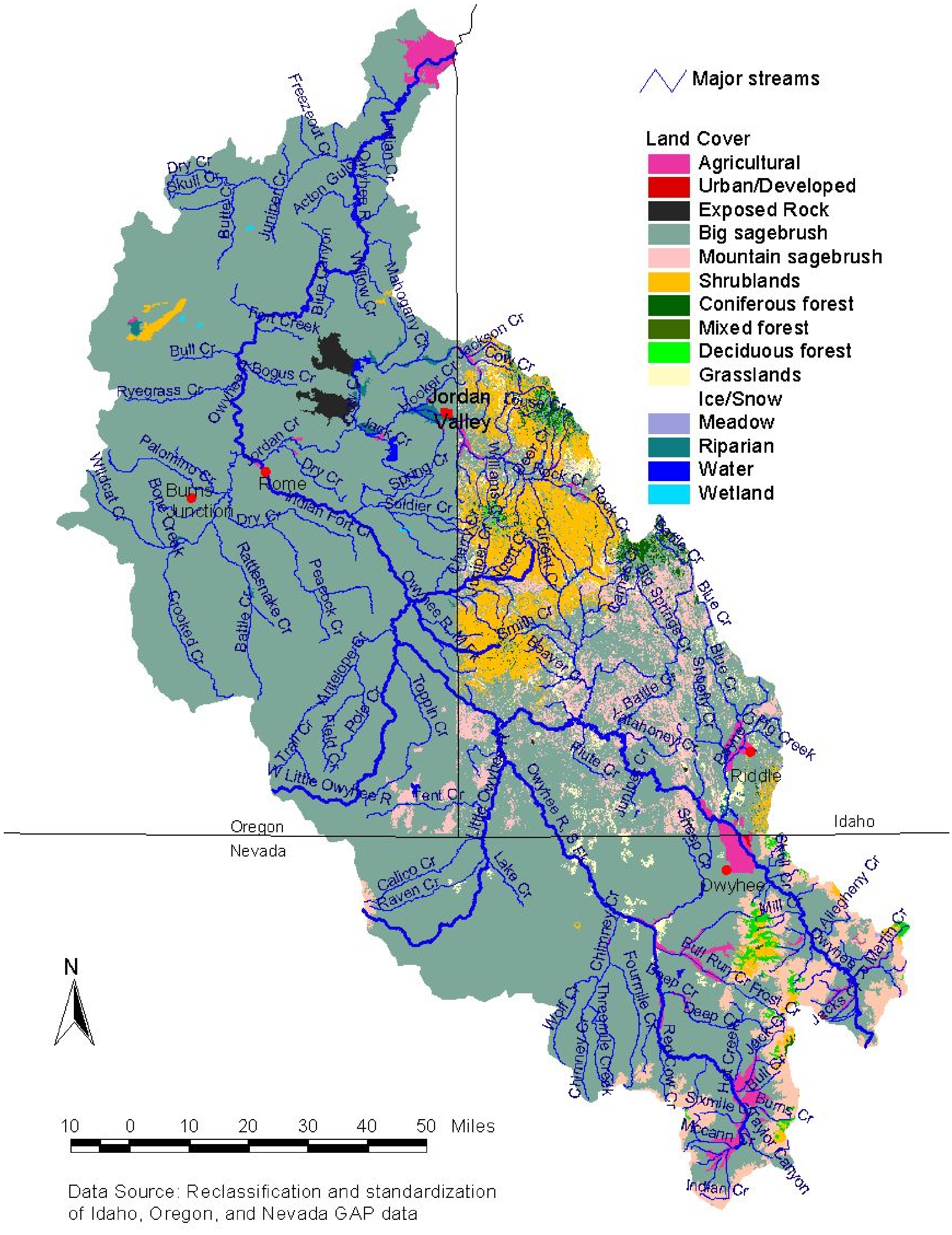


Figure 2.5. Vegetation in the Owyhee subbasin (Perugini et al. 2002)

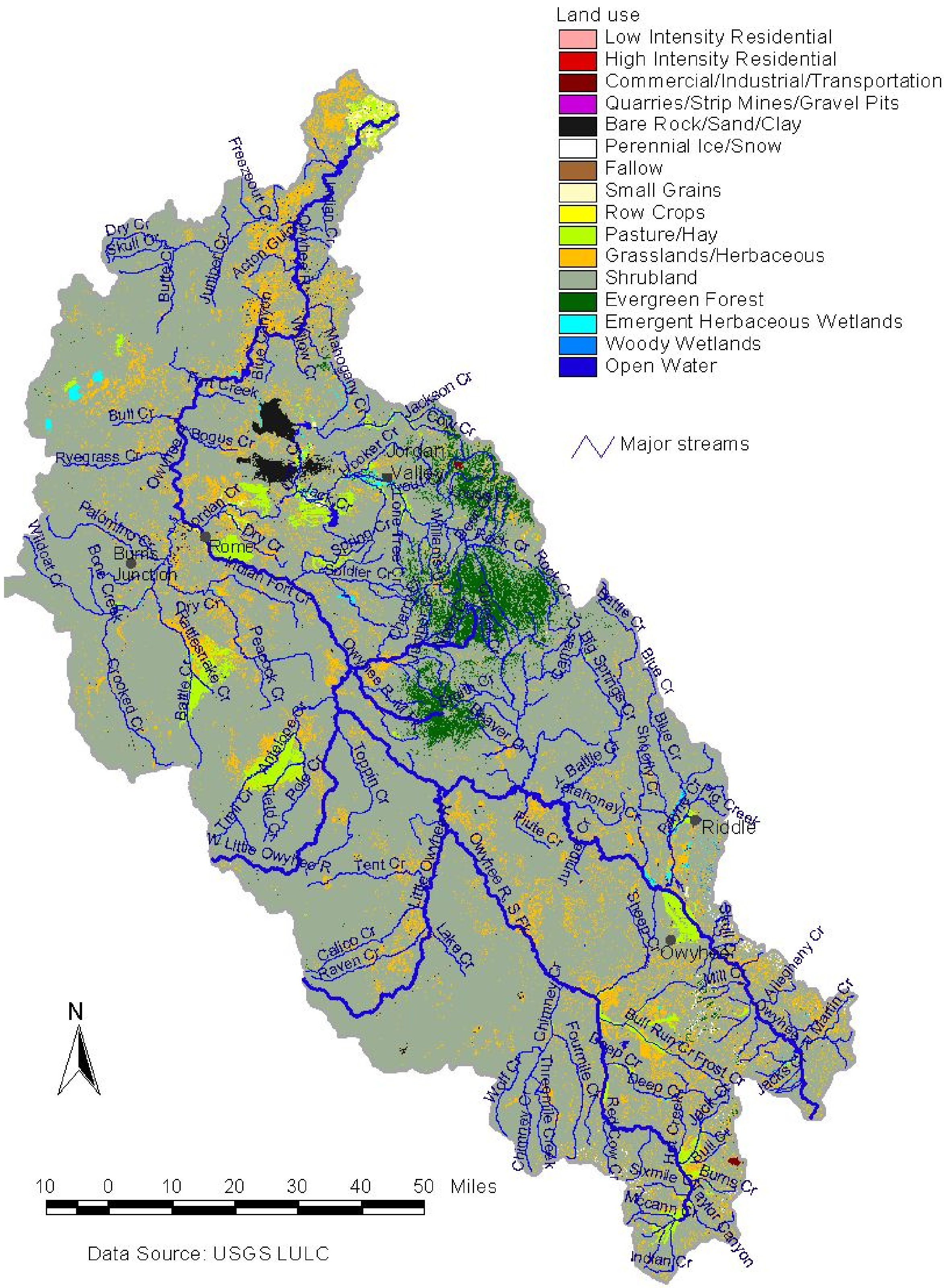


Figure 2.6. Land cover patterns in the Owyhee subbasin (Perugini et al. 2002)

Big sagebrush communities dominate almost every vegetation mosaic. Big sagebrush *(Artemisia tridentata)*, various bunchgrasses, shrubs, and juniper (*Juniperus* spp.) woodlands characterize high-elevation sagebrush-steppe. The Wyoming big sagebrush (*Artemisia tridentata* spp. *wyomingensis*)/bluebunch wheatgrass (*Agropyron spicatum*) association is the most widespread in the subbasin (USBR 1993; USDI 1999). Other common grass associates include Idaho fescue (*Festuca idahoensis*), squirreltail *(Hordeum jubatum)*, Sandberg bluegrass *(Poa secunda)*, Thurber needlegrass (*Stipa thurberiana*), Indian ricegrass *(Oryzopsis hymenoides)*, wildrye (*Elymus* spp.), and cheatgrass (*Bromus tectorum)*. The abundance and distribution of the grass associates varies with regard to slope, elevation and aspect as well as range condition (USBR 1993). The big sagebrush/grass association is most vigorous on north facing slopes and on deep soils. Low sagebrush/grass associations primarily occur on ridge tops with shallow, rocky soil profiles at intermediate and high elevations (USBR 1993).

Common shrubs in the subbasin include big sagebrush, low sagebrush (*Artemisia arbuscula*), rabbitbrush (*Chrysothamnus* spp.), antelope bitterbrush (*Purshia tridentata*), currant (*Ribes* spp.), red osier dogwood *(Cornus stolonifera)*, and wild rose *(Rosa* spp.*)*. Snowberry *(Symphoricarpos albus*), greasewood *(Sarcobatus vermiculatus)*, serviceberry (*Amelanchier alnifolia*), mountain mahogany (*Cercocarpus montanus)*, spiny hopsage (*Grayia spinosa*), four-wing saltbush (*Atriplex canescens*), broom snakeweed *(Gutierrezia sarothrae)*, horsebrush *(Tetradymia* spp.*)* and purple sage (*Salvia* spp.) occur less frequently, but are important to wildlife.

Alkaline soils occur on the flats above the upper Owyhee River and support a salt desert shrub mosaic. These communities are most common where internal drainage and old lakebeds are present (USBR 1993). The dominant shrubs in these communities include greasewood, shadscale saltbush (*Atriplex gardneri*), and spiny hopsage.

High elevation areas in the south and central portions of the subbasin, support aspen *(Populus* spp.*)*, Douglas fir (*Pseudotsuga menziesii)* and sub-alpine fir *(Abies lasiocarpa)* (Figure 2.). Juniper stands occur throughout the Owyhee Mountains and are a component of the sagebrush steppe vegetation type beginning at approximately 4,500 feet in elevation. Juniper can be found with stands of aspen and mahogany at 5,500 foot elevations and higher, and with Douglas fir and sub-alpine fir on the highest slopes (USDI 1999).

Fire suppression has facilitated the dispersion and expansion of juniper into former big sagebrush communities (USDI 1998; 1999). Heavy grazing prior to the Taylor Grazing Act has also had some impact of the expansion of juniper. This has decreased understory vegetation valuable for watershed protection, wildlife, and livestock. The uplands of the North Fork Owyhee River, and isolated areas along the main Owyhee are the only areas that have significant stands of juniper in Oregon's portion of the subbasin (USDI 1993).

The BLM estimates that 35,000–40,000 acres of Douglas fir occur at higher elevations of the Owyhee Mountains. Douglas fir communities are bordered by juniper communities at lower elevations and by sub-alpine fir communities at higher elevations (7,900 feet or above). Mountain mahogany is common at high elevations in the western portion of the subbasin and is the dominant species on Mahogany Mountain (Perkins and Bowers 2000). Other high elevation vegetation includes juniper, quaking aspen, snowberry, sagebrush and willow (*Salix* spp.) (USDI 1998).

No significant harvest of Douglas fir has occurred in the Owyhee Resource Area[2] for at least 20 years (USDI 1999). A Timber Production Capability Classification (TPCC) forest inventory conducted in 1980 found 36,200 acres of commercial forest (primarily Douglas fir) in the Owyhee Mountains (BLM 1999). Approximately 25% (10,000 acres) were classified as in excellent condition.

At lower elevations, such as in the bottom of draws and canyons, riparian vegetation is the dominant vegetation type and includes cottonwood (*Populus* spp.), coyote willow (*Salix* spp.), hawthorn (*Crataegus* spp.), and chokecherry (*Prunus virginiana*) (USDI 1999). Juniper and hackberry occur in isolated areas (USBR 1993). Meadow grasses, sedges (*Carex* spp.), rushes (*Juncus* spp.) and forbs occur in the understory. Greasewood dominates alkaline riparian areas (USBR 1993). High flows during spring runoff and high magnitude storm events limit riparian vegetation and favor establishment of herbaceous shrubs.

Riparian areas in the Owyhee Mountains are generally narrow bands consisting of willow, aspen, black cottonwood, red osier dogwood or alder. Chokecherry, black hawthorn and Wood's rose are common at the edge of riparian areas (Idaho Department of Environmental Quality Date Unknown IDEQ DU). Herbaceous riparian communities include rushes, bluegrass and other grasses and forbs. In general, high elevation riparian areas are in better ecological condition because of higher precipitation and subsurface moisture. Areas where livestock grazing has been restricted by steep terrain or other physical barriers have also faired better (IDEQ DU). Deep soil meadows are typically dominated by rushes, sedges, bluegrass, mules-ears, iris and other herbaceous species, while shallow sites are dominated by willows, aspen, and woody riparian plant species (IDEQ DU).

Exotic weeds pose a significant threat to native vegetative communities and wildlife species throughout the subbasin (BLM 1999). These weeds have become established in many areas, resulting in a reduction in foraging, nesting and brood rearing habitat for wildlife. Cheatgrass represents a serious threat to sagebrush-steppe communities and the wildlife species that depend on them. This introduced species invades disturbed areas such as roadsides, grazed areas and agricultural lands. It can outcompete native perennial species because it germinates earlier in the season, allowing it to establish and monopolize soil resources before other species. Cheatgrass provides less protection to soils and less cover for wildlife than the shrubs or bunchgrasses that it replaces. Once established, this species is very difficult and expensive to control.

Sensitive Plants

Sensitive Plants are found throughout the subbasin and are listed in Appendix Table 2.4.1.

2.1.2 Hydrology

Surface Flows

Surface flows in the Owyhee subbasin fluctuate interannually and seasonally (BLM 1999). Forty-one years of stream flow data on the Owyhee River gauging station at Rome, Oregon showed no discernible trend (due to the substantial variation in annual precipitation) (BLM 1998). The basinwide average annual streamflow is 995 cfs, (USGS data). Maximum discharge at the Rome station was 50,000 cfs on March 18, 1993, and minimum flow was 42 cfs on August 12, 1954.

Most surface runoff originates as high elevation rainfall or snowmelt, producing peak discharges during the spring (BLM 1998; Perkins and Bowers 2000). Year-to-year variability in rainfall and snowfall influence both quantity and duration of spring runoff (BLM 1998). The average annual runoff per unit area ranges from less than 1 inch throughout the majority of the subbasin, to greater than 5 inches in the Trout Creek Mountains (BLM 1998). Runoff from snowmelt can be many times the discharge of streams in the summer months. Snow pack in the headwaters and groundwater inputs sustain flows in the mainstem Owyhee (USDI 1993).

The morphology of stream channels in the Owyhee subbasin influences hydrology. The highly confined, steep gradient channels that characterize the mainstem and tributary rivers do not allow efficient dispersal of energy during high flow events. These features contribute significantly to the disruption of riparian vegetation and fish habitat during runoff, and act to accelerate high flows. The average stream gradient from the Oregon-Idaho border to the backwater of the Owyhee Dam is 13 feet per mile ((USDI-BLM 1993). Most of this stretch of river is confined to narrow canyons with bedrock substrate (USDI-BLM 1993). Approximately 41 miles of the West Little Owyhee's 51 miles total length is confined to a canyon with an average gradient drop per mile of 47 feet (USDI-BLM 1993). Toppin Creek (the main tributary to West Little Owyhee) has a gradient drop of 160 feet per mile over the lower 5 miles of the stream.

The South Fork's hydrology is characterized as "flashy," with peak flows occurring any time between January and June, most typically in May and June (Ingham 1999). The South Fork headwaters are located in the Bull Run Mountains (primarily Paleozoic sedimentary rock in origin) of northern Nevada. Below the headwaters, the South Fork flows through the high desert Owyhee Plateau where the geology is primarily basalt and rhyolite.

Groundwater

Limited information is available on groundwater quantity. Aquifers occur in silicic volcanic rocks and are mainly recharged from precipitation (BLM 1999). The groundwater in the subbasin occurs at great depths, but supplements surface flows in many areas through springs or seeps (BLM 1999). Based on water data taken from 134 springs occurring within the Owyhee Resource Area, 70% yield $\leq$2 gallons per minute (GPM), 19% yield 2-3 GPM, and 11% yield $\geq$3 GPM (BLM 1999). The average yield for all 134 springs was 17 GPM.

Water Quality

Water quality impairment can be linked to historic and present land use activities as well as to natural geology of the area. Improper management of livestock grazing, mining, and agricultural activities have impacted water quality.

Prolonged and intense grazing that result in the removal or elimination of riparian vegetation may contribute to elevated water temperatures, fine sediment deposition, and an increase in fecal coliform bacteria (Platts 1986).

Historic mining operations still impact watersheds today through elevated concentrations of heavy metals, such as mercury, in sediments. Sources of mercury in the Owyhee are both natural and anthropogenic, but its introduction into the water system was accelerated by historic placer mining activities. Residual mercury from gold and silver mining is especially problematic in Jordan Creek (Newell et al. 1996). In addition, the Rio Mine upstream of Duck Valley Indian Reservation has negatively impacted water quality for humans, fish and wildlife.

Pesticides and their breakdown products have been detected at sites along the Owyhee River below irrigated farmland and in drain water return canals (Rinella et al. 1994). Nitrate-plus-nitrite, arsenic, boron, TDS, major ions, and selenium concentrations increase proportionally downstream along the Owyhee River, as irrigated agricultural return flows enter the channel.

The effects of reduced water quality on aquatic and terrestrial biota vary. Fish sampled from the Owyhee Reservoir, Antelope Reservoir and Jordan Creek by Oregon Department of Environmental Quality (ODEQ) contained concentrations of mercury that exceeded levels allowed by FDA for commercial fish (mean mercury level 2.9 mg/kg)and EPA protection levels for pregnant women (Rinella et al. 1994). Fish consumption advisories were issued by the State in response to these findings. Selenium concentrations in aquatic insects exceeded State standards for waterfowl in portions of the Owyhee River, and cadmium levels were detected at high concentrations in carp samples from Owyhee Reservoir.

Riparian area conditions influence water quality. The excessive removal of riparian vegetation leaves streambanks vulnerable. Removal of riparian vegetation through livestock grazing leaves streambanks vulnerable to erosion during high flows, causes streambank sloughing and cave-in, and ultimately contributes to the high sedimentation levels common in many streams throughout the subbasin. Riparian disturbance and subsequent increases in sedimentation may occur from imProper placed roads, poorly vegetated uplands and improper grazing (Perkins and Bowers 2000).

2.1.3 Land Ownership

The majority (77.8%) of the land in the Owyhee subbasin is federally owned. The remainder is owned by the Shoshone-Paiute Tribes (3.7%), private landowners (13.2%), and the state (5.3%) (Figure 2.; Table 2.2).

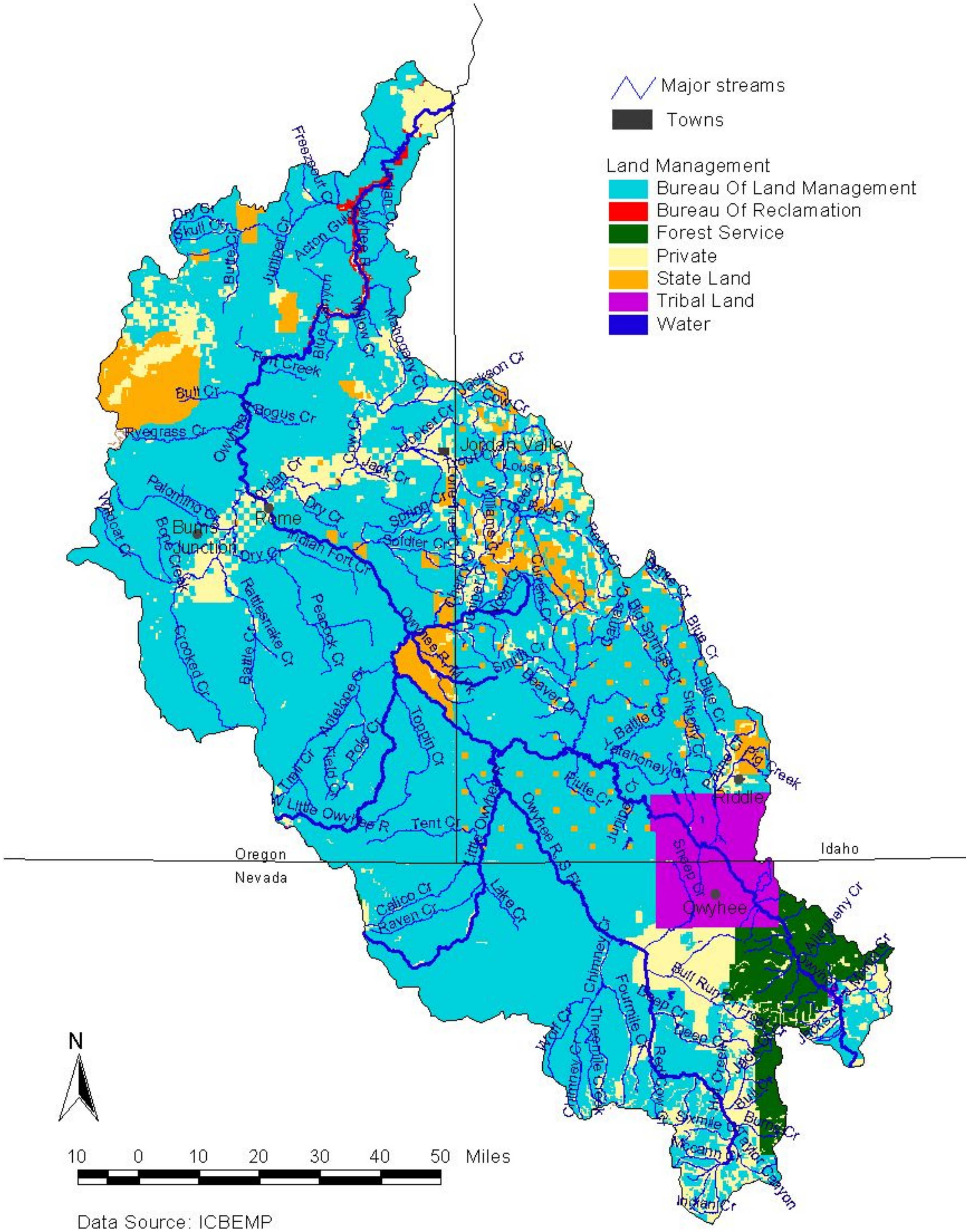


Figure 2.7. Land management of the Owyhee subbasin (Perugini et al. 2002)

Table 2.2. Ownership in the Owyhee Subbasin (ICBEMP data)

Ownership	Management	Acres	Kilometers^2	Miles^2	Percent
Federal	Bureau of Land Management	5,339,525.19	21,608.76	8,343.14	73.9
Private	Private	954,689.14	3,863.57	1,491.73	13.2
Federal	Bureau of Reclamation	28,143.68	113.90	43.98	0.4
State	State Land	382,818.14	1,549.24	598.16	5.3
Tribal	Shoshone-Paiute Tribes	265,833.44	1,075.81	415.37	3.7
Federal	Water	9,743.13	39.43	15.22	0.1
Federal	Forest Service	242,004.13	979.38	378.14	3.4
Totals		7,222,756.85	29,230.09	11,285.74	100.0

2.2 Focal Species Characterization and Status

A summary of focal species for the Owyhee Subbasin is presented in (Table 2.4).

Table 2.4. Owyhee Subbasin Focal Species – final list agreed-upon at the 1-28-2004 meeting.

Assessment Section	Focal Habitat Types Owyhee Subbasin	Focal Species
Terrestrial	Upland aspen forest	Aspen
	Pine/Fir/Mixed Conifer Forests	Elk
	Old Growth western juniper and mountain mahogany woodlands	Mule deer
	Shrub-steppe (including sagebrush steppe and salt-scrub shrublands)	Sage grouse Golden eagle Pronghorn antelope
	Riparian and wetlands	Columbia spotted frog Beaver Yellow Warbler Bald eagle White-faced ibis
	Agricultural Lands	California quail
	Grasslands	Grasshopper sparrow
	Canyon / Gorge	California Bighorn sheep Peregrine falcon
Aquatic	Fishes	
	Streams (creeks & rivers)	Redband trout
	Reservoirs/lakes (upper reaches only)	Redband trout

2.2.1 Focal Habitats

2.2.1.1 Upland aspen forest

Geographic Distribution. Quaking aspen groves are the most widespread habitat in North America, but are a minor type Oregon (Crawford and Kagan 2004; Image 2.2). Upland Aspen habitat is found in isolated mountain ranges of Southeastern Oregon, e.g. Steens Mountains. Aspen stands are much more common in the Rocky Mountain region.

Image 2.2. Upland Aspen Forest (Source: nwhi.org/ibis).

In the western United States, aspen may form extensive stands which occupy a considerable area within a drainage or its distribution may be more limited and is expressed as riparian stringers or disjunct patches. As a general rule, the latter is more characteristic in Nevada – exceptions include extensive aspen stands in the Snake, Schell Creek, White Pine, Jarbidge, Independence, and Monitor Ranges, as well as the Santa Rosa and Ruby Mountains. Scattered stands occur as far south as the Spring Mountains near Las Vegas and in the adjacent Sheep Range (Lanner 1984). The Nevada GAP reports 122,070 hectares of aspen in Nevada, likely a serious underestimation.

Physical Setting. This habitat generally occurs on well-drained mountain slopes or canyon walls that have some moisture. Rockfalls, talus, or stony north slopes are often typical sites. It may occur in steppe on moist microsites. This habitat is usually not associated with streams, ponds, or wetlands. This habitat is found from 2,000 to 9,500 ft (610 to 2,896 m) elevation.
Within Nevada, aspen generally occupies elevations between 6.000 and 8,000 feet (Lanner 1984). Aspen stands are found on all aspects and grow where soil moisture is not a limiting factor.

Landscape Setting. Aspen forms a "subalpine belt" above the Western Juniper and Mountain Mahogany Woodland habitat and below Montane Shrub-steppe Habitat on Steens Mountain in southern Oregon (Crawford and Kagan 2004). It can occur in seral stands in the lower Eastside Mixed Conifer Forest and Ponderosa Pine Forest and Woodlands habitats. Primary land use is livestock grazing.

Structure. Deciduous trees usually <48 ft (15 m) tall dominate this woodland or forest habitat (Figure 2.12). The tree layer grows over a forb-, grass-, or low-shrub-dominated undergrowth. Relatively simple 2-tiered stands characterize the typical vertical structure of woody plants in this habitat. This habitat is composed of 1 to many clones of trees with larger trees toward the center of each clone. Conifers invade and create mixed evergreen-deciduous woodland or forest habitats.

Succession and Stand Dynamics. There is no generalized successional pattern across the range of this habitat. Aspen sprouts after fire and spreads vegetatively into large clonal or multiclonal stands. Because aspen is shade intolerant and cannot reproduce under its own canopy, conifers can invade most aspen habitat.

Effects of Management and Anthropogenic Impacts. Domestic sheep reportedly consume four times more aspen sprouts than do cattle. Heavy livestock browsing can adversely impact aspen growth and regeneration. With fire suppression and alteration of fine fuels, fire rejuvenation of aspen habitat has been greatly reduced since about 1900. Conifers now dominate many seral aspen stands and extensive stands of young aspen are uncommon (Crawford and Kagan 2004). The current distribution of Upland Aspen in Mid-Snake subbasins is presented in Figure 2.8 and the historic distribution is presented in Figure 2.9 (Source: nwhi.org/ibis).

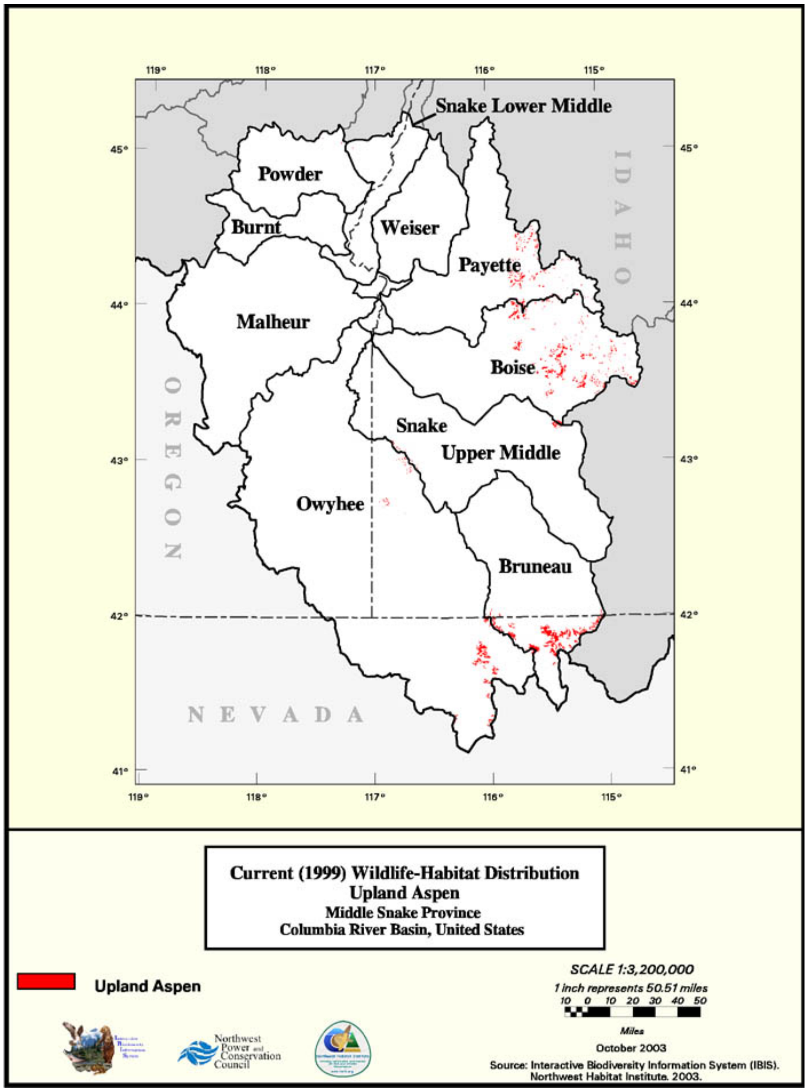


Figure 2.8. Current wildlife-habitat distribution of Upland Aspen in Mid-Snake subbasins (Source: nwhi.org/ibis).

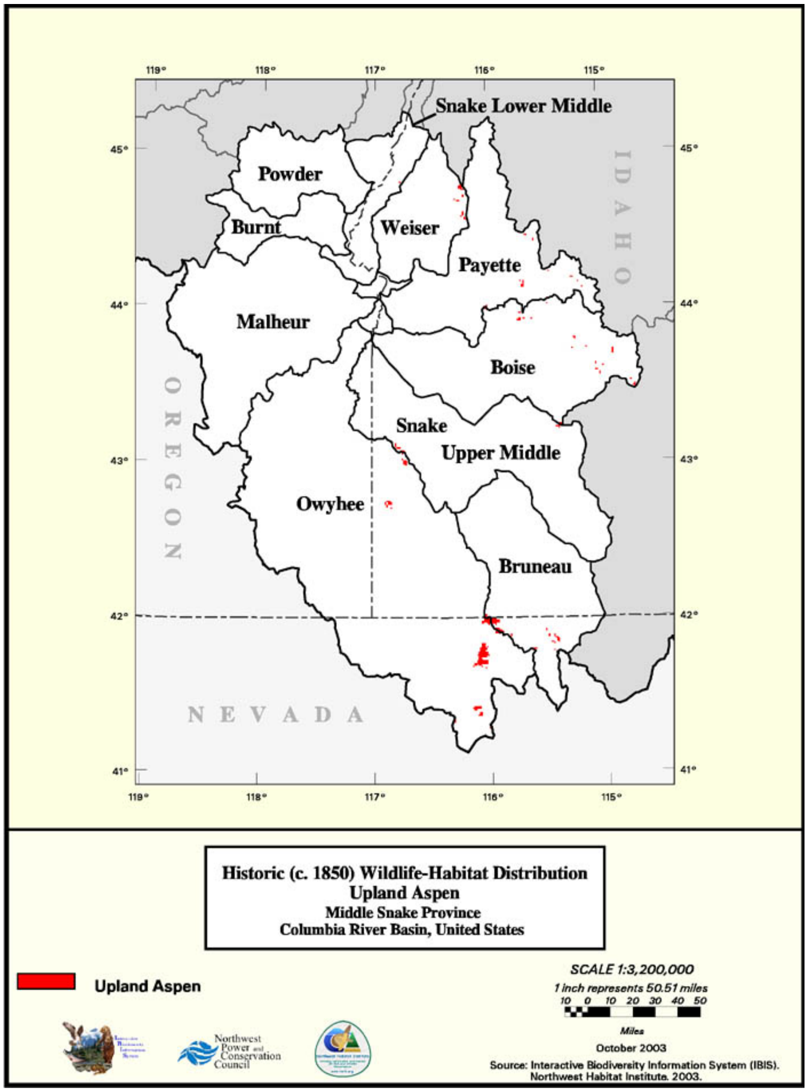


Figure 2.9. Historic wildlife-habitat distribution of Upland Aspen in Mid-Snake subbasins (Source: nwhi.org/ibis).

Status and Trends. With fire suppression and change in fire regimes, the Aspen Forest habitat is less common than before 1900. None of the 5 Pacific Northwest upland quaking aspen community types in the National Vegetation. ?

2.2.1.2 Mixed Conifer Forests (Fir and Pine)

Geographic Distribution. The Eastside Mixed Conifer Forest habitat appears primarily the Blue Mountains, East Cascades, and Okanogan Highland Ecoregions of Oregon, Washington, adjacent Idaho, and western Montana (Image 2.3). It also extends north into British Columbia.

Image 2.3. Mixed Conifer Forest – Fir and Pine (Source: nwhi.org/ibis).

In Nevada, these forests are mostly concentrated on the western and eastern margins of the state. Coniferous forests comprise the major vegetative expressions for the Sierra Nevada, and are distributed in widely scattered tracts of varying size along Nevada's eastern border from Jarbidge in the northeast corner to Great Basin National Park in the Snake Range along the central Utah border (Neel 1999).

Physical Setting. The Eastside Mixed Conifer Forest habitat is primarily mid-montane with an elevation range of between 1,000 and 7,000 ft (305-2,137 m), mostly between 3,000 and 5,500 ft (914-1,676 m). Parent materials for soil development vary. This habitat receives some of the greatest amounts of precipitation in the inland northwest, 30-80 inches (76-203 cm)/year. Elevation of this habitat varies geographically, with generally higher elevations to the east.
Coniferous forests in Nevada take on two major growth forms. The forests of the Sierra Nevada and the eastern border attain well-developed timber stand structures typified by tall stems reaching diameters at breast height (dbh) up to 190 cm, but usually ranging between 38 and 76 cm. The limber pine - bristlecone pine forests of the central mountain ranges rarely attain saw-timber characteristics; rather, they typically assume stunted, tortured growth forms highly influenced by wind and the harsh conditions of their high elevation sites (Neel 1999).

Landscape Setting. This habitat makes up most of the continuous montane forests of the inland Pacific Northwest (Crawford 2004). It is located between the subalpine portions of the Montane Mixed Conifer Forest habitat in eastern Oregon and lower tree line Ponderosa Pine and Forest and Woodlands.

Structure. Eastside Mixed Conifer habitats are montane forests and woodlands. Stand canopy structure is generally diverse, although single-layer forest canopies are currently more common than multilayered forests with snags and large woody debris (Figure 2.11(Crawford 2004). The tree layer varies from closed forests to more open-canopy forests or woodlands. This habitat may include very open stands. The undergrowth is complex and diverse. Tall shrubs, low shrubs, forbs or any combination may dominate stands. Deciduous shrubs typify shrub layers. Prolonged canopy closure may lead to development of a sparsely vegetated undergrowth.

Composition. This habitat contains a wide array of tree species (9) and stand dominance patterns. Douglas-fir (Pseudotsuga menziesii) is the most common tree species in this habitat. It is almost always present and dominates or co-dominates most overstories. Lower elevations or drier sites may have ponderosa pine (Pinus ponderosa) as a co-dominant with Douglas-fir in the overstory and often have other shade-tolerant tree species growing in the undergrowth. On moist sites, grand fir (Abies grandis), western redcedar (Thuja plicata) and/or western hemlock (Tsuga heterophylla) are dominant or co-dominant with Douglas-fir. Other conifers include western larch (Larix occidentalis) and western white pine (Pinus monticola) on mesic sites, Engelmann spruce (Picea engelmannii), lodgepole pine (Pinus contorta), and subalpine fir (Abies lasiocarpa) on colder sites. Rarely, Pacific yew (Taxus brevifolia) may be an abundant undergrowth tree or tall shrub.

Natural Disturbance Regime. Fires were probably of moderate frequency (30-100 years) in presettlement times. Inland Pacific Northwest Douglas-fir and western larch forests have a mean fire interval of 52 years 22. Typically, stand-replacement fire-return intervals are 150-500 years with moderate severity-fire intervals of 50-100 years. Specific fire influences vary with site characteristics. Generally, wetter sites burn less frequently and stands are older with more western hemlock and western redcedar than drier sites. Many sites dominated by Douglas-fir and ponderosa pine, which were formerly maintained by wildfire, may now be dominated by grand fir (a fire sensitive, shade-tolerant species) (Crawford 2004).

Succession and Stand Dynamics. Successional relationships of this type reflect complex interrelationships between site potential, plant species characteristics, and disturbance regime . Generally, early seral forests of shade-intolerant trees (western larch, western white pine, ponderosa pine, Douglas-fir) or tolerant trees (grand fir, western redcedar, western hemlock) develop some 50 years following disturbance. This stage is preceded by forb- or shrub- dominated communities. These early stage mosaics are maintained on ridges and drier topographic positions by frequent fires. Early seral forest develops into mid-seral habitat of large trees during the next 50-100 years. Stand replacing fires recycle this stage back to early seral stages over most of the landscape. Without high-severity fires, a late-seral condition develops either single-layer or multilayer structure during the next 100-200 years. These structures are typical of cool bottomlands that usually only experience low-intensity fires.

Effects of Management and Anthropogenic Impacts. This habitat has been most affected by timber harvesting and fire suppression. Timber harvesting has focused on large shade-intolerant species in mid- and late-seral forests, leaving shade-tolerant species. Fire suppression enforces those logging priorities by promoting less fire-resistant, shade-intolerant trees. The resultant stands at all seral stages tend to lack snags, have high tree density, and are composed of smaller and more shade-tolerant trees. Mid-seral forest structure is currently 70% more abundant than in historical, native systems. Late-seral forests of shade-intolerant species are now essentially absent. Early-seral forest abundance is similar to that found historically but lacks snags and other legacy features.

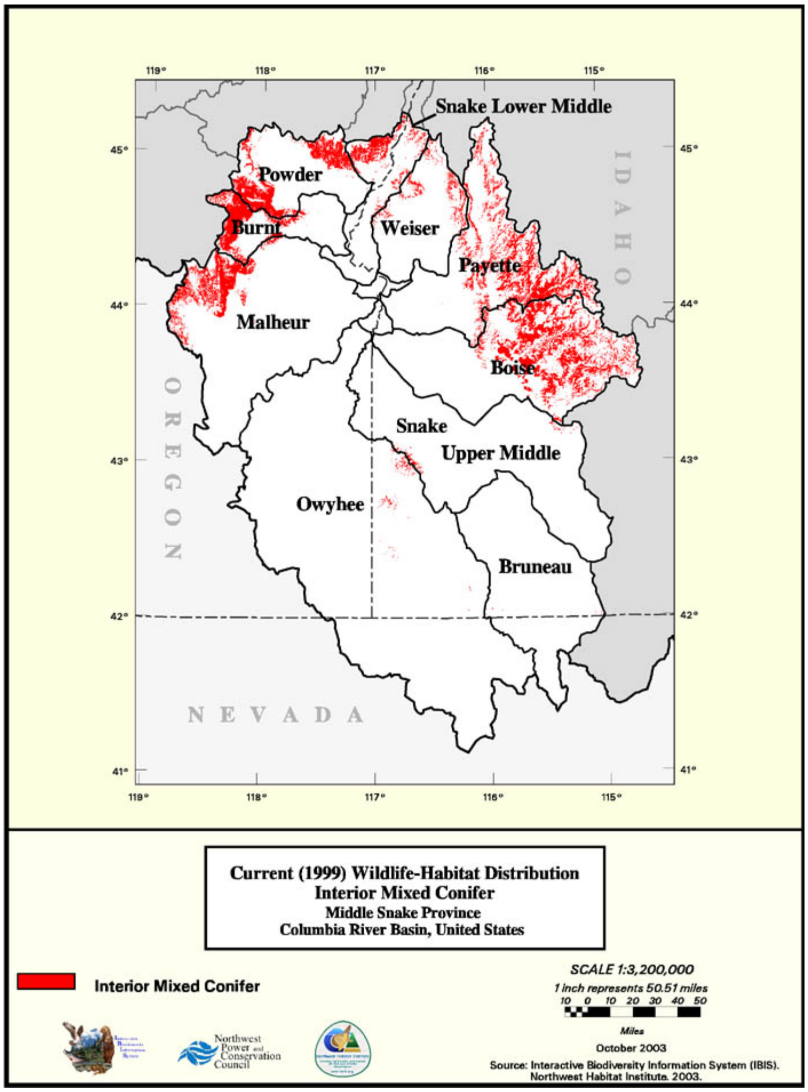


Figure 2.10. Current Wildlife-Habitat Distribution Interior Mixed Conifer (Source: nwhi.org/ibis).

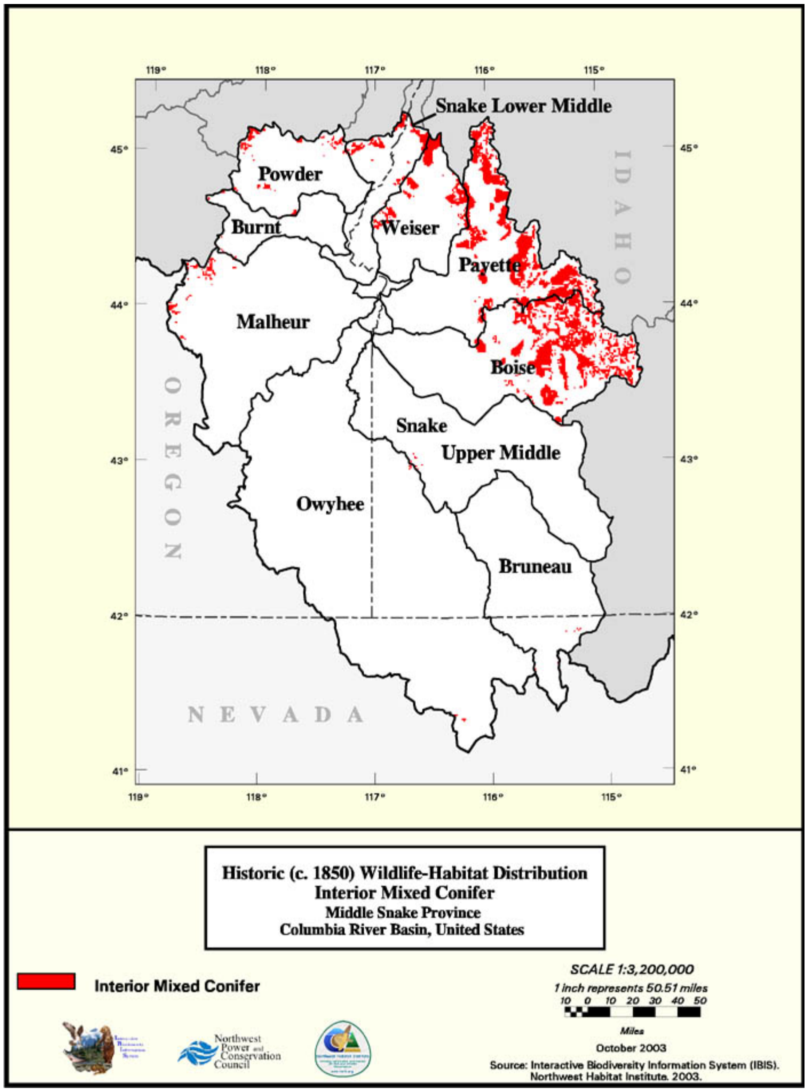


Figure 2.11. Historic Wildlife-Habitat Distribution Interior Mixed Conifer (Source: nwhi.org/ibis).

Status and Trends. Quigley and Arbelbide (1997)concluded that the Interior Douglas-fir, Grand fir, and Western redcedar/Western hemlock cover types are more abundant now than before 1900, whereas the Western larch and Western white pine types are significantly less abundant. Twenty percent of Pacific Northwest Douglas-fir, grand fir, western redcedar, western hemlock, and western white pine associations listed in the National Vegetation Classification are considered imperiled or critically imperiled. Roads, timber harvest, periodic grazing, and altered fire regimes have compromised these forests. Even though this habitat is more extensive than pre-1900, natural processes and functions have been modified enough to alter its natural status as functional habitat for many species.

2.2.1.3 Old Growth western juniper and mountain mahogany woodlands

Geographic Distribution. This habitat is distributed from the Pacific Northwest south into southern California and east to western Montana and Utah, where it often occurs with pinyon-juniper habitat (Image 2.4).

Image 2.4. Old Growth Western Juniper and Mountain Mahogany Woodlands (Source: nwhi.org/ibis).

In Oregon , this dry woodland habitat appears primarily in the Owyhee Uplands, High Lava Plains, and northern Basin and Range ecoregions. Many isolated mahogany communities occur throughout canyons and mountains of eastern Oregon (Crawford and Kagan 2004). In Nevada, the mountain mahogany habitat type generally occurs in scattered pockets on mountain slopes throughout the Great Basin and is most common in central, eastern and northern Nevada. The Nevada GAP estimates 228,320 hectares of this type occur in the state (Neel 1999). Utah juniper dominates isolated areas in northeastern Nevada along the Utah border, and mixes freely with pinyon across the mountain ranges south of the Humboldt River.

Physical Setting. This habitat is widespread and variable, occurring in basins and canyons, and on slopes and valley margins in the southern Columbia Plateau, and on fire-protected sites in the northern Basin and Range province. It may be found on benches and foothills. Western juniper and/or mountain mahogany woodlands are often found on shallow soils, on flats at mid- to high elevations, usually on basalts. Other sites range from deep, loess soils and sandy slopes to very stony canyon slopes. At lower elevations, or in areas outside of shrub-steppe, this habitat occurs on slopes and in areas with shallow soils. Mountain mahogany can occur on steep rimrock slopes, usually in areas of shallow soils or protected slopes. This habitat can be found at elevations of 1,500- 8,000 ft (457-2,438 m), mostly between 4,000-6,000 ft (1,220-1,830 m). Average annual precipitation ranges from approximately 10 to 13 inches (25 to 33 cm), with most occurring as winter snow.

Landscape Setting. This habitat reflects a transition between Ponderosa Pine Forest and Woodlands and Shrub-steppe, Eastside Grasslands, and rarely Desert Playa and Salt Desert Scrub habitats. Western juniper generally occurs on higher topography, whereas the shrub communities are more common in depressions or steep slopes with bunchgrass undergrowth. In the Great Basin, mountain mahogany may form a distinct belt on mountain slopes and ridgetops above pinyon-juniper woodland. Mountain-mahogany can occur in isolated, pure patches that are often very dense. The primary land use is livestock grazing.

Structure. This habitat is made up of savannas, woodlands, or open forests with 10-60% canopy cover. The tallest layer is composed of short (6.6-40 ft 2-12 m tall) evergreen trees. Dominant plants may assume a tall-shrub growth form on some sites. The short trees appear in a mosaic pattern with areas of low or medium-tall (usually evergreen) shrubs alternating with areas of tree layers and widely spaced low or medium-tall shrubs. The herbaceous layer is usually composed of short or medium tall bunchgrass or, rarely, a rhizomatous grass-forb undergrowth. These vegetated areas can be interspersed with rimrock or scree. A well-developed cryptogam layer often covers the ground, although bare rock can make up much of the ground cover (Figure 2.14)

Succession and Stand Dynamics. Juniper invades shrub-steppe and steppe and reduces undergrowth productivity (Crawford and Kagan 2004). Although slow seed dispersal delays recovery time, western juniper can regain dominance in 30-50 years following fire. A fire-return interval of 30-50 years typically arrests juniper invasion. The successional role of curl-leaf mountain mahogany varies with community type. Mountain brush communities where curl-leaf mountain mahogany is either dominant or co-dominant are generally sTable 2.2.and successional rates are slow.

Effects of Management and Anthropogenic Impacts. Over the past 150 years, with fire suppression, overgrazing, and changing climatic factors, western juniper has increased its range into adjacent shrub-steppe, grasslands, and savannas. Increased density of juniper and reduced fine fuels from an interaction of grazing and shading result in high severity fires that eliminate woody plants and promote herbaceous cover, primarily annual grasses. Diverse mosses and lichens occur on the ground in this type if it has not been too disturbed by grazing. Excessive grazing will decrease bunchgrasses and increase exotic annual grasses plus various native and exotic forbs. Animals seeking shade under trees decrease or eliminate bunchgrasses and contribute to increasing cheatgrass cover (Crawford and Kagan 2004).

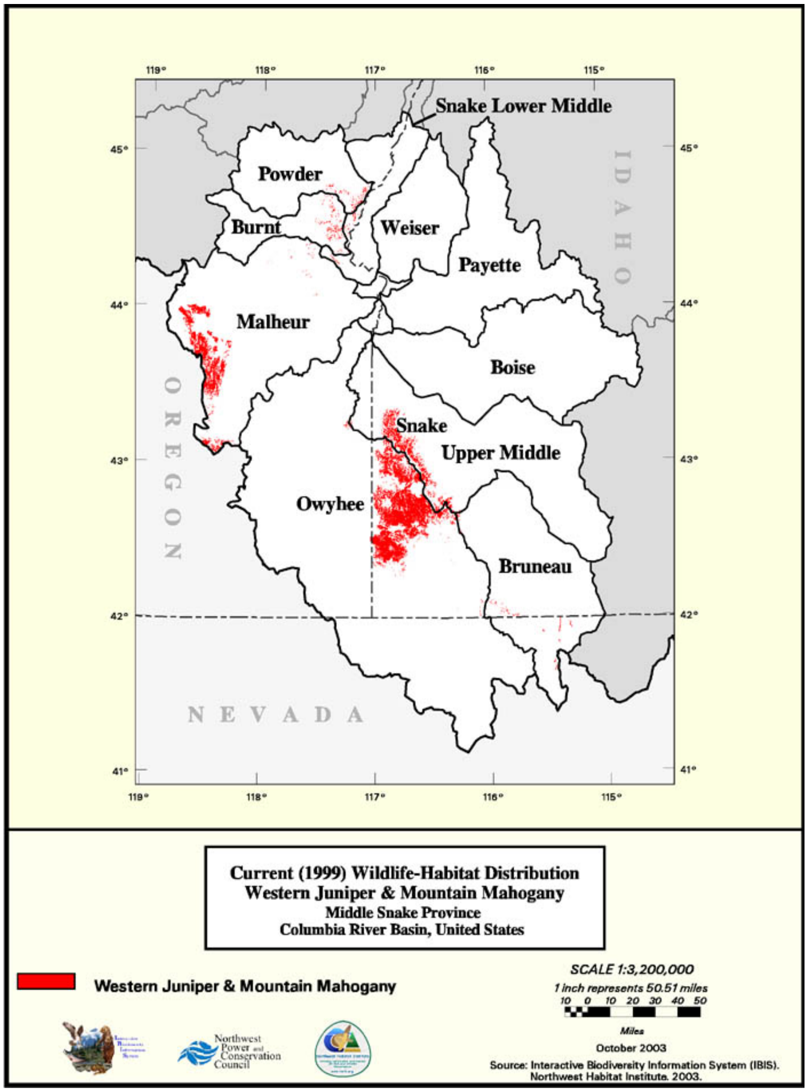


Figure 2.12. Current Wildlife-Habitat Distribution Old Growth Western Juniper and Mountain Mahogany Woodlands (Source: nwhi.org/ibis).

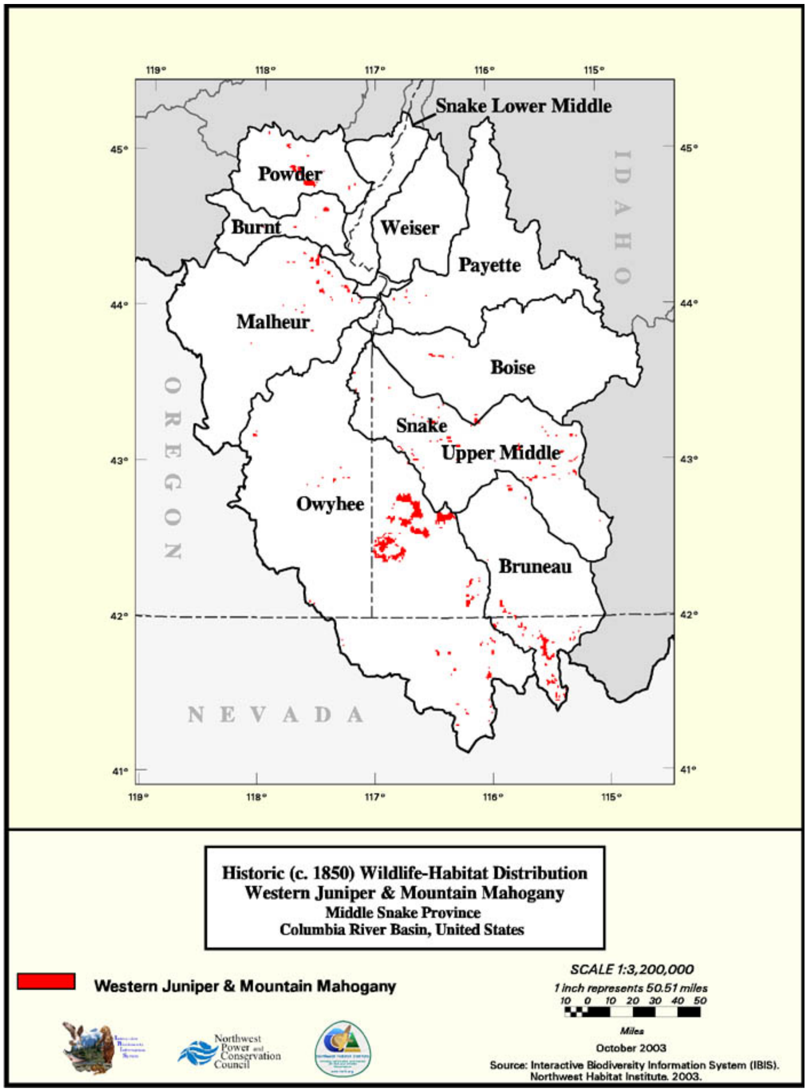


Figure 2.13. Historic Wildlife-Habitat Distribution Old Growth Western Juniper and Mountain Mahogany Woodlands (Source: nwhi.org/ibis).

Status and Trends. This habitat is dominated by fire-sensitive species, and therefore, the range of western juniper and mountain mahogany has expanded because of an interaction of livestock grazing and fire suppression. Quigley and Arbelbide (1997)concluded that in the Inland Pacific Northwest, Juniper/Sagebrush, Juniper Woodlands, and Mountain Mahogany cover types now are significantly greater in extent than before 1900. Although it covers more area, this habitat is generally in degraded condition because of increased exotic plants and decreased native bunchgrasses. One third of Pacific Northwest juniper and mountain mahogany community types listed in the National Vegetation Classification are considered imperiled or critically imperiled (Crawford and Kagan 2004).

2.2.1.4 Shrub-steppe (including sagebrush steppe and salt-scrub shrublands)

Geographic Distribution. Shrub-steppe habitats are common across the Columbia Plateau of Oregon, Idaho, and adjacent Nevada (Image 2.5).

Image 2.5. Shrub-steppe habitat (Source: nwhi.org/ibis).

In Nevada, sagebrush generally occurs throughout the Great Basin and is most common in valleys and mountain ranges north of the Mojave Desert biome. GAP analysis defined 4 major sagebrush classifications in Nevada including Sagebrush, Sagebrush/Bitterbrush, Sagebrush/Perennial Grass, and Mountain Sagebrush habitat types arranged respectively from lower to higher elevational types (Neel 1999). The salt desert scrub type is the most extensive habitat type in the state of Nevada, covering roughly 8.9 million hectares. The term "salt desert scrub" actually encompasses several subtypes, characterized by the presence of a variety of generally salt-tolerant shrubs of the family Chenopodiaceae ("Goosefoot" family). Community composition is largely influenced by soil salinity and drainage (Neel 1999).

It extends up into the cold, dry environments of surrounding mountains. Basin big sagebrush shrub-steppe occurs along stream channels, in valley bottoms and flats throughout eastern Oregon. Wyoming sagebrush shrub-steppe is the most widespread habitat in eastern Oregon, occurring throughout the Columbia Plateau. Mountain big sagebrush shrub-steppe habitat occurs throughout the mountains of the eastern Oregon. Three-tip sagebrush shrub-steppe occurs mostly along the northern and western Columbia Basin and occasionally appears in the Owyhee Upland ecoregions of Oregon. Interior shrub dunes and sandy steppe and shrub-steppe habitat is concentrated at low elevations near the Columbia River and in isolated pockets in the Northern Basin and Range and

Owyhee Uplands. Bolander silver sagebrush shrub-steppe is common in southeastern Oregon.

Physical Setting. Generally, this habitat is associated with dry, hot environments in the Pacific Northwest although variants are in cool, moist areas with some snow accumulation in climatically dry mountains. Elevation range is wide (300-9,000 ft 91-2,743 m) with most habitat occurring between 2,000 and 6,000 ft (610-1,830 m). Habitat occurs on deep alluvial, loess, silty or sandy-silty soils, stony flats, ridges, mountain slopes, and slopes of lake beds with ash or pumice soils.

Landscape Setting. Shrub-steppe habitat defines a biogeographic region and is the major vegetation on average sites in the Columbia Plateau, usually below Ponderosa Pine Forest and Woodlands, and Western Juniper and Mountain Mahogany Woodlands habitats. It forms mosaic landscapes with these woodland habitats and Eastside Grasslands, Dwarf Shrub-steppe, and Desert Playa and Salt Scrub habitats (Crawford and Kagan 2004). Mountain sagebrush shrub-steppe occurs at high elevations occasionally within the dry Eastside Mixed Conifer Forest and Montane Mixed Conifer Forest habitats. Shrub-steppe habitat can appear in large landscape patches (Figure 2.17). Livestock grazing is the primary land use in the shrub-steppe although much has been converted to irrigation or dry land agriculture. Large areas occur in military training areas and wildlife refuges.

Natural Disturbance Regime. Barrett et al.concluded that the fire-return interval for this habitat is 25 years. The native shrub-steppe habitat apparently lacked extensive herds of large grazing and browsing animals until the late 1800's. Burrowing animals and their predators likely played important roles in creating small-scale patch patterns.

Succession and Stand Dynamics. With disturbance, mature stands of big sagebrush are reinvaded through soil-stored or windborne seeds. Invasion can be slow because sagebrush is not disseminated over long distances. Site dominance by big sagebrush usually takes a decade or more depending on fire severity and season, seed rain, postfire moisture, and plant competition. Three-tip sagebrush is a climax species that reestablishes (from seeds or commonly from sprouts) within 5-10 years following a disturbance. Certain disturbance regimes promote three-tip sagebrush and it can out-compete herbaceous species. Bitterbrush is a climax species that plays a seral role colonizing by seed onto rocky and/or pumice soils. Bitterbrush may be declining and may be replaced by woodlands in the absence of fire. Silver sagebrush is a climax species that establishes during early seral stages and coexists with later arriving species. Big sagebrush, rabbitbrush, and short-spine horsebrush invade and can form dense stands after fire or livestock grazing. Frequent or high-intensity fire can create a patchy shrub cover or can eliminate shrub cover and create Eastside Grasslands habitat.

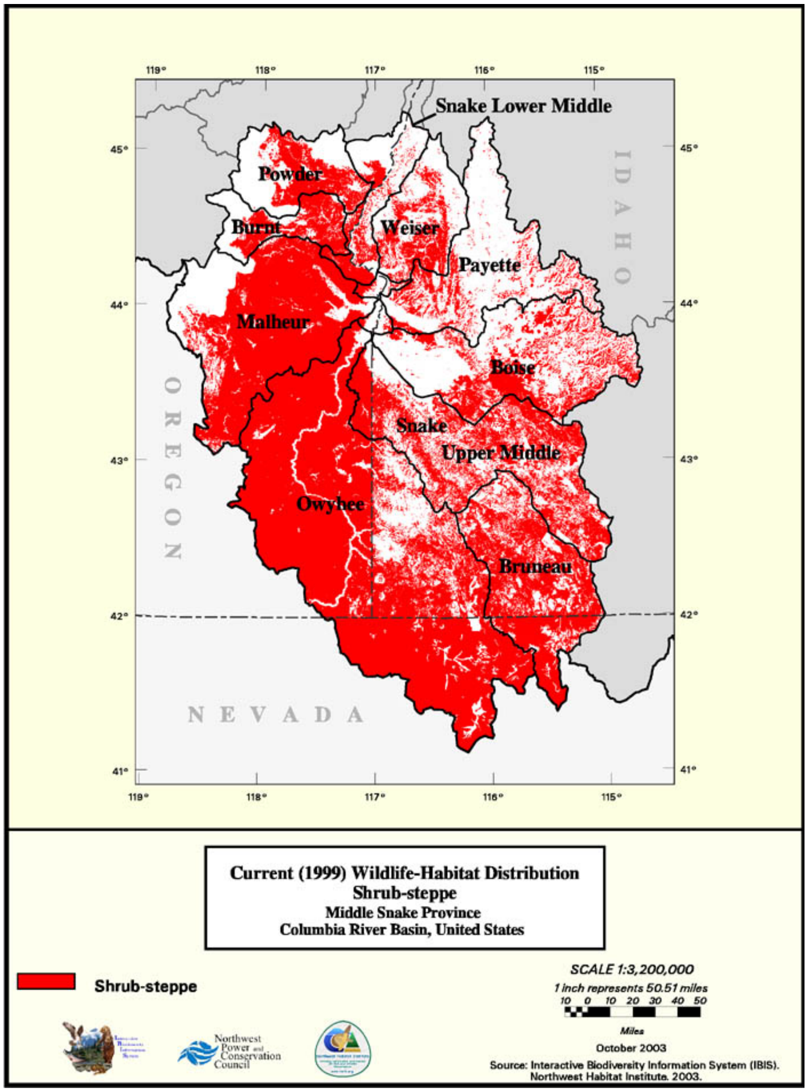


Figure 2.14. Current wildlife-habitat distribution shrub-steppe (Source: nwhi.org/ibis).

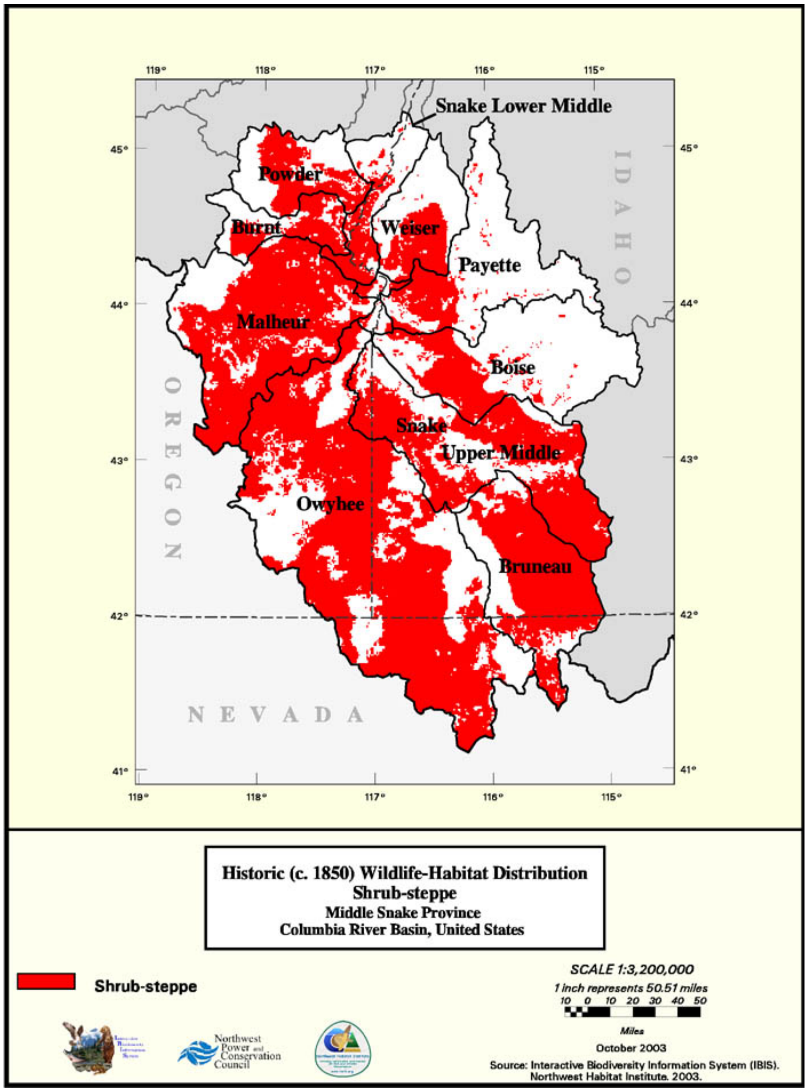


Figure 2.15. Historic wildlife-habitat distribution shrub-steppe (Source: nwhi.org/ibis).

Status and Trends. Shrub-steppe habitat still dominates most of southeastern Oregon although half of its original distribution in the Columbia Basin has been converted to agriculture (Crawford and Kagan 2004). Alteration of fire regimes, fragmentation, livestock grazing, and the addition of >800 exotic plant species have changed the character of shrub-steppe habitat. Quigley and Arbelbide (1997)concluded that Big Sagebrush and Mountain Sagebrush cover types are significantly smaller in area than before 1900, and that Bitterbrush/Bluebunch Wheatgrass cover type is similar to the pre-1900 extent. They concluded that Basin Big Sagebrush and Big sagebrush-Warm potential vegetation type's successional pathways are altered, that some pathways of Antelope Bitterbrush are altered and that most pathways for Big Sagebrush-Cool are unaltered. Overall this habitat has seen an increase in exotic plant importance and a decrease in native bunchgrasses (Crawford and Kagan 2004). More than half of the Pacific Northwest shrub-steppe habitat community types listed in the National Vegetation Classification are considered imperiled or critically imperiled.

2.2.1.5 Riparian and wetlands

Geographic Distribution. Riparian and wetland habitats dominated by woody plants are scarce but important habitats found throughout the Owyhee Subbasin of southeast Oregon, southwest Idaho, and north-central Nevada (Image 2.6). Mountain alder-willow riparian shrublands are major habitats in the forested zones of eastern Oregon. Eastside lowland willow and other riparian shrublands are the major riparian types throughout eastern Oregon at lower elevations. Black cottonwood riparian habitats occur throughout eastern Oregon, at low to middle elevations. White alder riparian habitats are restricted to perennial streams at low elevations, in drier climatic zones in Hells Canyon at the border of Oregon and Idaho, in the Malheur River drainage.

Image 2.6. Eastside (Interior) riparian-wetlands habitat (Source: nwhi.org/ibis).

Lowland riparian habitats are those associated with the floodplains of Nevada's major river systems occurring below 5,000 feet elevation in the northern half of the state and below 4,000 feet in the southern half. Those river systems are the Humboldt, the Truckee, the Carson and the Walker Rivers in the north, and the Colorado River and its tributaries in the south. Habitat conditions supported by these lowland floodplains are lush in stark contrast to the arid landscapes through which they course. Total lowland riparian habitat area in Nevada is estimated at 57,344 hectares (Nevada GAP).

Physical Setting. Riparian habitats appear along perennial and intermittent rivers and streams. This habitat also appears in impounded wetlands and along lakes and ponds. Their associated streams flow along low to high gradients. The riparian and wetland forests are usually in fairly narrow bands along the moving water that follows a corridor along montane or valley streams. The most typical stand is limited to 100-200 ft (31-61 m) from streams. Riparian forests also appear on sites subject to temporary flooding during spring runoff. Irrigation of streamsides and toeslopes provides more water than precipitation and is important in the development of this habitat, particularly in drier climatic regions. Hydrogeomorphic surfaces along streams supporting this habitat have seasonally to temporarily flooded hydrologic regimes. Eastside riparian and wetland habitats are found from 100- 9,500 ft (31-2,896 m) in elevation.

Landscape Setting. Eastside riparian habitats occur along streams, seeps, and lakes within the Eastside Mixed Conifer Forest, Ponderosa Pine Forest and Woodlands, Western Juniper and Mountain Mahogany Woodlands, and part of the Shrub-steppe habitat. This habitat may be described as occupying warm montane and adjacent valley and plain riparian environments (Crawford and Kagan 2004).

Structure. The Eastside riparian and wetland habitat contains shrublands, woodlands, and forest communities. Stands are closed to open canopies and often multilayered. A typical riparian habitat would be a mosaic of forest, woodland, and shrubland patches along a stream course. The tree layer can be dominated by broadleaf, conifer, or mixed canopies. Tall shrub layers, with and without trees, are deciduous and often nearly completely closed thickets. These woody riparian habitats have an undergrowth of low shrubs or dense patches of grasses, sedges, or forbs. Tall shrub communities (20-98 ft 6-30 m, occasionally tall enough to be considered woodlands or forests) can be interspersed with sedge meadows or moist, forb-rich grasslands. Intermittently flooded riparian habitat has ground cover composed of steppe grasses and forbs. Rocks and boulders may be a prominent feature in this habitat (Figure 2.20).
Annual precipitation and temperature ranges for Nevada's lowland riparian habitats reflect Nevada's extremes – from less than 12 to more than 76 cm of precipitation per year and from -30 to over 120 F temperature. Riparian vegetation is distributed according to different plant species' affinity for water and the extent to which the river's flow is distributed across its floodplain.

The Humboldt River drains most of northeastern Nevada from the southwestern foot of the Jarbidge Mountains and the western foot of the Ruby Mountains over 467 km to the Humboldt Sink south of Lovelock. Meadows of grasses, sedges (Carex spp.) and rushes (Juncus spp.) are predominant on much of the floodplain of the Humboldt River and its tributaries, while occurring on shorter, more disjunct stretches of the other northern Nevada river floodplains. Creeping wildrye (Elymus triticoides) is one of the most important meadow grasses. Other types that may occur on a lowland floodplain include saltgrass (Distichlis spicata), greasewood (Sarcobatus vermiculatus), sagebrush (Artemisia tridentata), wildrye (Elymus cinereus), and in southern Nevada, arrowweed (Pluchea sericea) and saltgrass.

Natural Disturbance Regime. This habitat is tightly associated with stream dynamics and hydrology (Crawford and Kagan 2004). Flood cycles occur within 20-30 years in most riparian shrublands although flood regimes vary among stream types. Fires recur typically every 25-50 years but fire can be nearly absent in colder regions or on topographically protected streams. Rafted ice and logs in freshets may cause considerable damage to tree boles in mountain habitats. Beavers crop younger cottonwood and willows and frequently dam side channels in these stands. These forests and woodlands require various flooding regimes and specific substrate conditions for reestablishment. Grazing and trampling is a major influence in altering structure, composition, and function of this habitat; some portions are very sensitive to heavy grazing (Crawford and Kagan 2004).

Succession and Stand Dynamics. Riparian vegetation undergoes "typical" stand development that is strongly controlled by the site's initial conditions following flooding and shifts in hydrology (Crawford and Kagan 2004). The initial condition of any hydrogeomorphic surface is a sum of the plants that survived the disturbance, plants that can get to the site and the amount of unoccupied habitat available for invasions. Subsequent or repeated floods or other influences on the initial vegetation select species that can survive or grow in particular life forms. A typical woody riparian habitat dynamic is the invasion of woody and herbaceous plants onto a new alluvial bar away from the main channel. If the bar is not scoured in 20 years, a tall shrub and small deciduous tree stand will develop. Approximately 30 years without disturbance or change in hydrology will allow trees to overtop shrubs and form woodland. Another 50 years without disturbance will allow conifers to invade and in another 50 years a mixed hardwood-conifer stand will develop. Many deciduous tall shrubs and trees cannot be invaded by conifers. Each stage can be reinitiated, held in place, or shunted into different vegetation by changes in stream or wetland hydrology, fire, grazing, or an interaction of those factors.

Effects of Management and Anthropogenic Impacts. Management effects on woody riparian vegetation can be obvious, e.g., removal of vegetation by dam construction, roads, logging, or they can be subtle, e.g., removing beavers from a watershed, removing large woody debris, or construction of a weir dam for fish habitat (Crawford and Kagan 2004). In general, excessive livestock or native ungulate use leads to less woody cover and an increase in sod-forming grasses particularly on fine-textured soils. Undesirable forb species, such as stinging nettle and horsetail, increase with livestock use.

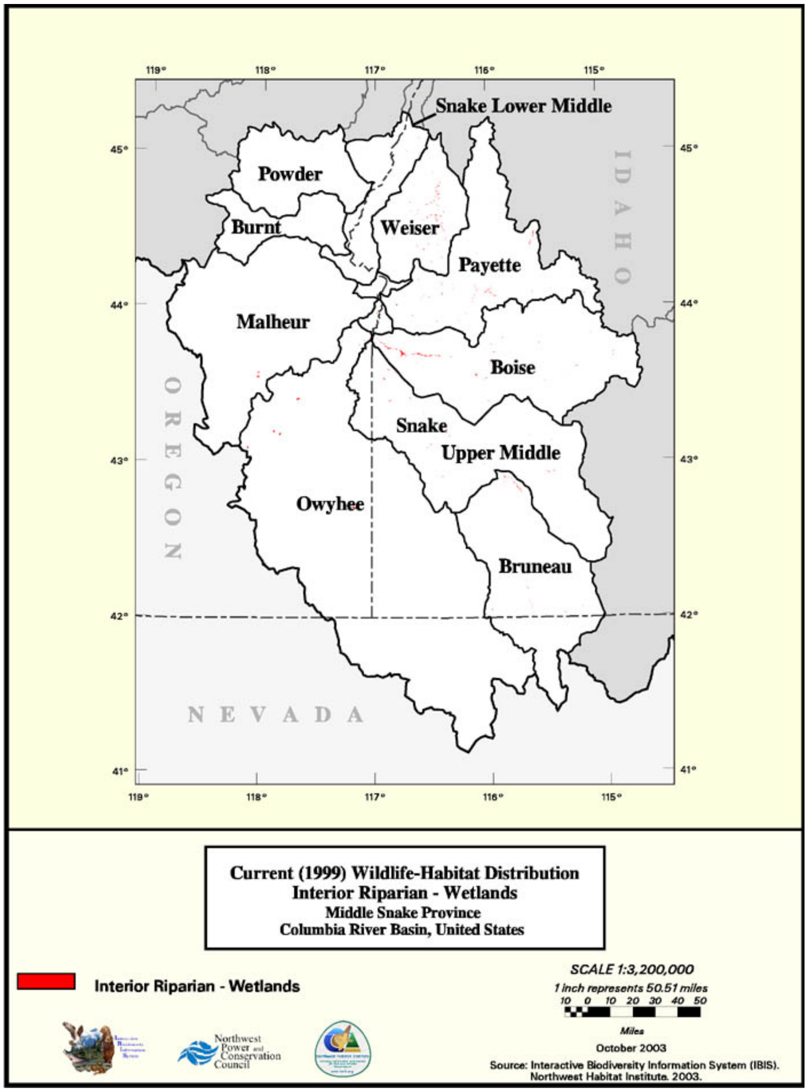


Figure 2.16. Current Wildlife-Habitat Distribution Eastside (Interior) Riparian-Wetlands (Source: nwhi.org/ibis).

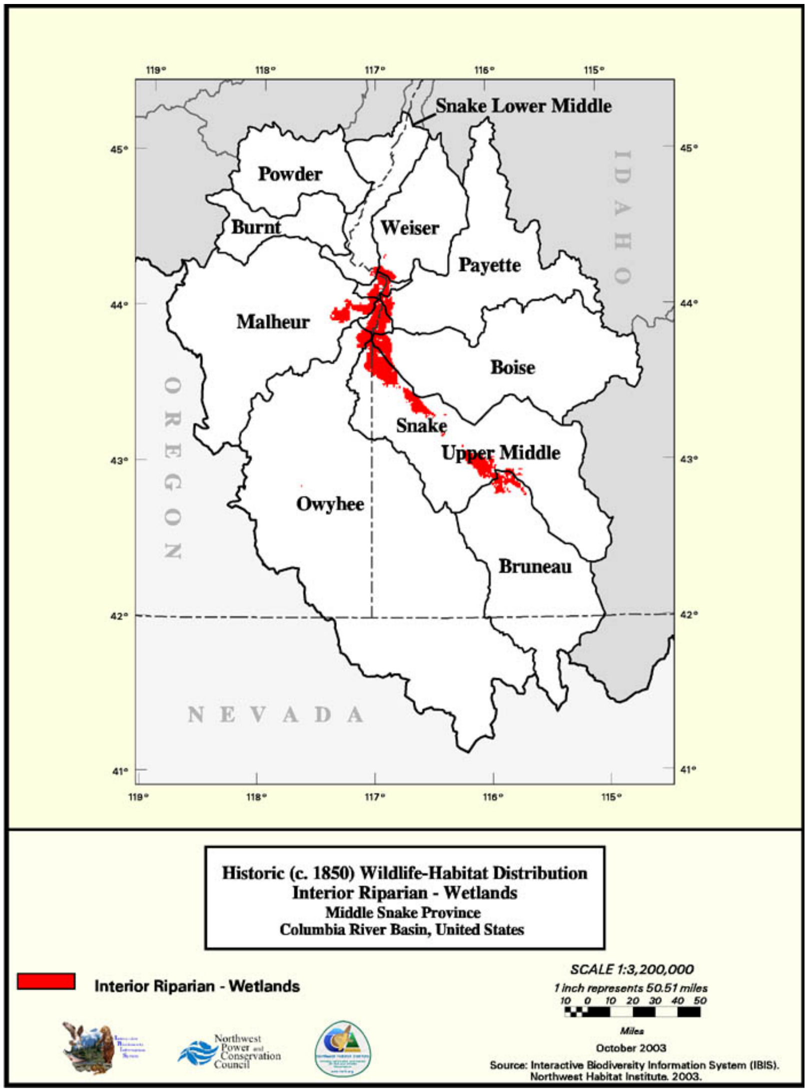


Figure 2.17. Historic Wildlife-Habitat Distribution Eastside (Interior) Riparian-Wetlands (Source: nwhi.org/ibis).

Status and Trends. Quigley and Arbelbide (1997)concluded that the Cottonwood-Willow cover type covers significantly less in area now than before 1900 in the Inland Pacific Northwest. The authors concluded that although riparian shrubland was a minor part of the landscape, occupying 2%, they estimated it to have declined to 0.5% of the landscape. Approximately 40% of riparian shrublands occurred above 3,280 ft (1,000 m) in elevation pre-1900; now nearly 80% is found above that elevation. This change reflects losses to agricultural development, roading, dams and other flood-control activities. The current riparian shrublands contain many exotic plant species and generally are less productive than historically. Quigley and Arbelbide (1997)found that riparian woodland was always rare and the change in extent from the past is substantial.

2.2.1.6 Agricultural Lands

Geographic Distribution. Agricultural habitat in the Owyhee Subbasin is restricted to relatively low to mid-elevations (<6,000 ft) associated with river systems or irrigation diversions (Image 2.7). Although in the Pacific Northwest this habitat is generally most plentiful in broad river valleys, it is more restricted in the gentle rolling terrain and high desert east of the Cascades.

Image 2.7. Agriculture, Pasture and Mixed Environs (Source: nwhi.org/ibis).

The majority of Nevada's agricultural lands are located in valley bottoms and on river systems. Water is taken from streams and rivers or large, high volume wells. Crops are watered by either flood irrigation or sprinkler systems. Approximately 222,469 hectares (less than one percent) of Nevada is classified as irrigated land and an additional 2,481,624 hectares (less than nine percent) are recorded as irrigated pastureland (Neel 1999).

Physical Setting. Agricultural habitat in arid regions east of the Cascades with <10 inches (25 cm) of rainfall require supplemental irrigation or fallow fields for 1-2 years to accumulate sufficient soil moisture. Soils types are variable, but usually have a well developed A horizon. This habitat is found from 0 to 6,000 ft (0 to 1,830 m) elevation.

Landscape Setting. Agricultural habitat occurs within a matrix of other habitat types at low to mid-elevations, including Eastside grasslands, Shrub-steppe, Westside Lowlands Conifer-Deciduous Forest and other low to mid-elevation forest and woodland habitats (Edge et al. 2004). This habitat often dominates the landscape in flat or gently rolling terrain, on well-developed soils, broad river valleys, and areas with access to abundant irrigation water. Unlike other habitat types, agricultural habitat is often characterized by regular landscape patterns (squares, rectangles, and circles) and straight borders because of ownership boundaries and multiple crops within a region. Edges can be abrupt along the habitat borders within agricultural habitat and with other adjacent habitats.

Structure. This habitat is structurally diverse because it includes several cover types ranging from low-stature annual grasses and row crops (<3.3 ft 1 m) to mature orchards (>66 ft 20 m)(Figure 2.27). However, within any cover type, structural diversity is typically low because usually only 1 to a few species of similar height are cultivated (Edge et al. 2004). Depending on management intensity or cultivation method, agricultural habitat may vary substantially in structure annually; cultivated cropland and modified grasslands are typified by periods of bare soil and harvest whereas pastures are mowed, hayed, or grazed 1 or more times during the growing season. Structural diversity of agricultural habitat is increased at local scales by the presences of non-cultivated or less intensively managed vegetation such as fencerows, roadsides, field borders, and shelterbelts.

Natural Disturbance Regime. Natural fires are almost totally suppressed in this habitat, except for unimproved pastures and modified grasslands, where fire-return intervals can resemble those of native grassland habitats. Fires are generally less frequent today than in the past, primarily because of fire suppression, construction of roads, and conversion of grass and forests to cropland. Bottomland areas along streams and rivers are subject to periodic floods, which may remove or deposit large amounts of soil.

Succession and Stand Dynamics. Management practices disrupt natural succession and stand dynamics in most of the agricultural habitats (Edge et al. 2004). Abandoned eastside agricultural habitats may convert to other habitats, mostly grassland and shrub habitats from the surrounding native habitats. Some agricultural habitats that occur on highly erodible soils, especially east of the Cascades, have been enrolled in the U.S. Department of Agriculture Conservation Reserve Program. In the absence of fire or mowing, westside unimproved pastures have increasing amounts of hawthorn, snowberry, rose (Rosa spp.), Himalaya blackberry, spirea, Scot's broom, and poison oak. Douglas-fir or other trees can be primary invaders in some environments.

Effects of Management and Anthropogenic Impacts. The dominant characteristic of agricultural habitat is a regular pattern of management and vegetation disturbance. With the exception of the unimproved pasture cover type, most areas classified as agricultural habitat receive regular inputs of fertilizer and pesticides and have some form of vegetation harvest and manipulation. Management practices in cultivated cropland include different tillage systems, resulting in vegetation residues during the non-growing season that range from bare soil to 100% litter. Cultivation of some crops, especially in the arid eastern portions of both states, may require the land to remain fallow for 1-2 growing seasons in order to store sufficient soil moisture to grow another crop. Harvest in cultivated cropland, Christmas tree plantations, and nurseries, and mowing or haying in improved pasture cover types substantially change the structure of vegetation. Harvest in orchards and vineyards are typically less intrusive, but these crops as well as Christmas trees and some ornamental nurseries are regularly pruned. Improved pastures are often grazed after haying or during the nongrowing season. Livestock grazing is the dominant use of unimproved pastures (Edge et al. 2004). All of these practices prevent agricultural areas from reverting to native vegetation. Excessive grazing in unimproved pastures may increase the prevalence of weedy or exotic species.

In Nevada, the greatest threat to the long-term productivity of agricultural lands may turn out to be the increased pressure upon prime lands from residential and commercial development. As Nevada's population continues to grow, land prices will continue to grow as well. Simple economics will make it more difficult for a farmer to stay on his land in the face of increasingly lucrative offers to sell and subdivide. When prime farm land goes under asphalt, it is likely out of production for decades. Most potential that land may have had as wildlife habitat has been effectively precluded for the duration. While efforts to make housing developments more "wildlife friendly" are commendable and worth continuing, the overall loss of land potential can never be completely mitigated. Societal trends will continue to pose difficult challenges with respect to the maintenance of Nevada's most productive parcels of land in the foreseeable future (Neel 1999).

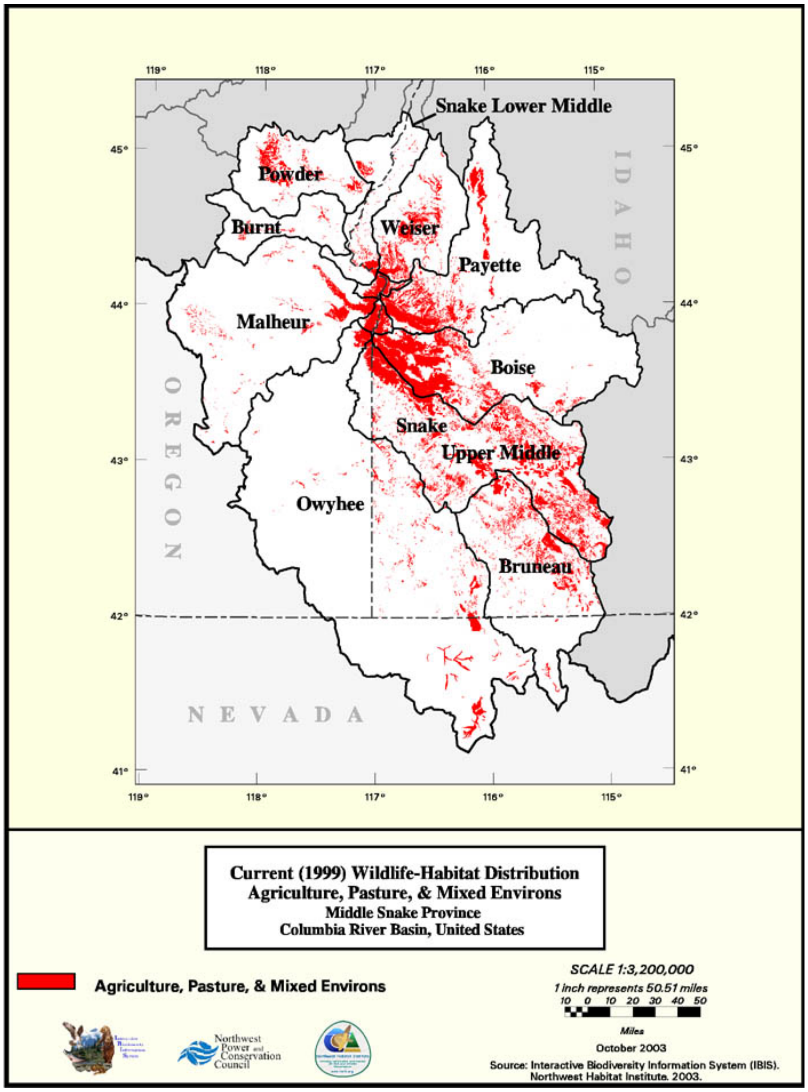


Figure 2.18 Current Wildlife-Habitat Distribution Agriculture, Pasture and Mixed Environs (Source: nwhi.org/ibis).

Status and Trends. Agricultural habitat has steadily increased in amount and size in both states since Eurasian settlement of the region. Conversion to agricultural habitat threatens several native habitat types. The greatest conversion of native habitats to agricultural production occurred between 1950 and 1985, primarily as a function of U.S. agricultural policy 96. Since the 1985 Farm Bill and the economic downturn of the early to mid 1980's, the amount of land in agricultural habitat has stabilized and begun to decline. The 1985 and subsequent Farm Bills contained conservation provisions encouraging farmers to convert agricultural land to native habitats 96, 153. Clean farming practices and single-product farms have become prevalent since the 1960's, resulting in larger farms and widespread removal of fencerows, field borders, roadsides, and shelterbelts. In Oregon, land-use planning laws prevent or slow urban encroachment and subdivisions into areas zoned as agriculture.

2.2.1.7 Grasslands

Geographic Distribution. This habitat is found primarily in the Columbia Basin of Idaho, Oregon, Idaho fescue grassland habitats were formerly widespread in Idaho; most of this habitat has been converted to agriculture (Crawford and Kagan 2004; Image 2.8).

Image 2.8. Eastside (Interior) Grasslands (Source: nwhi.org/ibis).

Similar grasslands appear on the High Lava Plains ecoregion, where they occur in a matrix with big sagebrush or juniper woodlands. In Oregon they are also found in burned shrub-steppe and canyons in the Basin and Range and Owyhee Uplands. Sand dropseed and three-awn needlegrass grassland habitats are restricted to river terraces Owyhee Uplands of Oregon. Primary location of this habitat extends along the Snake River from Lewiston south to the Owyhee River.

Physical Setting. This habitat develops in hot, dry climates in the Pacific Northwest. Annual precipitation totals 8-20 inches (20-51 cm); only 10% falls in the hottest months, July through September. Snow accumulation is low (1-6 inches 3-15 cm) and occurs only in January and February in eastern portions of its range and November through March in the west. More snow accumulates in grasslands within the forest matrix. Soils are variable: (1) highly productive loess soils up to 51 inches (130 cm) deep, (2) rocky flats, (3) steep slopes, and (4) sandy, gravel or cobble soils. An important variant of this habitat occurs on sandy, gravelly, or silty river terraces or seasonally exposed river gravel or Spokane flood deposits. The grassland habitat is typically upland vegetation but it may also include riparian bottomlands dominated by non-native grasses. This habitat is found from 500 to 6,000 ft (152-1,830 m) in elevation.

Landscape Setting. Eastside grassland habitats appear well below and in a matrix with lower treeline Ponderosa Pine Forests and Woodlands or Western Juniper and Mountain Mahogany Woodlands. It can also be part of the lower elevation forest matrix. Most grassland habitat occurs in 2 distinct large landscapes: plateau and canyon grasslands. Several rivers flow through narrow basalt canyons below plateaus supporting prairies or shrub-steppe. The canyons can be some 2,132 ft (650 m) deep below the plateau. The plateau above is composed of gentle slopes with deep silty loess soils in an expansive rolling dune-like landscape. Grasslands may occur in a patchwork with shallow soil scablands or within biscuit scablands or mounded topography. Naturally occurring grasslands are beyond the range of bitterbrush and sagebrush species. This habitat exists today in the shrub-steppe landscape where grasslands are created by brush removal, chaining or spraying, or by fire. Agricultural uses and introduced perennial plants on abandoned or planted fields are common throughout the current distribution of eastside grassland habitats.

Structure. This habitat is dominated by short to medium-tall grasses (<3.3 ft 1 m)(Figure 2.25). Total herbaceous cover can be closed to only sparsely vegetated (Crawford and Kagan 2004). In general, this habitat is an open and irregular arrangement of grass clumps rather than a continuous sod cover. These medium-tall grasslands often have scattered and diverse patches of low shrubs, but few or no medium-tall shrubs (<10% cover of shrubs are taller than the grass layer). Native forbs may contribute significant cover or they may be absent. Grasslands in canyons are dominated by bunchgrasses growing in lower densities than on deep-soil prairie sites. The soil surface between perennial plants can be covered with a diverse cryptogamic or microbiotic layer of mosses, lichens, and various soil bacteria and algae. Moister environments can support a dense sod of rhizomatous perennial grasses. Annual plants are a common spring and early summer feature of this habitat.

Natural Disturbance Regime. The fire-return interval for sagebrush and bunchgrass is estimated at 25 years 22. The native bunchgrass habitat apparently lacked extensive herds of large grazing and browsing animals until the late 1800's. Burrowing animals and their predators likely played important roles in creating small-scale patch patterns.

Succession and Stand Dynamics. Currently fires burn less frequently in the Palouse grasslands than historically because of fire suppression, roads, and conversions to croplan. Without fire, black hawthorn shrubland patches expand on slopes along with common snowberry and rose. Fires covering large areas of shrub-steppe habitat can eliminate shrubs and their seed sources and create eastside grassland habitat. Fires that follow heavy grazing or repeated early season fires can result in annual grasslands of cheatgrass, medusahead, knapweed, or yellow star-thistle. Annual exotic grasslands are common in dry grasslands and are included in modified grasslands as part of the Agriculture habitat.

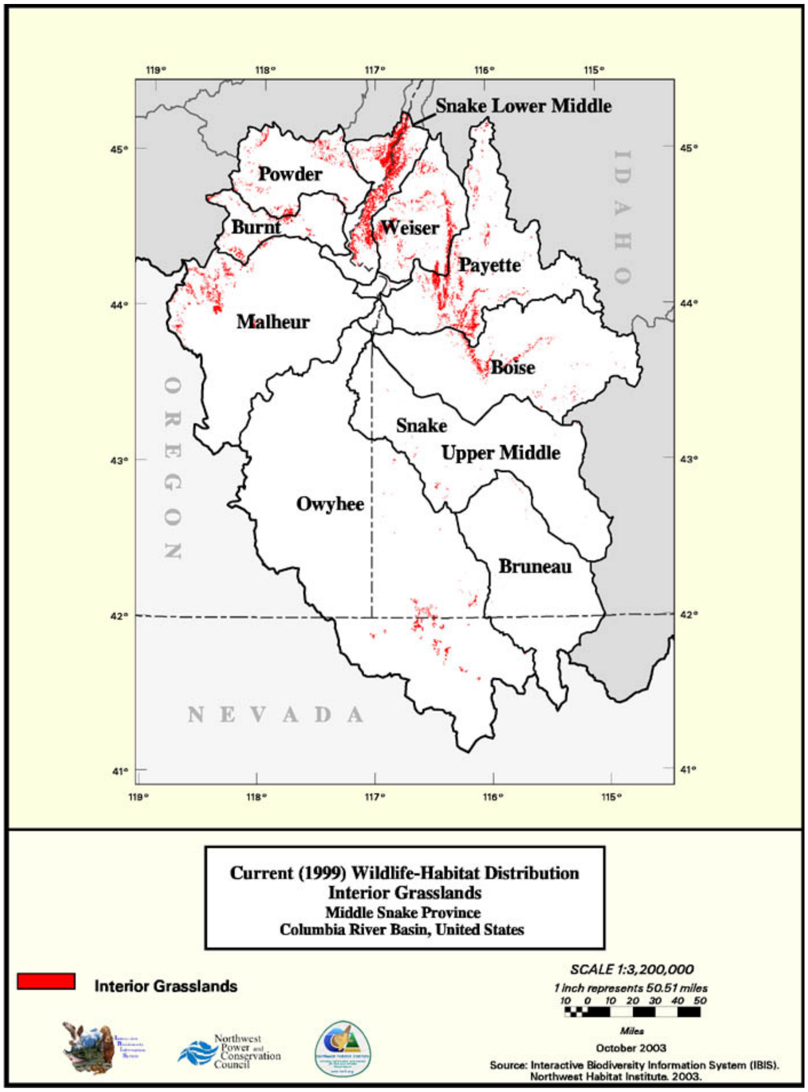


Figure 2.19. Current wildlife-habitat distribution interior grasslands (Source: nwhi.org/ibis).

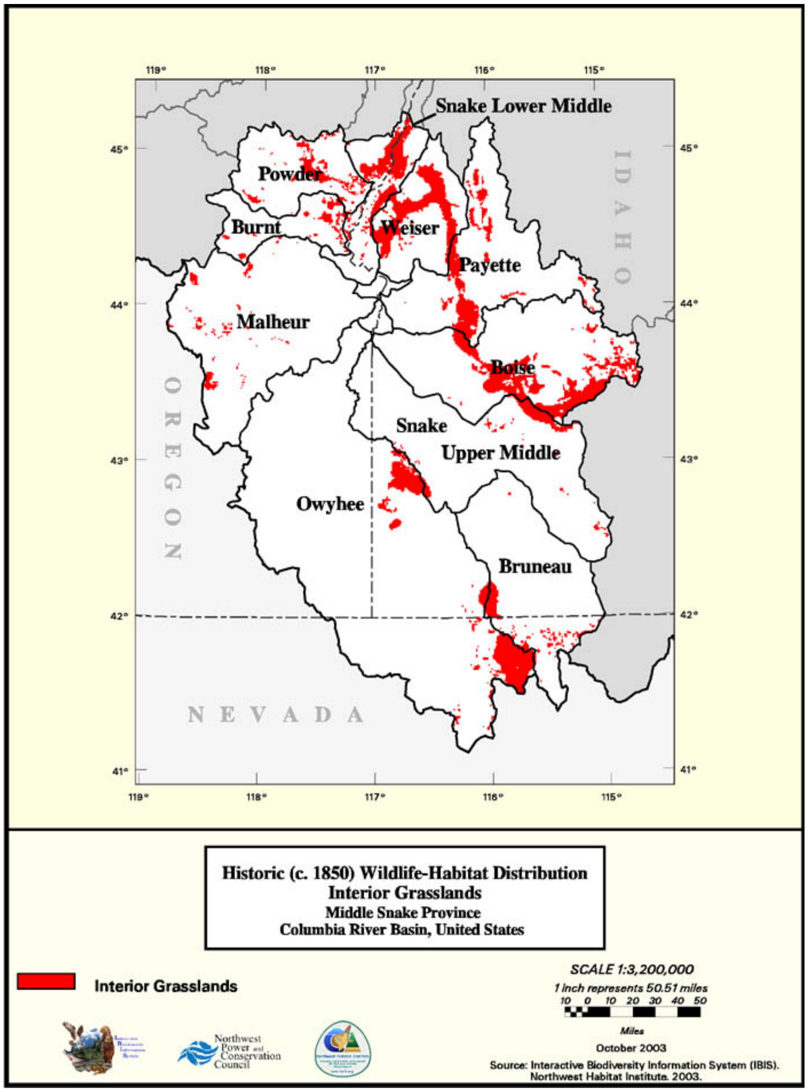


Figure 2.20. Historic wildlife-habitat distribution interior grasslands (Source: nwhi.org/ibis).

Effects of Management and Anthropogenic Impacts. Large expanses of grasslands are currently used for livestock ranching (Crawford and Kagan 2004). Deep soil Palouse sites are mostly converted to agriculture. Drier grasslands and canyon grasslands, those with shallower soils, steeper topography, or hotter, drier environments, were more intensively grazed and for longer periods than were deep-soil grasslands. Evidently, these drier native bunchgrass grasslands changed irreversibly to persistent annual grass and forblands. Some annual grassland, native bunchgrass, and shrub-steppe habitats were converted to intermediate wheatgrass, or more commonly, crested wheatgrass (Agropyron cristatum)-dominated areas. Apparently, these form persistent grasslands and are included as modified grasslands in the Agriculture habitat. With intense livestock use, some riparian bottomlands become dominated by non-native grasses. Many native dropseed grasslands have been submerged by dam reservoirs.

2.2.1.8 Canyon / Gorge[3]

Violent geological forces first molded this landscape about 14 million years ago. The shifting Yellowstone hot spot first erupted in the area where Idaho, Oregon and Nevada meet, spewing gigantic clouds of volcanic ash into the air. When these superheated billows of ash reached the ground, they cooled into masses of welded rhyolitic tuffs characteristic of the Owyhee region (source: http://www.sierraclub.org/owyhee).

Shifting slowly northeast, the rhyolite caldera blew again, about 11 million years ago, in the Bruneau region, belching more molten rhyolite and leaving basalt shield volcanoes (source: http://www.sierraclub.org/owyhee). Later, massive Lake Idaho began to form, flooding the volcanic crescent of the Snake River Plain. As time passed, the climate grew moist and cool; plants and animals, some long-extinct like the saber-toothed tiger and the scimitar-toothed cat, flourished in and around this series of ancient lakes just north of the eruptions. The fossils of these creatures are still visible in a series of extraordinary exposed strata found only in the Owyhee-Bruneau Canyonlands.

Nearly a million years ago in a prolonged flood, Lake Idaho drained out Hells Canyon, and, as the water level dropped, the mouths of the Owyhee, Bruneau, and Jarbidge Rivers and their tributaries began to erode headwards, carving a fantastic labyrinth of canyons in the thick layers of igneous deposits (source: http://www.sierraclub.org/owyhee). These gargantuan natural forces left a network of exposed rhyolitic formations found nowhere else in the world, and molded the fantastic topography of the Owyhee-Bruneau Canyonlands. Just 3,000 years ago, the climate began to grow warmer and drier, and the surrounding flora and fauna in turn changed and adapted, until the present-day high desert ecosystem developed in the remnants of massive volcanic and climatic changes.

Today, in this desert is defined by rivers, expansive reaches of sage steppe, lush riparian pockets, ancient juniper woodlands, and intermittent drainages. The canyon/gorge habitat supports rare, endemic, and diverse populations of flora and fauna including sage grouse, California bighorn sheep, spotted bats, Columbia spotted frogs, red band trout, rattlesnake stickseed, Davis's peppergrass, and the unique papposa sagebrush (source: http://www.sierraclub.org/owyhee). The prevailing sagebrush steppe supports a network of thriving biotic communities. Pronghorn antelope, gray fly-catchers, mule deer, loggerhead shrikes, ferruginous hawks, pygmy rabbits, and scores of other birds, mammals, reptiles, and invertebrates utilize the forage and cover of the sagebrush landscape.

This diversity of biological life is linked to the health of the Owyhee as a dynamic ecosystem, in which all the fish & wildlife species rely on the streams, riparian oases, and sage-related terrestrial communities to provide necessary habitat and food. The Owyhee syatem has been identified by the Interior Columbia Basin Ecosystem Management Project (ICBEMP) as one of only three regions in the entire basin with high range

[3] The information in this section is derived primarily from the Canyonlands description from the Sierra Club website (source: http://www.sierraclub.org/owyhee/natural_history.asp).

integrity, the Owyhee is the largest and one of the last remaining examples of the flourishing sage steppe that once covered the Columbia Plateau. It provides the expansive habitat that these species and natural processes need to survive in one of the most rapidly growing and changing sectors of the West.

The Owyhee Canyonlands also incorporate a rich cultural resource where people have long joined in a close-linked relationship between water, land and life. The canyons run through some of the richest archaeological and cultural sites in the country, a place inhabited for thousands of years by the ancestors of the Shoshone and Northern Paiute Tribes and bands, and still an essential and sacred landscape for native Tribal peoples.

2.2.2 Focal Species

Determining focal species for an ecoprovince/subbasin, planners should consider the following criteria (Ibis 2004):

- Threatened, endangered, and state sensitive species.
- Species listed in the Partners in Flight program.
- Species used to model impacts from adjacent hydro-development under the USFWS Habitat Evaluation Procedure (HEP Species).
- Managed Species (i.e. game species).
- Functional specialist and critically linked species (These are species that represent the only species performing a few functions or filling a critical functional role in a given analysis area).
- Species with an association to salmonids.

Although certain wildlife species were selected as "focal species" for specific habitat types, most of these species frequently occur in many other habitat types in the Owyhee Subbasin. Many terrestrial wildlife species migrate during the year, and some species occur predominately in a given habitat type during a specific season. The following list of "focal species" for the Owyhee Subbasin indicates the number of habitats – where the species is present, generally associated, or closely associated – as determined from the Northwest Habitat Institute's www.Ibis data base.

Number of Habitats:	Present	Generally Associated	Generally Associated	Total Number
Rocky Mountain elk	2	4	--	6
Mule deer	--	8	--	8
Sage grouse	2	1	4	7
Golden eagle	7	7	--	14
Pronghorn antelope	2	2	4	8
Columbia spotted frog	--	9	3	12
American Beaver	4	3	3	10
Yellow Warbler	--	1	1	2

Bald eagle	4	6	1	11
White-faced ibis	--	3	1	4
California quail	--	7	--	7
Grasshopper sparrow	--	2	2	4
California Bighorn sheep	3	1	2	6
Peregrine falcon	3	13	--	16

Table 2.5. Focal species selected by the Owyhee Subbasin Planning group for specific habitat types (shaded yellow). The extent of the species common distribution is indicated by "X"s across the range of habitat types listed in the table.

Focal Species	Habitat Type for Focal Species (shaded yellow; see Table 2.4.key for full name)						
	Aspen	Conifer	Juniper	Shrub	Wet	Ag.	Grass	Canyon
Rocky Mountain elk		X (summer)		X (Sum/ fall)	X	X	X (Sum/ fall)	
Mule deer	X	X	X	X	X	X	X	X
Sage grouse			X	X	X	X	X	X
Golden eagle	X	X	X	X	X	X	X	X
Pronghorn antelope				X			X	
Columbia spotted frog	X	X	X	X	X	X	X	
American Beaver					X			
Yellow Warbler					X			
Bald eagle					X			
White-faced ibis					X			
California quail						X		
Grasshopper sparrow							X	
California Bighorn sheep								X
Peregrine falcon	X	X	X	X	X	X	X	X

Table 2.5.Key:
Conifer= Mixed Conifer Forests (pine, fir)
Juniper= Old Growth western juniper and mountain mahogany woodlands
Shrub= Shrub-steppe Our "shrub-steppe designation includes sagebrush steppe and salt-scrub shrublands.
Wet= Riparian and wetlands
Ag.= Agricultural Lands
Grass= Grasslands
Canyon= Canyon / Gorge

2.2.2.1 Rocky Mountain elk[4]

Focal Habitat – Species Box
Pine/Fir/Mixed Conifer Forests
Rocky Mountain elk

Rocky Mountain elk are a common game species associated with forested habitats in the foothills and mountainous areas of the Owyhee Subbasin (Image 2.9). Elk were an important source of food for Native Americans.

Image 2.9. Rocky Mountain elk; photo credits Stan Osolinski.

Elk occur in six habitat types in the Owyhee Subbasin -- based on current wildlife-habitat types (Table 2.6); Elk are present in two habitats;

- Alpine Grasslands and Shrublands
- Urban and Mixed Environments

And generally associated with the following four habitats;

- Montane Mixed Conifer Forest

[4] This species account is based in part on a draft by Paul Ashley and Stacy Stovall. (2004). Rocky mountain elk. Southeast Washington Ecoregional Assessment., January 2004

- Agriculture, Pastures, and Mixed Environs
- Herbaceous Wetlands
- Montane Coniferous Wetlands

Table 2.6. Elk (Cervus elaphus) association with all habitats occurring in the OWYHEE Subbasin (Source: nwhi.org/ibis).

Wildlife-Habitat Type	Association Type	Activity Type	Confidence Level	Comments
Montane Mixed Conifer Forest	Generally Associated	Feeds and Breeds	High	Genetic ecotone for Roosevelt and Rocky Mountain elk; generally summer use only.
Alpine Grasslands and Shrublands	Present	Feeds and Breeds	High	Summer and fall only.
Agriculture, Pastures, and Mixed Environs	Generally Associated	Feeds and Breeds	High	none
Urban and Mixed Environs	Present	Feeds and Breeds	High	none
Herbaceous Wetlands	Generally Associated	Feeds	High	none
Montane Coniferous Wetlands	Generally Associated	Feeds and Breeds	High	none
Total Habitat Associations with Elk:	6			

The vegetative communities are a mixture of forests and bunch-grasses on the ridges. The lowlands comprise mostly agricultural crops and range land. This combination of habitats is very attractive to elk.

Elk are highly adaptable animals, occupying variable habitats throughout western North American, from deserts in some areas to mountains at over 10,000 feet in elevation. As with most species, elk require food, water, and cover. Thomas (1979) defined various habitat components and how they should be managed to maximize elk use. Optimum elk habitat is arranged in such a way that forage and cover receive the maximum proper use of the maximum possible area (forage/cover ratio). In optimum habitat, cover/forage ratios should be arranged in such a way that elk make maximum use of the area in an efficient manner.

Optimum elk habitat consists of a forage cover ratio of 60% forage area and 40% cover (Thomas et al. 1979). Cover quality is defined in two ways; satisfactory and marginal. 40% stands of coniferous trees that are > 40 feet tall, with a canopy closure of > 70%. Marginal cover is defined as coniferous trees > 10 feet tall with a canopy closure of >

40%. Cover provides protection from weather and predators. Forage areas are all areas that do not fall into the definition of cover. Optimal elk use of forage areas occurs within 600 feet of cover areas (Reynolds 1962; Harper 1969; Kirsch 1962; Hershey and Leege 1976; Pedersen 1974; Leckenby 1984).Proper spacing of forage and cover areas is very important in order to maximize use of these areas by elk (Thomas et al. 1979).

Limiting Factors Affecting Elk Population Status
Recent studies (Myers et al. 1999) have documented how road densities, forage: cover ratios, stand composition, amount of edge, and opening size influence seasonal elk use. Elk face problems from high road densities, and habitat deterioration from long term fire suppression and past logging practices. Many habitat improvement projects have been developed and completed. Other projects have attempted to reduce elk damage on private lands.

2.2.2.2 Mule deer[5]

Focal Habitat – Species Box
Old Growth western juniper and mountain mahogany woodlands
Mule deer

Image 2.10. Mule deer in sagebrush habitat; photo credits Marinel Miklja.

[5] This species account is based in part on a draft by Paul Ashley and Stacey Stovall (2004) Mule Deer. Southeast Washington Subbasin Planning Ecoregion Wildlife Assessment. Appendix F: Focal Species Accounts. February, 2004.

Mule deer have been an important member of the Owyhee Subbasin for Native Americans prior to settlement by Euro-Americans. Today mule deer remain an important component of the landscape, providing recreational opportunities for hunters and wildlife watchers. Mule deer range throughout the Owyhee Subbasin, occupying various habitats from coniferous forest to the farmlands and shrub steppe/grassland habitats.

Mule deer occupy a variety of cover types across the Owyhee Subbasin. Consequently, habitat requirements vary with vegetative and landscape components contained within each herd range. Forested habitats provide mule deer with forage as well as snow intercept, thermal, and escape cover. Mule deer occupying mountain-foothill habitats live within a broad range of elevations, climates, and topography which includes a wide range of vegetation; many of the deer using these habitats are migratory. Mule deer are found in the deep canyon complexes along the major rivers and in the channeled scablands of the Owyhee Subbasin; these areas are dominated by native bunch grasses or shrub-steppe vegetation. Habitats that were historically shrub step and are currently utilized for agriculture likely enable the land to support higher number of mule deer.

The Mule Deer occurs in eight habitat types in the Owyhee Subbasin -- based on current wildlife-habitat types (Table 2.7); Mule Deer are generally associated with the following eight habitats;

- Montane Mixed Conifer Forest
- Interior Mixed Conifer Forest
- Alpine Grasslands and Shrublands
- Agriculture, Pastures, and Mixed Environs
- Urban and Mixed Environs
- Herbaceous Wetlands
- Montane Coniferous Wetlands
- Interior Riparian-Wetlands

Table 2.7. Mule Deer (Odocoileus hemionus) association with all habitats occurring in the OWYHEE Subbasin (Source: nwhi.org/ibis).

Wildlife-Habitat Type	Association Type	Activity Type	Confidence Level	Comments
Montane Mixed Conifer Forest	Generally Associated	Feeds and Breeds	High	none
Interior Mixed Conifer Forest	Generally Associated	Feeds and Breeds	High	none
Alpine Grasslands and Shrublands	Generally Associated	Feeds and Breeds	High	none
Agriculture, Pastures, and Mixed Environs	Generally Associated	Feeds and Breeds	High	none
Urban and Mixed Environs	Generally Associated	Feeds and Breeds	High	none
Herbaceous Wetlands	Generally Associated	Feeds	High	none
Montane Coniferous Wetlands	Generally Associated	Feeds and Breeds	High	none
Interior Riparian-Wetlands	Generally Associated	Feeds and Breeds	High	none

Mule deer diets are as varied as the landscapes they inhabit. (Kufeld et. al. 1973) have identified 788 plant species that have been eaten by mule deer; this list includes 202 trees and shrubs, 484 forbs, and 84 grasses, rushes, and sedges. Diets vary by season, age, and sex. Mule deer utilize agriculture land resources for forage. The Mule deer population increased after livestock grazing cattle ate Bitterbrush buck (Jerry Hoagland; personal correspondent; 2004).

Mule deer are distributed throughout the Owyhee Subbasin, from higher elevations (6000 ft.) in the mountains, to the lowland farming areas.

Limiting Factors Affecting Mule Deer Population Status: Population numbers need to be substantiated.

Some of the limiting factors affecting mule deer include competition by other ungulates, drought, fire, over-harvest by hunters, predation, disease and parasites.

2.2.2.3 Sage grouse[6]

Focal Habitat – Species Box
Shrub-steppe (including sagebrush steppe and salt-scrub shrublands)
Sage Grouse

[6] This species account is based in part from a draft written by Tim Dykstra, Shoshone-Paiute Tribes with input from Keith Paul, US Fish & Wildlife Service (April 2004); and in part from Nevada Partners in Flight; Bird Conservation Plan; Edited by Larry A. Neel; November 29, 1999.

Golden Eagle
Pronghorn Antelope

Image 2.11. Sage grouse; photo credits Herbert Clarke.

The sage grouse is North America's largest grouse, a characteristic feature of habitats dominated by big sagebrush (Artemisia tridentate) in Western North America (Schroeder et al. 1999). The first written accounts of this species were based on observations by the Lewis and Clark expedition in 1805, when the species was widespread in the West (Schroeder et al. 1999). Sage grouse were an important game species for Native Americans and European settlers and continue to be valued for hunting and food (Storch 2000). Because of the stunning display of sage grouse on their strutting grounds, they have become popular with naturalists and bird watchers.

Due to loss, fragmentation, and degradation of greater sage grouse habitat and large reductions of their population, seven petitions have been submitted to the U.S. Fish and Wildlife Service (Service) requesting listing of distinct populations and the entire species, collectively. The Service determined that there was not significant information available to classify the greater sage grouse into two distinct population segments (the western and eastern subspecies of sage grouse). In a recent news release dated April 15, 2004, the Service announced its completion of evaluating three petitions to list the greater sage grouse rangewide as either threatened or endangered. The Service has determined that the petitions and other available information provide substantial biological information indicating that further review of the status of the species is warranted. This status review will determine whether the greater sage grouse warrants listing as a threatened or endangered species.

Concern about long-term declines in sage grouse populations has prompted western State wildlife agencies and Federal agencies such as the Bureau of Land Management (BLM), U.S. Forest Service, and the Service to engage in a variety of cooperative efforts aimed at conserving and managing sagebrush habitat for the benefit of sage grouse and other sagebrush-dependent species.

The sage grouse occurs in seven habitat types in the Owyhee Subbasin -- based on current wildlife-habitat types (Table 2.8). Sage grouse are closely associated with four habitat types in the Owyhee Subbasin:

- Interior Grasslands
- Shrub-steppe
- Dwarf Shrub-steppe
- Desert Playa and Salt Scrub Shrublands

Table 2.8. Sage Grouse (Centrocercus urophasianus) association with all habitats occurring in the OWYHEE Subbasin: (Source: nwhi.org/ibis).

Wildlife-Habitat Type	Association Type	Activity Type	Confidence Level	Comments
Western Juniper and Mountain Mahogany Woodlands	Present	Feeds and Breeds	High	none
Interior Canyon Shrublands	Present	Feeds and Breeds	High	none
Interior Grasslands	Closely Associated	Feeds and Breeds	High	none
Shrub-steppe	Closely Associated	Feeds and Breeds	High	Sagebrush obligate species.
Dwarf Shrub-steppe	Closely Associated	Feeds and Breeds	High	Potentially critical early brooding habitat; sagebrush obligate species.
Desert Playa and Salt Scrub Shrublands	Closely Associated	Feeds and Breeds	High	Desert playa, not the salt scrub shrublands, is the critical post brood-rearing habitat.
Agriculture, Pastures, and Mixed Environs	Generally Associated	Feeds and Breeds	High	Uses Conservation Reserve Program (CRP) lands within this habitat; usually uses this habitat only in close proximity to shrub steppe habitat (1- 2 km).
Total Habitat Associations with Sage Grouse:	7			

Description

Adult male sage grouse has fuscous upperparts, profusely marked with drab gray and white; tail long and pointed; primaries plain brown; chin and throat sepia (blackish); sides of neck, breast, and upper belly whitish and slightly distended, forming a ruff; belly and undertail-coverts sepia, with large white spots on tips of undertail-coverts; thighs buff (Schroeder et al. 1999). Head has yellow fleshy comb above eye, and long filoplumes that arise from back of the neck (Schroeder et al. 1999). During courtship displays, tail fanned and breast distended, exposing two yellow ocher patches of bare skin (cervical apteria) on lower throat and breast (Schroeder et al. 1999). These apteria briefly exposed during the display, appearing as round balloons. The adult female is similar to the male but smaller and has fuscous feathers, marked with drab gray and white on head and breast, creating a more cryptic appearance overall than in male (Schroeder et al. 1999). Female also lacks cervical apteria and has smaller comb over eye than male (Schroeder et al. 1999).

Life History

Diet

Sagebrush dominates diet during late autumn, winter, and early spring (Girard 1937, Rasmussen and Griner 1938, Bean 1941, Batterson and Morse 1948, Patterson 1952, Leach and Hensley 1954, Barber 1968, Wallestad et al. 1975, Schroeder et al. 1999). Sage grouse eat numerous species of sagebrush, including big, low (*Artemisia arbuscula*), silver (*Artemisia cana*), and fringed (*Artemisia fridida*) (Remington and Braun 1985, Welch et al. 1988, 1991, Myers 1992, Schroeder et al. 1999). Insects are an important component of the juvenile diet, especially during the first three weeks of life; after which forbs increase in importance as juveniles age (Patterson 1952, Trueblood 1954, Klebenow and Gray 1968, Savage 1968, Peterson 1970, Johnson and Boyce 1990, Drut et al. 1994, Pyle and Crawford 1996, Schroeder et al. 1999). Although insects are also eaten by adults during spring and summer, forbs and sagebrush dominate their diet (Rasmussen and Griner 1938, Moos 1941, Knowlton and Thornley 1942, Patterson 1952, Leach and Hensley 1954, Schroeder et al. 1999).

Reproduction

The breeding of sage grouse begins in mid-March when the males start to congregate on the leks (BLM et al. 2000). Females come to the leks to mate and generally nest in the vicinity (BLM et al. 2000). Nesting rates vary from year to year and from area to area (Bergerud 1988, Coggins 1998, Connelly et al 1993, Gregg 1991, and Schroeder 1997). This variation is most likely a result of the quality of available nutrition and the general health of pre-laying females (Barnett and Crawford 1994). At least 70% of the females in a population will initiate a nest each year, with higher nest initiation rate recorded during years of higher precipitation in comparison to periods of drought (Coggins 1998). Renesting rates by females who have lost their first clutch are 10 to 40 % (Bergerud 1988, Connelly et al. 1993, Eng 1963, Patterson 1952, and Petersen 1980). Clutch size per nest normally ranges from seven to ten eggs (Connelly unpub., Schroeder 1997, Wakkinen 1990, BLM et al. 2000).

Breeding Territory/Home Range

Adult males are highly territorial on leks, actively defending areas of 53.8-1076 ft^2 (5-100 m^2) (Simon 1940, Patterson 1952, Dalke et al 1960, Hartzler 1972, Wiley 1973, Gibson and Bradbury 1987, Schroeder et al. 1999). Yearling males rarely defend territories or breed, although they are physiologically capable of breeding (Eng 1963). Leks vary from 1 to 16 ha in size because of number of males attending lek and topography of lek site (Scott 1942, Patterson 1952, Wiley 1973, Schroeder et al. 1999). Male sage grouse are not territorial off leks (Schroeder et al. 1999). Home range for sage grouse may exceed 579 mi^2 (1,500 km^2) (Connelly, unpub. data, cited in BLM et al. 2000). Sage grouse may have two or more seasonal ranges including a breeding range, a brood-rearing range, and a winter range (BLM et al. 2000).

Migration/Overwintering

Sage grouse populations can be migratory or non-migratory (Beck 1975, Berry and Eng 1985, Connelly et al 1988, Fischer 1994, Wakkinen 1990, and Wallestad 1975, BLM et al. 2000), depending on location and associated land form. Where topographic relief allows, sage grouse generally move to higher elevations from spring through fall as snow melts and plant growth advances (BLM et al. 2000). Non-migratory populations may spend the entire year within an area of 38.61 mi² (100 km²) or less in size (BLM et al. 2000). In migratory populations, seasonal movements may exceed 46.5 mi (75 km) (Connelly et al. 1998, Dalke et al. 1963, BLM et al. 2000).

Survivorship

Annual survival rates for yearling and adult sage grouse vary from 35 to 85 percent for females, and from 38 to 54 percent for males (Connelly et al. 1994, Wallestad 1975, and Zablan 1993, BLM et al. 2000). Lower survival rates for males may be related to the higher predation rates on males during the lekking season (Swensen 1986). Sage grouse tend to live longer than other upland gamebird species; individual birds four to five years old are common (BLM et al. 2000).

Mortality

Predation on eggs and birds is the primary cause of mortality (Schroeder et al. 1999). Other causes of mortality include human disturbance, livestock, farm machinery, moving vehicles, electric or telephone wires, fences, pesticides, fire flood, drought, sun exposure, heavy rain, and cold (Borell 1939, Bean 1941, Batterson and Morse 1948, Patterson 1952, Dalke et al. 1963, Rogers 1964, Wallestad 1975, Barber 1991, Schroeder et al. 1999).

Habitat Requirements

Breeding

Breeding grounds are centered on and within the vicinity of leks. The some lek sites are used from year to year. They are established in open areas surrounded by sagebrush, which is used for escape and protection from predators (Gill 1965, Patterson 1952, BLM et al. 2000). Examples of lek sites include landing strips, old lake beds or playas, low sagebrush flats, openings on ridges, roads, crop land, and burned areas (Connelly et al. 1981, Gates 1985, BLM et al. 2000). The lek is considered the center of year-round activity for resident grouse populations (Eng and Schladweiler 1972, Wallestad and Pyrah 1974, Wallestad and Schladweiler 1974). On the average, most nests are located within 4 miles (6.2 km) of the lek; however some females or hens may nest more than 12 miles (20 km) away from the lek (Autenrieth 1981, Fischer 1994, Hanf et al. 1994, Wakkinen et al. 1992, BLM et al. 2000). Most sage grouse nests are located under sagebrush plants (Gill 1965, Gray 1967, Patterson 1952, Schroeder et al. 1999, Wallestad and Pyrah 1974, BLM et al. 2000). Optimum sage grouse nesting habitat consists of the following: sagebrush stands containing plants 16 to 32 inches (40 to 80 cm) tall with a canopy cover ranging from 15 to 25 percent and an herbaceous understory of at least 15 percent grass canopy cover and 10 percent forb canopy cover that is at least 7 inches (18 cm) tall (BLM et al. 2000). Ideally, these vegetative conditions should be on 80 percent of the breeding habitat for any given population of sage grouse (BLM 2000).

Non-breeding

Sage grouse winter habitats are relatively similar throughout most of their ranges. Because their winter diet consists almost exclusively of sagebrush, winter habitats must provide adequate amounts of sagebrush (BLM et al. 2000). Sagebrush canopy can be highly variable (Beck 1977, Eng and Schladweiler 1972, Patterson 1952, Robertson 1991, Wallestad et al. 1975, BLM et al. 2000). Sage grouse tend to select areas with both high canopy and taller Wyoming big sagebrush (*A. t. wyomingensis*) and feed on plants highest in protein content (Remington and Braun 1985, Robertson 1991, BLM et al 2000). It is critical that sagebrush be exposed at least 10 to 12 inches (25 to 30 cm) above snow level to provide food and cover for wintering sage grouse (Hupp and Braun 1989, BLM et al. 2000). If snow covers the sagebrush, the birds move to areas where sagebrush is exposed. Therefore, good wintering habitat consists of sagebrush with 10 to 30 percent canopy cover on 80 percent of the wintering area (BLM et al. 2000).

Population and Distribution

Distribution

Historic Distribution
Historically, sage grouse occurred in at least 16 states and three Canadian provinces. Since then, sage grouse have been extirpated from British Columbia, Arizona, Utah, Montana, New Mexico, Colorado, Wyoming, Alberta, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, and Nebraska (Connelly and Braun 1997, Braun 1998, Schroeder et al. 1999). It is unclear whether birds in Oklahoma and Kansas represented a distinct population (Schroeder et al. 1999). Historically, it is estimated that 220 million acres (81 million ha) of sagebrush-steppe vegetation types existed in North America (McArthur and Ott 1996), making it one of the most widespread habitats in the country (BLM et al. 2000). However, much of this habitat has been lost or degraded over the last 100 years (BLM et al. 2000).

Current Distribution
Currently, in states and provinces that still have sage grouse, their range has been reduced. Declines in distribution have been noted throughout the twentieth century (Hornaday 1916, Locke 1932, McClanahan 1940, Aldrich and Duvall 1955, Connelly and Braun 1997, Schroeder et al. 1999). Within the Interior Columbia River Basin, sagebrush habitat has been reduced from about 40 million acres (16 million ha) to 26 million acres (11 million ha), representing a loss of about 35% since the early 1900's (Hann et al. 1997, BLM et al. 2000). Most remaining sagebrush-steppe ecosystems in Oregon are on public lands managed by the Bureau of Land Management (BLM) (BLM et al. 2000).

Objectives and Strategies

Objectives and strategies for Sage Grouse conservation are presently being formulated by the Western States Sage Grouse Committee. Rather than try to set its own objectives, the Nevada Working Group will wait for the completion of the Sage Grouse Committee product and incorporate its recommendations into the framework of its restoration plan.

Objectives and Strategies for Sage Grouse:
http://www.blm.gov/nhp/spotlight/sage_grouse/draft_sage_grouse_strategy.pdf
DRAFT BLM Sage-Grouse Habitat Conservation Strategy
A U.S. Forest Service report on the life history of the sage grouse is available at:
http://www.srs.fs.usda.gov/pubs/gtr/gtr_pnw187.pdf

2.2.2.4 Golden eagle[7]

Focal Habitat – Species Box
Shrub-steppe (including sagebrush steppe and salt-scrub shrublands)
Sage Grouse
Golden Eagle
Pronghorn Antelope

Image 2.12. Golden eagle; photo credits Dale and Marian Zimmerman.

The golden eagle is the largest soaring raptor found within the Owyhee subbasin. They inhabit open country and mountainous terrain. The golden eagle was a powerful and skillful hunter.

[7] This species account is based in part on a draft by Keith Paul, U.S. Fish & Wildlife Service, 4-14-2004.

The golden eagle has long, broad wings and rounded tails which enable them to soar effortless for long periods of time on flat or slightly up-tilted wings. Their wingspan will reach 6-7 feet (2 m) and they will have a length of 30-40 inches (76-102 cm) (BLM 2004). They typically weigh about 7-14 pounds (3.2-6.4 kg) (NYSDEC 2003). Golden eagles have a dark brown body and get their name from the “golden” colored feathers on the back of their head and upper neck. The eyes and beak are dark. The legs are completely feathered to the toes. As with most raptors, the females are noticeably larger than the males. Immature goldens have a patch of white on the tail with a broad black band at the end. The adult tail is gray and brown (BLM 2004).

The sexes are similar, and in flight, the adults are essentially all dark with no light markings. The juveniles, immatures, and sub-adults resemble the adults in their dark plumage, but have white at the base of the primaries and the base of the tail (BLM 2004).

The golden eagle occurs in fourteen habitat types in the Owyhee Subbasin -- based on current wildlife-habitat types (Table 2.9); Golden eagles are more generally associated with the following seven habitats:

- Western Juniper and Mountain Mahogany Woodlands
- Interior Canyon Shrublands
- Interior Grasslands
- Shrub-steppe
- Dwarf Shrub-steppe
- Agriculture, Pastures, and Mixed Environs
- Interior Riparian-Wetlands

Table 2.9. Golden Eagle (Aquila chrysaetos) association with all habitats occurring in the OWYHEE Subbasin: (Source: nwhi.org/ibis).

Wildlife-Habitat Type	Association Type	Activity Type	Confidence Level	Comments
Montane Mixed Conifer Forest	Present	Feeds and Breeds	High	Needs cliffs for nesting.
Interior Mixed Conifer Forest	Present	Feeds and Breeds	High	Needs cliffs for nesting.
Upland Aspen Forest	Present	Feeds	Low	none
Alpine Grasslands and Shrublands	Present	Feeds	Moderate	none
Western Juniper and Mountain Mahogany Woodlands	Generally Associated	Feeds and Breeds	High	Needs cliffs for nesting.
Interior Canyon Shrublands	Generally Associated	Feeds and Breeds	High	Needs cliffs for nesting.
Interior Grasslands	Generally Associated	Feeds and Breeds	High	Needs cliffs for nesting.
Shrub-steppe	Generally Associated	Feeds and Breeds	High	Needs cliffs for nesting.
Dwarf Shrub-steppe	Generally Associated	Feeds and Breeds	High	Needs cliffs for nesting.
Desert Playa and Salt Scrub Shrublands	Present	Feeds	High	none
Agriculture, Pastures, and Mixed Environs	Generally Associated	Feeds	High	none
Open Water - Lakes, Rivers, and Streams	Present	Feeds	High	none
Herbaceous Wetlands	Present	Feeds	High	none
Interior Riparian-Wetlands	Generally Associated	Feeds and Breeds	High	Needs cliffs for nesting.
Total Habitat Associations with Golden Eagle:	14			

Regardless of the habitat type it lives in, cliff nesting is key habitat feature required by the golden eagle for reproduction.

Diet

On average, an adult golden eagle consumes eight to 12 ounces (227 to 340 grams) of food per day throughout the year. Consumption is not likely to be consistent each day, with periods of gorging versus fasting, depending upon availability of prey. Winter consumption is likely greater than summer consumption (BLM 2004).

Principle foods of golden eagles include rodents, hares, and rabbits. The mammalian component of eagle diets as noted form many studies, varies from 70-97 percent, with birds variably being another major component (BLM 2004). A review of North American literature by the BLM (2004) revealed that 52 species of mammals, 48 birds, five reptiles, and two fishes have been recorded in the diets of the golden eagle. Insects, such as the Mormon cricket, are also documented as a prey item (BLM 2004). Throughout most of the Great Basin, black-tailed jackrabbits are the main prey item and numerous studies have correlated eagle production with jackrabbit abundance (Olendorff 1976; Kochert 1980; Thompson et al.; 1982, Carey 2003).

Much has been written about golden eagle attacks on domestic livestock. It is noted that while depredation does occur on occasion, the amount of depredation depends upon the availability of natural food supply, ranching practices, weather, and a variety of other factors (BLM 2004).

Habitat Requirements

Breeding/Foraging
Golden eagles generally prefer open country, usually avoiding extensive areas of coniferous forests. They are commonly found in arid, sloping valleysides, benchlands or flatlands cut by canyons, gullies or rock outcrops, tundra, alpine country, deserts, southern coastal areas, eastern bogs, logged openings, grasslands, and early seral stages of forested lands (BLM 2004). In the Great Basin, golden eagles are usually found in shrub-steppe, grassland, juniper, open ponderosa pine, and mixed conifer/deciduous habitats (Carey 2003). Nests are often found on cliffs with ledges or less commonly in large trees (BLM 2004). They forage in a variety of habitat types and successional stages, preferring areas with an open shrub component that provides food and cover for prey (Carey 2003). Foraging areas may also be characterized by broken terrain that is subjected to varied air currents that provide lift to the eagles (BLM 2004).

Non-breeding/Foraging
For resident golden eagles, non-breeding habitat will typically be the same as breeding habitat with a focus on foraging sites. Migrating eagles tend to use mountain ridges in order to benefit from drafts and other air currents to aid in migration (BLM 2004). Migrating eagles prefer the arid, shrub-steppe habitat for wintering in mid-western and western states (BLM 2004).

Continuing Threat
Golden eagles are extremely susceptible to human disturbance which has been a major factor to nesting failures (BLM 2004). Another major threat to the golden eagle is the loss of shrub steppe habitat. Factors affecting shrub steppe habitat include the actual loss of shrub steppe to agriculture and urbanization, degradation from excessive grazing, and an ever increasing threat from wildfire. In the Great Basin, the loss of shrub steppe habitat has lead to a decrease in the golden eagles main prey, the black-tailed jackrabbit. Electrocution still posses a threat to eagles, but power companies have increasingly been

taking actions to modify power line design to eliminate electrocution as a source of mortality.

2.2.2.5 Pronghorn antelope

Focal Habitat – Species Box
Shrub-steppe (including sagebrush steppe and salt-scrub shrublands)
Sage Grouse
Golden Eagle
Pronghorn Antelope

Image 2.13. Pronghorn antelope; photo credits Michael Durham.

The body is distinctly marked with white on the underside and rump. When alarmed, the guard hairs on the white rump patch are extended vertically, making the white rump patch visible for great distances. The back is brown with shades of cinnamon and the males have a black cheek patch, muzzle and forehead. This dark mask is much less pronounced in females.

The horns are made up of a bony inner core and an outer sheath, which is shed annually. Both sexes have horns but the female horns are rarely longer than two inches if present at all. The average male horns are approximately 12 inches in length and have a prominent prong on one of the two branches.

The Pronghorn Antelope occurs in eight habitat types in the Owyhee Subbasin -- based on current wildlife-habitat types (Table 2.10).; The Pronghorn Antelope is closely associated with four of the habitat types in the Owyhee Subbasin:

- Interior Grasslands
- Shrub-steppe
- Dwarf Shrub-steppe
- Desert Playa and Salt Scrub Shrublands

Table 2.10. Pronghorn Antelope (Antilocapra americana) association with all habitats occurring in the OWYHEE Subbasin. (source: http://nwhi.org/ibis/subbasin/subs3.asp).

Wildlife-Habitat Type	Association Type	Activity Type	Confidence Level	Comments
Interior Mixed Conifer Forest	Present	Feeds and Breeds	High	May use this habitat where it occurs in a matrix with preferred open habitat types.
Western Juniper and Mountain Mahogany Woodlands	Generally Associated	Feeds and Breeds	High	none
Interior Grasslands	Closely Associated	Feeds and Breeds	High	none
Shrub-steppe	Closely Associated	Feeds and Breeds	High	none
Dwarf Shrub-steppe	Closely Associated	Feeds and Breeds	High	none
Desert Playa and Salt Scrub Shrublands	Closely Associated	Feeds and Breeds	High	none
Agriculture, Pastures, and Mixed Environs	Generally Associated	Feeds and Breeds	High	none
Interior Riparian-Wetlands	Present	Feeds	Moderate	none
Total Habitat Associations with Pronghorn Antelope:	8			

HABITAT:

Pronghorn prefer gentle rolling to flat, wide-open topography. Low sagebrush and northern desert shrubs are the preferred vegetation types. Areas such as these with low understory allow antelope to see great distances and permit the animals to move quickly to avoid predators. In Oregon, this is a species of grasslands, sagebrush flats and shad scale-covered valleys of the central and southeastern part of the state. Low sagebrush is an important habitat component (Csuti et al. 1997)

RANGE:

In the Owyhee Subbasin this antelope species is restricted to Western North America (Csuti et al. 1997). Pronghorn antelope are found primarily in the valleys between mountain ranges. Development managers have helped antelope extend their range in the Owyhee Subbasin through numerous transplants and water developments.

FOOD HABITS:

Over 150 different species of grasses, forbs and browse plants are eaten by antelope, which allows them to occupy a variety of habitat types. Succulent plants and sprouts are preferred. Some of the main components of pronghorn diet in many locations include sagebrush, antelope bitterbrush, saltbrush, rabbitbrush, cheatgrass, indian rice grass, crested wheat grass, lambsquarter and shadscale.

STATUS:

Drought and climatic conditions affect populations in the short term, but generally, the basin wide population of pronghorn is increasing.
{From: http://ndow.org/wild/animals/facts/antelope.shtm}

2.2.2.6 Columbia spotted frog (Rana luteiventris) [8]

Focal Habitat – Species Box
Riparian and wetlands
Columbia Spotted Frog
American Beaver
Yellow Warbler
Bald Eagle
White-faced Ibis

[8] The spotted frog species account is based in part on a draft written by Keith Paul, USFWS (02-24-2004) for the Owyhee Subbasin Plan.

Image 2.14. Columbia spotted frog; photo credits William P. Leonard.

The Columbia Spotted Frog occurs in twelve habitat types in the Owyhee Subbasin -- based on current wildlife-habitat types (Table 2.11). The Columbia spotted frog is closely associated with the following three habitats:

- Open Waters: Lakes, Rivers, and Streams
- Herbaceous Wetlands
- Interior Riparian-Wetlands

Table 2.11. Columbia Spotted Frog (Rana luteiventris) association with all habitats occurring in the OWYHEE Subbasin:

Wildlife-Habitat Type	Association Type	Activity Type	Confidence Level	Comments
Montane Mixed Conifer Forest	Generally Associated	Feeds	Moderate	Requires shallow water in wet meadows or stream/pond edges with abundant aquatic vegetation for breeding.
Interior Mixed Conifer Forest	Generally Associated	Feeds	Moderate	Requires shallow water in wet meadows or stream/pond edges with abundant aquatic vegetation for breeding.
Upland Aspen Forest	Generally Associated	Feeds	Moderate	Requires shallow water in wet meadows or stream/pond edges with abundant aquatic vegetation for breeding.
Western Juniper and Mountain Mahogany Woodlands	Generally Associated	Feeds	Moderate	Requires shallow water in wet meadows or stream/pond edges with abundant aquatic vegetation for breeding.
Interior Canyon Shrublands	Generally Associated	Feeds	Moderate	Requires shallow water in wet meadows or stream/pond edges with abundant aquatic vegetation for breeding.
Interior Grasslands	Generally Associated	Feeds	Moderate	Requires shallow water in wet meadows or stream/pond edges with abundant aquatic vegetation for breeding.
Shrub-steppe	Generally Associated	Feeds	Moderate	Requires shallow water in wet meadows or stream/pond edges with abundant aquatic vegetation for breeding.
Agriculture, Pastures, and Mixed Environs	Generally Associated	Feeds	Low	Requires shallow water in wet meadows or stream/pond edges with abundant aquatic vegetation for breeding.
Open Water - Lakes, Rivers, and Streams	Closely Associated	Feeds and Breeds	Moderate	Rare or absent where predatory fish or bullfrogs occur. Requires shallow water in wet meadows or stream/pond edges with abundant aquatic vegetation for breeding.
Herbaceous Wetlands	Closely Associated	Feeds and Breeds	High	Rare or absent where predatory fish or bullfrogs occur. Requires shallow water in wet meadows or stream/pond edges with abundant aquatic vegetation for breeding.
Montane Coniferous Wetlands	Generally Associated	Feeds and Breeds	Moderate	Rare or absent where predatory fish or bullfrogs occur. Requires shallow water in wet meadows

				or stream/pond edges with abundant aquatic vegetation for breeding.
Interior Riparian-Wetlands	Closely Associated	Feeds and Breeds	High	Rare or absent where predatory fish or bullfrogs occur. Requires shallow water in wet meadows or stream/pond edges with abundant aquatic vegetation for breeding.

The following is a brief description of the three habitat types that the Columbia Spotted Frog is most closely associated with:

1. Herbaceous Wetlands
This habitat may be found on permanently or seasonally flooded wetlands. In general, this habitat is flat, usually with stream or river channels or open water present. Herbaceous wetlands are found in all terrestrial habitats except Subalpine Parkland, Alpine Grasslands, and Shrublands habitats (Crawford et al. nwhi.org/ibis 2004). Herbaceous wetland habitat is generally a mix of emergent herbaceous plants with a grass-like life form (graminoids). Various wetland communities are found in mosaics or in nearly pure stands of single species. Herbaceous cover varies from open to dense.

2. Open Water
There are 4 distinct zones within this aquatic system: (1) the littoral zone at the edge of lakes is the most productive with diverse aquatic beds and emergent wetlands (part of Herbaceous Wetland's habitat); (2) the limnetic zone is deep open water, dominated by phytoplankton and freshwater fish, and extends down to the limits of light penetration; (3) the profundal zone below the limnetic zone, devoid of plant life and dominated with detritivores; (4) and the benthic zone reflecting bottom soil and sediments. Nutrients from the profundal zone are recycled back to upper layers by the spring and fall turnover of the water. Water in temperate climates stratifies because of the changes in water density. The uppermost layer, the epilimnion, is where water is warmer (less dense). Next, the metalimnion or thermocline, is a narrow layer that prevents the mixing of the upper and lowermost layers. The lowest layer is the hypolimnion, with colder and most dense waters. During the fall turnover, the cooled upper layers are mixed with other layers through wind action. High desert streams of the interior are similar to those of the Willamette Valley but are shallower, with fewer pools, and more runs, glides, cobbles, boulders, and sand.

3. Interior Riparian-Wetlands

Riparian habitats appear along perennial and intermittent rivers and streams. This habitat also appears in impounded wetlands and along lakes and ponds. Their associated streams flow along low to high gradients. The riparian and wetland forests are usually in fairly narrow bands along the moving water that follows a corridor along montane or valley streams. The most typical stand is limited to 100-200 ft (31-61 m) from streams.

Columbia Spotted Frog Life History, Key Environmental Correlates, and Habitat Requirements

Life History

The Columbia spotted frog (CSF) is olive green to brown in color, with irregular black spots. They may have white, yellow, or salmon coloration on the underside of the belly and legs (Engle 2004). The hind legs are relatively short relative to body length and there is extensive webbing between the toes on the hind feet. The eyes are upturned (Amphibia Web 2004). Tadpoles are black when small, changing to a dark then light brown as they increase in size. CSFs are about one inch in body length at metamorphosis (Engle 2004). Females may grow to approximately 100 mm (4 inches) snout-to-vent length, while males may reach approximately 75 mm (3 inches) snout-vent length (Nussbaum et al. 1983; Stebbins 1985; Leonard et al. 1993).

Diet

The CSF eats a variety of food including arthropods (e.g., spiders, insects), earthworms and other invertebrate prey (Whitaker et al. 1982). Adult CSFs are opportunistic feeders and feed primarily on invertebrates (Nussbaum et al. 1983). Larval frogs feed on aquatic algae and vascular plants, and scavenged plant and animal materials (Morris and Tanner 1969).

Reproduction

The timing of breeding varies widely across the species range owing to differences in weather and climate, but the first visible activity begins in late winter or spring shortly after areas of ice-free water appear at breeding sites (Licht 1975; Turner 1958; Leonard et al 1996). Breeding typically occurs in late March or April, but at higher elevations, breeding may not occur until late May or early June (Amphibia Web 2004). Great Basin population CSFs emerge from wintering sites soon after breeding sites thaw (Engle 2001).

Adults exhibit a strong fidelity to breeding sites, with oviposition typically occurring in the same areas in successive years. Males arrive first, congregating around breeding sites, periodically vocalizing "advertisement calls" in a rapid series of 3-12 "tapping" notes that have little carrying power (Davidson 1995; Leonard et al. 1996). As a female enters the breeding area, she is approached by and subsequently pairs with a male in a nuptial embrace referred to as amplexus. From several hours to possibly days later, the female releases her complement of eggs into the water while the male, still clinging to the female, releases sperm upon the ova (Amphibia Web 2004). Breeding is explosive (as opposed to season-long), occurring only in the first few weeks following emergence (USFWS 2002a). After breeding is completed, adults often disperse into adjacent wetland, riverine and lacustrine habitats (Amphibia Web 2004).

CSF's have a strong tendency to lay their eggs communally and it is not uncommon to find 25 or more egg masses piled atop one another in the shallows (Amphibia Web 2004). Softball-sized egg masses are usually found in groups, typically along northeast edges of slack water amongst emergent vegetation (USFWS 2002a). After a few weeks thousands of small tadpoles emerge and cling to the remains of the gelatinous egg masses. Newly-hatched larvae remain clustered for several days before moving throughout their natal site (USFWS 2002a). In the Columbia Basin tadpoles may grow to 100 mm (4 in) total length prior to metamorphosing into froglets in their first summer or fall. At high-elevation montane sites, however, tadpoles barely reach 45 mm (1.77 in) in total length prior to the onset of metamorphosis in late fall (Amphibia Web 2004). As young-of-the-year transform, many leave their natal sites and can be found in nearby riparian corridors (USFWS 2002a).

Females may lay only one egg mass per year; yearly fluctuations in the sizes of egg masses are extreme (Utah Division of Wildlife Resources 1998). Successful egg production and the viability and metamorphosis of CSF's are susceptible to habitat variables such as temperature, depth, and pH of water, cover, and the presence/absence of predators (e.g., fishes ,snakes, birds and bullfrogs) (Morris and Tanner 1969; Munger et al. 1996; Reaser 1996).

Migration

David Pilliod observed movements of approximately 2,000 m (6,562 ft) linear distance within a basin in montane habitats (Reaser and Pilliod, in press). Pilliod et al. 1996 (in Koch et al. 1997) reported that individual high mountain lake populations of *R. luteiventris* in Idaho are actually interdependent and are part of a larger contiguous metapopulation that includes all the lakes in the basin. In Nevada, Reaser (1996; in Koch et al. 1997) determined that one individual of R. luteiventris traveled over 5 km (3.11 mi) in a year (NatureServe 2003).

In a three-year study of *R. luteiventris* movement within the Owyhee Mountain subpopulation of the Great Basin population in southwestern Idaho, Engle (2000) PIT-tagged over 1800 individuals but documented only five (of 468) recaptures over 1,000 m (3,281 ft) from their original capture point. All recaptures were along riparian corridors and the longest distance between capture points was 1,765 m (5,791). Although gender differences were observed, 88 percent of all movement documented was less than 300 m (984 ft) from the original capture point (NatureServe 2003).

Though movements exceeding 1 km (0.62 mi) and up 5 km (3.11 mi) have been recorded, these frogs generally stay in wetlands and along streams within 0.6 km (0.37 mi) of their breeding pond (Turner 1960, Hollenbeck 1974, Bull and Hayes 2001). Frogs in isolated ponds may not leave those sites (Bull and Hayes 2001) (NatureServe 2003).

In the Toiyabe Range in Nevada, Reaser (2000) captured 887 individuals over three years, with average mid-season density ranging from 2 to 24 frogs per 150 m (492 ft) of habitat (NatureServe 2003).

Mortality
Based on recapture rates in the Owyhee Mountains, some individuals live for at least five years. Skeletochronological analysis in 1998 revealed a 9-year old female (Engle and Munger 2000).

Mortality of eggs, tadpoles, and newly metamorphosed frogs is high, with approximately 5% surviving the first winter (David Pilliod, personal communication, cited in Amphibia Web 2004).

Habitat Requirements

General
This species is relatively aquatic and is rarely found far from water. It occupies a variety of still water habitats and can also be found in streams and creeks (Hallock and McAllister 2002). CSF's are found closely associated with clear, slow-moving or ponded surface waters, with little shade (Reaser 1997). CSF's are found in aquatic sites with a variety of vegetation types, from grasslands to forests (Csuti 1997).

A deep silt or muck substrate may be required for hibernation and torpor (Morris and Tanner 1969). In colder portions of their range, CSF's will use areas where water does not freeze, such as spring heads and undercut streambanks with overhanging vegetation (IDFG et al. 1995). CSF's may disperse into forest, grassland, and brushland during wet weather (NatureServe 2003). They will use stream-side small mammal burrows as shelter. Overwintering sites in the Great Basin include undercut banks and spring heads (Blomquist and Tull 2002). Cynthia Tait -- BLM Vale fisheries biologist -- provided the following information on Columbia spotted frog winter habitat requirements (Personal correspondence, 2-13-2004): "Spotted frogs overwinter underwater, and consequently require a source of perennial water, such as a spring, that is fairly deep and does not freeze."

Breeding

Reproducing populations have been found in habitats characterized by springs, floating vegetation, and larger bodies of pooled water (e.g., oxbows, lakes, stock ponds, beaver-created ponds, seeps in wet meadows, backwaters) (IDFG et al. 1995; Reaser 1997). Breeding habitat is the temporarily flooded margins of wetlands, ponds, and lakes (Hallock and McAllister 2002). Breeding habitats include a variety of relatively exposed, shallow-water (<60 cm), emergent wetlands such as sedge fens, riverine over-bank pools, beaver ponds, and the wetland fringes of ponds and small lakes. Vegetation in the breeding pools generally is dominated by herbaceous species such as grasses, sedges (Cares spp.) and rushes (Juncus spp.) (Amphibia Web 2004).

Columbia Spotted Frog Population and Distribution

Distribution

Populations of the CSF are found from Alaska and British Columbia to Washington east of the Cascades, eastern Oregon, Idaho, the Bighorn Mountains of Wyoming, the Mary's, Reese, and Owyhee River systems of Nevada, the Wasatch Mountains, and the western desert of Utah (Green et al. 1997). Genetic evidence (Green et al. 1996) indicates that Columbia spotted frogs may be a single species with three subspecies, or may be several weakly-differentiated species.

Two populations of CSFs are found within the Columbia River Basin: Northern DPS and Great Basin DPS. It has been considered to make the Snake River a boundary between the Northern and Great Basin populations, but further genetic work will need to be done to clarify the issue (J. Engle, pers. Comm.., 2004). The Great Basin DPS is further divided into five subpopulations: southeastern Oregon, Owyhee, Jarbidge-Independence, Ruby Mountains, and Toiyabe (J. Engle, C. Mellison, pers. comm., 2004). Of the five subpopulations, only the eastern Oregon, Owyhee, and the Jarbidge-Independence occur in the Columbia River subbasin.

Historic

Historic range of the Northern population is most likely similar to that of the current range. Moving south into the southern populations (Great Basin, Wasatch Front, and West Desert) the range was most likely larger in size. More research needs to be performed to determine the status of CFS in the Owyhee Subbasin.

Current

Great Basin DPS
Nevada The Great Basin population of Columbia spotted frogs in Nevada is geographically separated into three distinct subpopulations; the Jarbidge-Independence Range, Ruby Mountains, and Toiyabe Mountains subpopulations (USFWS 2002c).
The largest of Nevada's three subpopulation areas is the Jarbidge-Independence Range in Elko and Eureka counties. This subpopulation area is formed by the headwaters of streams in two major hydrographic basins. The South Fork Owyhee, Owyhee, Bruneau, and Salmon Falls drainages flow north into the Snake River basin. Mary's River, North Fork of the Humboldt, and Maggie Creek drain into the interior Humboldt River basin.
The Jarbidge-Independence Range subpopulation is considered to be genetically and geographically most closely associated with Columbia spotted frogs in southern Idaho (Reaser 1997)(USFWS 2002c).

Columbia spotted frogs occur in the Ruby Mountains in the areas of Green Mountain, Smith, and Rattlesnake creeks on lands in Elko County managed by the U.S. Forest Service (Forest Service). Although geographically, Ruby Mountains spotted frogs are close to the Jarbidge-Independence Range subpopulation, preliminary allozyme evidence suggests they are genotypically different (J. Reaser, pers. comm., 1998). The Ruby Mountains subpopulation is considered discrete because of this difference (J. Reaser, pers. comm., 1998) and because it is geographically isolated from the Jarbidge-

Independence Range subpopulation area to the north by an undetermined barrier (e.g., lack of suitable.habitat, connectivity, and/or predators), and from the Toiyabe Mountains subpopulation area to the southwest by a large gap in suitable.Humboldt River drainage habitat (USFWS 2002c).

Genetic analyses of Great Basin Columbia spotted frogs from the Toiyabe Range suggest that these frogs are distinctive in comparison to frogs from the Ruby Mountains and Jarbidge-Independence Range subpopulation areas (Green et al. 1996, 1997; J. Reaser, pers. comm., 1998). Genetic (mtDNA) differences between the Toiyabe Range frogs and the Ruby Mountains frogs are less than those between the Toiyabe Range frogs and the Jarbidge-Independence Range frogs, but this may be because of similar temporal and spatial isolation (J. Reaser, pers. comm., 1998) (USFWS 2002c).
Idaho and Oregon

Only six historical sites were known in the Owyhee Mountain range in Idaho, and only 11 sites were known in southeastern Oregon in Malheur County prior to 1995 (Munger et al. 1996) (USFWS 2002c). Currently, Columbia spotted frogs appear to be widely distributed throughout southwestern Idaho (mainly in Owyhee County) and eastern Oregon, but local populations within this general area appear to be isolated from each other by either natural or human induced habitat disruptions. The largest local population of spotted frogs in Idaho occurs in Owyhee County in the Rock Creek drainage. The largest local population of spotted frogs in Oregon occurs in Malheur County in the Dry Creek Drainage (USFWS 2002c).

Columbia Spotted Frog Population, Status, and Abundance Trends

Nevada

Declines of Columbia spotted frog populations in Nevada have been recorded since 1962 when it was observed that in many Elko County localities where spotted frogs were once numerous, the species was nearly extirpated (Turner 1962). Extensive loss of habitat was found to have occurred from conversion of wetland habitats to irrigated pasture and spring and stream dewatering by mining and irrigation practices. In addition, there was evidence of extensive impacts on riparian habitats due to intensive livestock grazing. Recent work by researchers in Nevada have documented the loss of historically known sites, reduced numbers of individuals within local populations, and declines in the reproduction of those individuals (Hovingh 1990; Reaser 1996a, 1996b, 1997). Surveys in Nevada between 1994 and 1996 indicated that 54 percent of surveyed sites known to have frogs before 1993 no longer supported individuals (Reaser 1997; USFWS 2002c).

Little historical or recent data are available for the largest subpopulation area in Nevada, the Jarbidge-Independence Range. Presence/absence surveys have been conducted by Stanford University researchers and the Forest Service, but dependable information on numbers of breeding adults and trends is unavailable. Between 1993 and 1998, 976 sites were surveyed for the presence of spotted frogs in northeastern Nevada, including the Ruby Mountains subpopulation area (Shipman and Anderson 1997; Reaser 2000). Of these, 746 sites (76 percent) that were believed to have characteristics suitable for frogs were unoccupied. For these particular sites there is no information on historical presence of spotted frogs. Of 212 sites that were known to support frogs before 1992, 107 (50 percent) sites no longer had frogs, while 105 sites did support frogs. At the occupied sites, surveyors observed more than 10 adults at only 13 sites (12 percent). Frogs in this area appear widely distributed (Reaser 1997). No monitoring or surveying has taken place in northeastern Nevada since 1998. The Forest Service is planning on surveying the area during the summer of 2002 (USFWS 2002c).

Lack of standardized or extensive monitoring and routine surveying has prevented dependable determinations of frog population numbers or trends in Nevada (USFWS 2002c).

Idaho and Oregon

Extensive surveys since 1996 throughout southern Idaho and eastern Oregon, have led to increases in the number of known spotted frog sites. Although efforts to survey for spotted frogs have increased the available information regarding known species locations, most of these data suggest the sites support small numbers of frogs. Of the 49 known local populations in southern Idaho, 61 percent had 10 or fewer adult frogs and 37 percent had 100 or fewer adult frogs (Engle 2000; Idaho Conservation Data Center (IDCDC) 2000). The largest known local population of spotted frogs occurs in the Rock Creek drainage of Owyhee County and supports under 250 adult frogs (Engle 2000). Extensive monitoring at 10 of the 46 occupied sites since 1997 indicates a general decline in the number of adult spotted frogs encountered (Engle 2000; Engle and Munger 2000; Engle 2002). All known local populations in southern Idaho appear to be functionally isolated (Engle 2000; Engle and Munger 2000) (USFWS 2002c).

Of the16 sites that are known to support Columbia spotted frogs in eastern Oregon, 81 percent of these sites appear to support fewer than 10 adult spotted frogs. In southeastern Oregon, surveys conducted in 1997 found a single population of spotted frogs in the Dry Creek drainage of Malheur County. Population estimates for this site are under 300 adult frogs (Munger et al. 1996). All of the known local populations of spotted frogs in eastern Oregon appear to be functionally isolated (USFWS 2002c).
Legal Status

In 1989, the U.S. Fish and Wildlife Service (USFWS) was petitioned to list the spotted frog (referred to as Rana pretiosa) under ESA (Federal Register 541989:42529). The USFWS ruled on April 23, 1993, that the listing of the spotted frog was warranted and designated it a candidate for listing with a priority 3 for the Great Basin population, but was precluded from listing due to higher priority species (Federal Register 5887:27260). The major impetus behind the petition was the reduction in distribution apparently associated with impacts from water developments and the introduction of nonnative species.

On September 19, 1997 (Federal Register 62182:49401), the USFWS downgraded the priority status for the Great Basin population of Columbia spotted frogs to a priority 9, thus relieving the pressure to list the population while efforts to develop and implement specific conservation measures were ongoing. As of January 8, 2001 (Federal Register 665:1295- 1300), however, the priority ranking has been raised back to a priority 3 due to increased threats to the species. This includes the Great Basin DPS Columbia spotted frog populations

Factors Affecting Columbia Spotted Frog Population Status Key Factors Inhibiting Populations and Ecological Processes

The present or range destruction, modification, or curtailment of its habitat or range Spotted frog habitat degradation and fragmentation is maybe a combined result of past and current influences of heavy livestock grazing, spring development, agricultural development and mining activities. These activities can eliminate vegetation necessary to protect frogs from predators and UV-B radiation; reduce soil moisture; create undesirable changes in water temperature, chemistry and water availability; and can cause restructuring of habitat zones through trampling, rechanneling, or degradation which in turn can negatively affect the available invertebrate food source (IDFG et al. 1995; Munger et al. 1997; Reaser 1997; Engle and Munger 2000; Engle 2002). Over time habitat occurs in the same areas where these activities are likely to take place or where these activities occurred in the past and resulting habitat degradation has not improved over time. Natural fluctuations in environmental conditions tend to magnify the detrimental effects of these activities, just as the activities may also magnify the detrimental effects of natural environmental events (USFWS 2002c).

Springs provide a stable, permanent source of water for frog breeding, feeding, and winter refugia (IDFG et al. 1995). Springs provide deep, protected areas which serve as hibernacula for spotted frogs in cold climates. Springs also provide protection from predation through underground openings (IDFG et al. 1995; Patla and Peterson 1996). Spring developments that result in the installation of a pipe or box to fully capture the water source and direct water to another location such as a livestock watering trough may result in a loss of aquatic habitat in desert ecosystems. This can lead to the loss of available spotted frogs habitat. Developed spring pools could be functioning as attractive nuisances for frogs, concentrating them into isolated groups, increasing the risk of disease and predation (Engle 2001). Many of the springs in southern Idaho, eastern Oregon, and Nevada have been developed (USFWS 2002c).

The reduction of beaver populations has been noted as an important feature in the reduction of suitable.habitat for spotted frogs. Beaver are important in the creation of small pools with slow-moving water that function as habitat for frog reproduction and create wet meadows that provide foraging habitat and protective vegetation cover, especially in the dry interior western United States (St. John 1994). Horticultural planning is still common in Idaho and harvest is unregulated in most areas (IDFG et al. 1995). In some areas, beavers are removed because of a perceived threat to water for agriculture or horticultural plantings. As indicated above, permanent ponded waters are important in maintaining spotted frog habitats during severe drought or winter periods. Removal of a beaver dam in Stoneman Creek in Idaho is believed to be directly related to the decline of a spotted frog subpopulation there. Intensive surveying of the historical site where frogs were known to have occurred has documented only one adult spotted frog (Engle 2000) (USFWS 2002c).

Fragmentation of habitat may be one of the most significant barriers to spotted frog recovery and population persistence. Recent studies in Idaho indicate that spotted frogs exhibit breeding site fidelity (Patla and Peterson 1996; Engle 2000; Munger and Engle 2000; J. Engle, IDFG, pers. comm., 2001). Movement of frogs from hibernation ponds to breeding ponds may be impeded by zones of unsuitable.habitat. If movement corridors become more fragmented due to loss of flows within riparian or meadow habitats, local populations will become more isolated (Engle 2000; Engle 2001). Vegetation and surface water along movement corridors provide relief from high temperatures and arid environmental conditions, as well as protection from predators. Loss of vegetation and/or lowering of the water Table 2.2.as a result of the above mentioned activities can pose a significant threat to frogs moving from one area to another. Likewise, fragmentation and loss of habitat can prevent frogs from colonizing suitable.sites elsewhere (USFWS 2002c).

A direct correlation between spotted frog declines and livestock grazing has not been studied. The effects of improper grazing on riparian areas are will documented (Kauffman et al. 1982; Kauffman and Kreuger 1984; Skovlin 1984; Kauffman et al. 1985; Schulze and Leininger 1990).

The effects of mining on Great Basin Columbia spotted frogs, specifically, have not been studied, but the adverse effects of mining activities on water quality and quantity, other wildlife species, and amphibians in particular have been addressed in professional scientific forums (Chang et al. 1974; Birge et al. 1975; Greenhouse 1976; Khangarot et al. 1985) (USFWS 2002c). More research is necessary to determine the impacts of mining activities on SCF.

Disease or predation

Predation by fishes is likely an important threat to spotted frogs. The introduction of nonnative salmonid and bass species for recreational fishing may have negatively affected frog species throughout the United States. The negative effects of predation of this kind are difficult to document, particularly in stream systems. However, significant negative effects of predation on frog populations in lacustrine systems have been documented (Hayes and Jennings 1986; Pilliod et al. 1996, Knapp and Matthews 2000). One historic site in southern Idaho no longer supports spotted frog although suitable.habitat is available. This may be related to the presence of introduced bass in the Owyhee River (IDCDC 2000). The stocking of nonnative fishes is common throughout waters of the Great Basin. The Nevada Division of Wildlife (NDOW) has committed to conducting stomach sampling of stocked nonnative and native species to determine the effects of predation on spotted frogs. However, this commitment will not be fulfilled until the spotted frog conservation agreements are signed. To date, NDOW has not altered fish stocking rates or locations in order to benefit spotted frogs (USFWS 2002c).

The bull frog (Rana catesbeiana), a nonnative ranid species, occurs within the range of the spotted frog in the Great Basin. Bullfrogs are known to prey on other frogs (Hayes and Jennings 1986). They are rarely found to co-occur with spotted frogs, but whether this is an artifact of competitive exclusion is unknown at this time (USFWS 2002c).

Although a diversity of microbial species is naturally associated with amphibians, it is generally accepted that they are rarely pathogenic to amphibians except under stressful environmental conditions. Chytridiomycosis (chytrid) is an emerging panzootic fungal disease in the United States (Fellers et al. 2001). Clinical signs of amphibian chytrid include abnormal posture, lethargy, and loss of righting reflex. Gross lesions, which are usually not apparent, consist of abnormal epidermal sloughing and ulceration; hemorrhages in the skin, muscle, or eye; hyperemia of digital and ventrum skin, and congestion of viscera. Diagnosis is by identification of characteristic intracellular flask-shaped sporangia and septate thalli within the epidermis. Chytrid can be identified in some species of frogs by examining the oral discs of tadpoles which may be abnormally formed or lacking pigment (Fellers et al. 2001) (USFWS 2002c).

Chytrid was confirmed in the Circle Pond site, Idaho, where long term monitoring since 1998 has indicated a general decline in the population (Engle 2002). It is unclear whether the presence of this disease will eventually result in the loss of this subpopulation. Two additional sites may have chytrid, but this has yet to be determined (J. Engle, pers. comm., 2001). Protocols to prevent further spread of the disease by researchers were instituted in 2001. Chytrid has also been found in the Wasatch Columbia spotted frog distinct population segment (K. Wilson, pers comm., 2002). Chytrid has not been found in Nevada populations of spotted frogs (USFWS 2002c).

The spotted frog occurrence sites and potential habitats occur on both public and private lands. This species is included on the Forest Service sensitive species list; as such, its management must be considered during forest planning processes. However, little habitat restoration, monitoring or surveying has occureed on Forest Service Lands (USFWS 2002c).

BLM policies direct management to consider candidate species on public lands under their jurisdictional. To date, BLM efforts to conserve spotted frogs and their habitat in Idaho, Oregon, and Nevada have not been adequate to address threats (USFWS 2002c).

The status of local populations of spotted frogs on Yomba-Shoshone or Duck Valley Tribal lands is unknown.

The Nevada Division of Wildlife classifies the spotted frog as a protected species, but they are not afforded official protection and populations are not monitored. Though the spotted frog is on the sensitive species list for the State of Idaho, this species is not given any special protection by the State. Columbia spotted frogs are not on the sensitive species list for the State of Oregon. Protection of wetland habitat from loss of water to irrigation or spring development is difficult because most water in the Great Basin has been allocated to water rights applicants based on historical use and spring development has already occurred within much of the known habitat of spotted frogs. Federal lands may have water rights that are approved for wildlife use, but these rights are often superceded by historic rights upstream or downstream that do not provide for minimum flows. Also, most public lands are managed for multiple use and are subject to livestock grazing, silvicultural activities, and recreation uses that may be incompatible with spotted frog conservation without adequate mitigation measures (USFWS 2002c).

Other natural or manmade factors affecting its continued existence

Multiple consecutive years of less than average precipitation may result in a reduction in the number of suitable.sites available to spotted frogs. Local extirpations eliminate source populations from habitats that in normal years are available as frog habitat (Lande and Barrowclough 1987; Schaffer 1987; Gotelli 1995). These climate events are likely to exacerbate the effects of other threats, thus increasing the possibility of stochastic extinction of subpopulations by reducing their size and connectedness to other subpopulations (see Factor A for additional information). As movement corridors become more fragmented, due to loss of flows within riparian or meadow habitats, local populations will become more isolated (Engle 2000). Increased fragmentation of the habitat can lead to greater loss of populations due to demographic and/or environmental stochasticity (USFWS 2002c).

2.2.2.7 American Beaver[9]

Focal Habitat – Species Box
Riparian and wetlands
Columbia Spotted Frog
American Beaver
Yellow Warbler
Bald Eagle
White-faced Ibis

[9] This species account is based in part on a draft by Paul Ashley and Stacey Stovall. 2004. Southeast Washington Subbasin Planning Ecoregion Wildlife Assessment.

Image 2.15. American beaver; photo credits Mark Wallner.

The American beaver (*Castor canadensis*) is a large, highly specialized aquatic rodent found in the immediate vicinity of aquatic habitats (Hoffman and Pattie 1968). The species occurs in streams, ponds, and the margins of large lakes throughout North America, except for peninsular Florida, the Arctic tundra, and the southwestern deserts (Jenkins and Busher 1979). Beavers construct elaborate lodges and burrows and store food for winter use. The species is active throughout the year and is usually nocturnal in its activities. Adult beavers are nonmigratory.

The American Beaver occurs in ten habitat types in the Owyhee Subbasin -- based on current wildlife-habitat types (Table 2.12); the Beaver is present in the following four habitats:

- Upland Aspen Forest
- Western Juniper and Mountain Mahogany Woodlands
- Agriculture, Pastures, and Mixed Environs
- Urban and Mixed Environs

The Beaver is closely associated with the following three habitats:

- Open Water - Lakes, Rivers, and Streams
- Herbaceous Wetlands
- Interior Riparian-Wetlands

And the beaver is generally associated with the following three habitats:

- Montane Mixed Conifer Forest
- Interior Mixed Conifer Forest
- Montane Coniferous Wetlands

Table 2.12. American Beaver (Castor canadensis) association with all habitats occurring in the OWYHEE Subbasin: (Source: nwhi.org/ibis).

Wildlife-Habitat Type	Association Type	Activity Type	Confidence Level	Comments
Montane Mixed Conifer Forest	Generally Associated	Feeds	High	none
Interior Mixed Conifer Forest	Generally Associated	Feeds	High	none
Upland Aspen Forest	Present	Feeds	High	May use this habitat if not too far from water.
Western Juniper and Mountain Mahogany Woodlands	Present	Feeds	Low	none
Agriculture, Pastures, and Mixed Environs	Present	Feeds	Moderate	none
Urban and Mixed Environs	Present	Feeds	Moderate	none
Open Water - Lakes, Rivers, and Streams	Closely Associated	Reproduces	High	none
Herbaceous Wetlands	Closely Associated	Feeds and Breeds	High	none
Montane Coniferous Wetlands	Generally Associated	Feeds and Breeds	High	none
Interior Riparian-Wetlands	Closely Associated	Feeds and Breeds	High	none
Total Habitat Associations with American Beaver:	10			

All wetland cover types (e.g., herbaceous wetland and deciduous forested wetland) must have a permanent source of surface water with little or no fluctuation in order to provide suitable beaver habitat (Slough and Sadleir 1977). Water provides cover for the feeding and reproductive activities of the beaver. Lakes and reservoirs that have extreme annual or seasonal fluctuations in the water level will be unsuitable habitat for beaver. Similarly, intermittent streams, or streams that have major fluctuations in discharge (e.g., high spring runoff) or a stream channel gradient of 15 percent or more, will have little year-round value as beaver habitat. Assuming that there is an adequate food source available, small lakes < 8 ha (20 acres) in surface area are assumed to provide suitable habitat. Large lakes and reservoirs > 8 ha (20 acres) in surface area must have irregular shorelines (e.g., bays, coves, and inlets) in order to provide optimum habitat for beaver.

Beavers can usually control water depth and stability on small streams, ponds, and lakes; however, larger rivers and lakes where water depth and/or fluctuation cannot be controlled are often partially or wholly unsuitable for the species (Murray 1961; Slough and Sadleir 1977). Rivers or streams that are dry during some parts of the year are assumed to be unsuitable beaver habitat. Beavers are absent from sizable portions of rivers in Wyoming, due to swift water and an absence of suitable dwelling sites during periods of high and low water levels (Collins 1976b).

In riverine habitats, stream gradient is the major determinant of stream morphology and the most significant factor in determining the suitability of habitat for beavers (Slough and Sadleir 1977). Stream channel gradients of 6 percent or less have optimum value as beaver habitat. Retzer et al. (1956) reported that 68 percent of the beaver colonies recorded in Colorado were in valleys with a stream gradient of less than 6 percent, 28 percent were associated with stream gradients from 7 to 12 percent, and only 4 percent were located along streams with gradients of 13 to 14 percent. No beaver colonies were recorded in streams with a gradient of 15 percent or more. Valleys that were only as wide as the stream channel were unsuitable beaver habitat, while valleys wider than the stream channel were frequently occupied by beavers. Valley widths of 46 m (150 ft) or more were considered the most suitable. Marshes, ponds, and lakes were nearly always occupied by beavers when an adequate supply of food was available.

Much of the food ingested by a beaver consists of cellulose, which is normally indigestible by mammals. However, these animals have colonies of microorganisms living in the cecum, a pouch between the large and small intestine, and these symbionts digest up to 30 percent of the cellulose that the beaver takes in. An additional recycling of plant food occurs when certain fecal pellets are eaten and run through the digestive process a second time (Findley 1987).

Woody and herbaceous vegetation comprise the diet of the beaver. Herbaceous vegetation is a highly preferred food source throughout the year, if it is available. Woody vegetation may be consumed during any season, although its highest utilization occurs from late fall through early spring. It is assumed that woody vegetation (trees and/or shrubs) is more limiting than herbaceous vegetation in providing an adequate food source.

Denney (1952) summarized the food preferences of beavers throughout North America:

- Aspen (*Populus tremuloides*)
- Willow (*Salix spp.*),
- Cottonwood (*P. balsamifera*)
- Alder (*Alnus spp*.)

Although several tree species have often been reported to be highly preferred foods, beavers can inhabit, and often thrive in, areas where these tree species are uncommon or absent (Jenkins 1975). Aspen and willow are considered preferred beaver foods; however, these are generally riparian tree species that may be more available for beaver foraging but are not necessarily preferred over all other deciduous tree species (Jenkins 1981). Beavers have been reported to subsist in some areas by feeding on coniferous trees, generally considered a poor quality source of food (Brenner 1962; Williams 1965).The types of food species present may be less important in determining habitat quality for beavers than physiographic and hydrologic factors affecting the site (Jenkins 1981).

Aquatic vegetation are preferred foods when available:

- Duck potato (*Sagittaria spp.)*
- Duckweed (*Lemna spp.)*
- Dondweed (*Potamogeton spp.)*
- Water weed (Elodea spp.)

Limiting Factors affecting the American Beaver is agriculture. Sources for beavers along many water ways has been removed in order to plant agricultural crops, thus removing important habitat and food sources for beaver. Limited water in the subbasin makes pools created by beavers undesirable to many local farmers and irrigation districts. Increased debris from beaver dams also causes a problem for many irrigation systems. This has led to continued beaver trapping in may of the agricultural areas.

2.2.2.8 Yellow Warbler[10]

Focal Habitat – Species Box
Riparian and wetlands
Columbia Spotted Frog
American Beaver
Yellow Warbler
Bald Eagle
White-faced Ibis

[10] This species account is based in part on a draft by Paul Ashley and Stacey Stovall. 2004. Grasshopper Sparrow. Southeast Washington Subbasin Planning Ecoregion Wildlife Assessment. Appendix F: Focal Species Accounts.

Image 2.16 Yellow Warbler; photo credits Brian E. Small.

The Yellow Warbler (Dendroica petechia) is a common species strongly associated with riparian and wet deciduous habitats throughout its North American range. In the Owyhee Subbasin it is found in many areas, generally at lower elevations. It occurs along most riverine systems, where appropriate riparian habitats exist. The Yellow Warbler is a good indicator of functional subcanopy/shrub habitats in riparian areas.

The Yellow Warbler is a riparian obligate species most strongly associated with wetland habitats and deciduous tree cover. Yellow Warbler abundance is positively associated with deciduous tree basal area, and bare ground; abundance is negatively associated with mean canopy cover, and cover of:

- Douglas-fir (Pseudotsuga menziesii)
- Oregon grape (Berberis nervosa)
- Mosses
- Swordfern (Polystuchum munitum)
- Blackberry (Rubus discolor)
- Hazel (Corylus cornuta)
- Oceanspray (Holodiscus discolor) (Rolph 1998).

The Yellow Warbler occurs in two habitat types in the Owyhee Subbasin -- based on current wildlife-habitat types (Table 2.13); the Yellow Warbler is closely associated in the following habitat:

- Interior Riparian Wetlands

And the Yellow Warbler is generally associated with the following habitat:

- Upland Aspen Forest

Table 2.13. Yellow Warbler (Dendroica petechia) association with all habitats occurring in the OWYHEE Subbasin:

Wildlife-Habitat Type	Association Type	Activity Type	Confidence Level	Comments
Upland Aspen Forest	Generally Associated	Feeds and Breeds	High	none
Interior Riparian-Wetlands	Closely Associated	Feeds and Breeds	High	none
Total Habitat Associations with Yellow Warbler:	2			

Partners in Flight have established biological objectives for this species in the lowlands of western Oregon and western Washington. These include providing habitats that meet the following definition: >70 percent cover in shrub layer (<3 m) and subcanopy layer (>3 m and below the canopy foliage) with subcanopy layer contributing >40 percent of the total; shrub layer cover 30-60 percent (includes shrubs and small saplings); and a shrub layer height >2 m. At the landscape level, the biological objectives for habitat included high degree of deciduous riparian heterogeneity within or among wetland, shrub, and woodland patches; and a low percentage of agricultural land use (Altman 2001).

The Yellow Warbler breeds across much of the North American continent, from Alaska to Newfoundland, south to western South Carolina and northern Georgia, and west through parts of the southwest to the Pacific coast (AOU 1998). Browning (1994) recognized 43 subspecies. This species is a long-distance migrant and has a winter range extending from western Mexico south to the Amazon lowlands in Brazil (AOU 1998). Neither the breeding nor winter ranges appear to have changed (Lowther et al. 1999).

The Yellow Warbler breeds in riparian habitats within the subbasin. It is a locally common breeder along rivers and creeks in the Columbia Basin, where it is declining in some areas.

Limiting factors that can affect the status of the Yellow Warbler are:

- habitat loss due to hydrological diversions and control of natural flooding regimes (e.g., dams) resulting in reduction of overall area of riparian habitat;
- conversion of riparian habitats;
- inundation from impoundments;
- cutting and spraying for ease of access to water courses; and,
- gravel mining

The following may contribute to habitat degradation from: loss of vertical stratification in riparian vegetation, lack of recruitment of young cottonwoods, ash, willows, and other subcanopy species; which bank stabilization (e.g., riprap) which narrowing the narrows stream channel, reducing the flood zone, and reducing extent of riparian vegetation;

invasion of exotic species such as reed canary grass and blackberry; overgrazing which can reduce understory cover; reductions in riparian corridor widths which may decrease suitability of the habitat and may increase encroachment of nest predators and nest parasites to the interior of the stand.

2.2.2.9 Bald eagle[11]

Focal Habitat – Species Box
Riparian and wetlands
Columbia Spotted Frog
American Beaver
Yellow Warbler
Bald Eagle
White-faced Ibis

Image 2.17. Bald eagle; photo credits Michael H. Francis.

The Bald Eagle occurs in eleven habitat types in the Owyhee Subbasin -- based on current wildlife-habitat types (Table 2.14): Bald Eagles are closely associated with the following habitat:

- Open Water - Lakes, Rivers, and Streams

[11] This species account is based in part on a draft by Paul, Keith. 2004. Owyhee Subbasin Planning, Technical Team. February, 2004

And Bald Eagles are generally associated with the following 6 habitats:

- Montane Mixed Conifer Forest
- Interior Mixed Conifer Forest
- Agriculture, Pastures, and Mixed Environs
- Urban and Mixed Environs
- Herbaceous Wetlands
- Interior Riparian-Wetlands

Table 2.14. Bald Eagle (Haliaeetus leucocephalus) association with all habitats occurring in the OWYHEE Subbasin: (Source: nwhi.org/ibis).

Wildlife-Habitat Type	Association Type	Activity Type	Confidence Level	Comments
Montane Mixed Conifer Forest	Generally Associated	Reproduces	High	Could breed in this habitat where near open water habitats.
Interior Mixed Conifer Forest	Generally Associated	Reproduces	High	Could breed in this habitat where near open water habitats.
Alpine Grasslands and Shrublands	Present	Feeds	Low	Known to occur in sub-alpine and alpine areas on Vancouver Island, B.C.
Shrub-steppe	Present	Reproduces	High	Could breed in this habitat where near open water habitats, and if suitable.nest structures are available.
Dwarf Shrub-steppe	Present	Reproduces	High	Could breed in this habitat where near open water habitats, and if suitable.nest structures are available.
Desert Playa and Salt Scrub Shrublands	Present	Feeds	High	Wintering.
Agriculture, Pastures, and Mixed Environs	Generally Associated	Feeds	High	none
Urban and Mixed Environs	Generally Associated	Feeds and Breeds	High	Could breed in this habitat where near open water habitats, and if suitable.nest structures are available.
Open Water - Lakes, Rivers, and Streams	Closely Associated	Feeds	High	none
Herbaceous Wetlands	Generally Associated	Feeds	High	none
Interior Riparian-Wetlands	Generally Associated	Feeds and Breeds	High	none
Total Habitat Associations with Bald Eagle:	11			

Bald eagles in the lower 48 states were first protected in 1940 by the Bald Eagle Protection Act and then were federally listed as endangered in 1967. In 1995, the bald eagle was reclassified as threatened in all of the lower 48 States. The bald eagle was proposed for delisting on July 6, 1999; a decision on whether to delist the bald eagle is pending (64 FR 36453). No critical habitat has been designated for the bald eagle (USFWS 2003).

The bald eagle is one of eight species of sea-eagle (genus Haliaeetus) worldwide (Brown 1977), and the only sea eagle found throughout North America (Stalmaster 1987). Large size, wingspan of 6.6-8.0 ft (200-243 cm) (Stalmaster 1987), and the contrast of white head and tail, and yellow eyes, beak, and legs, to dark brown body and wings make the adult bald eagle one of our most distinctive raptors (Isaacs and Anthony 2003a).

Bald Eagle Life History, Key Environmental Correlates, and Habitat Requirements

Life History
As our national symbol, the bald eagle is widely recognized. Its distinctive white head and tail do not appear until the bird is four to five years old. These large powerful raptors can live for 30 or more years in the wild and even longer in captivity (USFWS 2003).

Diet
Bald eagles consume a variety of prey that varies by location and season. Prey are taken alive, scavenged, and pirated (Frenzel 1985, Watson et al. 1991). Fish were the most frequent prey among 84 species identified at nest sites in south-central Oregon, and a tendency was observed for some individuals or pairs to specialize in certain species (Frenzel 1985). Wintering and migrant eagles in eastern Oregon fed on large mammal carrion, especially road-killed mule deer, domestic cattle that died of natural causes, and stillborn calves, as well as cow afterbirth, waterfowl, ground squirrels, other medium-sized and small rodents, and fish. Proportions varied by month and location. Food habitats are unknown for nesting eagles over much of the state (Isaacs and Anthony 2003a).

Reproduction
Bald eagles are most abundant in Oregon in late winter and early spring, because resident breeders (engaged in early nesting activities), winter residents, and spring transients are all present. Nest building and repair occur any time of year, but most often observed from February to June (Isaacs and Anthony unpublished data). Bald eagles are territorial when breeding but gregarious when not (Stalmaster 1987). They exhibit strong nest-site fidelity (Jenkins and Jackman 1993), but "divorce" has been documented (Frenzel 1985, Garrett et al 1993). Cooperative nesting by three adults was reported (Garcelon et al. 1995). Both sexes build the nest, incubate eggs, and brood and feed young (Stalmaster 1987). Egg laying occurs mid-February to late April; hatching late March to late May; and fledging late June to mid-Aug (Isaacs and Anthony unpublished data) (Isaacs and Anthony 2003a).

Bald eagles lay one to four eggs in late March or early April and both adults incubate the eggs for about 35 days until hatching. During the nest building, egg laying and incubating periods, eagles are extremely sensitive and will abandon a nesting attempt if there are excessive disturbances in the area during this time. The eaglets are able to fly in about three months and then, after a month, they are on their own. The first year is particularly difficult for young eagles. Only half may survive the first year due to disease, lack of food, bad weather, or human interference (USFWS 2003).

Migration
Bald eagles can be resident year-round where food is available; otherwise they will migrate or wander to find food. When not breeding, eagles may congregate where food is abundant, even away from water (Stalmaster 1987). Migrants passing through Glacier National Park generally followed north-south flyways similar to those of waterfowl (McClelland et al. 1994). In contrast, juveniles and subadults form California traveled north to Oregon, Washington, and British Columbia in late summer and fall (D. K. Garcelon p.c., R. E. Jackman p.c.) (Isaacs and Anthony 2003a).

Mortality
Reviews of published literature (Harmata et al. 1999., Jenkins et al. 1999) suggested that survival varies by location and age; hatch-year survival was usually >60%, and survivorship increased with age to adulthood. However, recent work by Harmata et al. (1999) showed survival lowest among 3- and 4-year old birds (Isaacs and Anthony 2003a).

The major factor leading to the decline and subsequent listing of the bald eagle was disrupted reproduction resulting from contamination by organochlorine pesticides. Other causes of death in bald eagles have included shooting, electrocution, impact injuries, and lead poisoning (USFWS 2003).

Habitat Requirements

General
Bald eagles are generally associated with large bodies of water, but can occur in any habitat with available prey (Isaacs and Anthony 2003a)

Nesting Habitat
Bald eagles nest in forested areas near the ocean, along rivers, and at estuaries, lakes, and reservoirs (Isaacs and Anthony 2001). Consequently, shoreline is an important component of nesting habitat; 84% of Oregon nests were within 1 mi (1.6 km) of water (Anthony and Isaacs 1989). Live trees are usually used for nest trees, although nests will continue to be used if the tree dies. Nest trees are usually large and prominent (Anthony et al. 1982). Large old trees have large limbs and open structure required for eagle access and nest territory. Some use has been made of artificial platforms placed in trees modified for Osprey (Witt 1996, Isaacs and Anthony unpublished data, R. Opp p.c.). Cliff nesting is thus unknown, but possible, especially in sparsely forested areas of southeast Oregon (Isaacs and Anthony 2003a).

Wintering Habitat
Wintering eagles in the Pacific Northwest perch on a variety of substrates; proximity to a food source is probably the most important factor influencing perch selection by bald eagles (Steenhof et al. 1980). Favored perch trees are invariably located near feeding

areas, and eagles consistently use preferred branches (Stalmaster 1976). Most tree perches selected by eagles provide a good view of the surrounding area (Servheen 1975, Stalmaster 1976), and eagles tend to use the highest perch sites available (Stalmaster 1976) (USFWS 1986).

Eagles use a variety of tree species as perch sites, depending on regional forest types and stand structures. Dead trees are used by eagles in some areas because they provide unobstructed view and are often taller than surrounding vegetation (Stalmaster 1976). Artificial perches may be important to wintering bald eagles in situations where natural perches are lacking. (Fielder, p.c.) in Washington, where perch trees are not available, eagles regularly use artificial perches, including both crossarm perches and a tripod perch (Fielder, p.c.) (USFWS 1986).

Habitat requirements for communal night roosting are different form those for diurnal perching. Communal roosts are invariably near a rich food resource and in forest stands that are uneven-aged and have at least a remnant of the old-growth forest component (Anthony et al. 1982). Close proximity to a feeding area is not the only requirement for night roosting sites, as there are minimum requirements for forest stand structure. In open areas, bald eagles also use cottonwoods and willows for night roosting (Isaacs and Anthony 1983). Most communal winter roosts used by bald eagles offer considerably more protection from the weather than diurnal habitat. Roost tree species and stand characteristics vary considerably throughout the Pacific Northwest (Anthony et al 1982) (USFWS 1986).

Isolation is an important feature of bald eagle wintering habitat. In Washington, 98% of wintering bald eagles tolerated human activities at a distance of 300 m (328 yards) (Stalmaster and Newman 1978). However, only 50% of eagles tolerated disturbances of 150 m (164 yards) (USFWS 1986).

Factors Affecting Bald Eagle Population Status

Currently, loss of habitat and human disturbance are still potential threats. Habitat loss results from the physical alteration of habitat as well as from human disturbance associated with development or recreation (i.e., hiking, camping, boating, and ORV use). Activities that can and have negatively impacted bald eagles include logging, mining, recreation, overgrazing (particularly in riparian habitats), road construction, wetland filling, and industrial development.

These activities, as well as suburban and vacation home developments are particularly damaging when they occur in shoreline habitats. Activities that produce increased siltation and industrial pollution can cause dissolved oxygen reductions in aquatic habitats, reduction s in bald eagle fish prey populations followed by reductions in the number of eagles. Not all developments in floodplain habitats are detrimental to bald eagles, as some reservoirs and dams have created new habitat with dependable food supplies (USFWS 2003). The Owyhee Reservoir is one example of this.

Although habitat loss and residual contamination remain a threat to the bald eagle's full recovery, breeding populations in most areas of the country are making encouraging progress. The following continue to be important conservation measures (USFWS 2003):
Avoid disturbance to nests during the nesting season: January – August.
Avoid disturbance to roosts during the wintering season: November – March.
Protect riparian areas from logging, cutting, or tree clearing.
Protect fish and waterfowl habitat in bald eagle foraging areas.
Development of site-specific management plans to provide for the long-term availability of habitat

2.2.2.10 White-faced ibis[12]

Focal Habitat – Species Box
Riparian and wetlands
Columbia Spotted Frog
American Beaver
Yellow Warbler
Bald Eagle
White-faced Ibis

Image 2.18. White-faced ibis; photo credits Tom J. Ulrich.

[12] This species account is based in part on a draft by Tim Dykstra, Shoshone-Paiute Tribes, 3-23-2004.

The white-faced ibis (*Plegadis chihi*) is a highly mobile, long-legged wading bird with a distinctively long, decurved bill. They are highly gregarious colony nesters that can also be found foraging in flocks (Ryder and Manry 1994). White-faced ibises have been identified by some ranchers as detrimental to alfalfa crops due to trampling and soil compaction.

The majority of recent North American works consider white-faced ibis a full species with no recognition of subspecies. White-faced ibises are associated with wetland areas such as reservoirs and irrigated fields during breeding and migration. During the breeding season, birds are usually found at inland, shallow marshes with "islands" of emergent vegetation. If regular nesting areas are dry from drought or human drainage, white-faced ibis will find new areas for nesting. During the nesting period, birds may forage 3 – 6 km from the breeding colony but have been documented traveling as far as 18 km. Towards the end of the breeding season, adults in Idaho were documented traveling 40 – 48 km between daytime feeding areas and nighttime roosts in tall emergents.

The White-faced ibis occurs in four habitat types in the Owyhee Subbasin -- based on current wildlife-habitat types (Table 2.15) the White-faced ibis is closely associated with the following habitat:

- Herbaceous Wetlands

And they are generally associated with the following three habitats:

- Desert Playa and Salt Scrub Shrublands
- Agriculture, Pastures, and Mixed Environs
- Open Water - Lakes, Rivers, and Streams

Table 2.15. White-faced Ibis (Plegadis chihi) association with all habitats occurring in the OWYHEE Subbasin (Source: nwhi.org/ibis).

Wildlife-Habitat Type	Association Type	Activity Type	Confidence Level	Comments
Desert Playa and Salt Scrub Shrublands	Generally Associated	Feeds	Moderate	In wet areas.
Agriculture, Pastures, and Mixed Environs	Generally Associated	Feeds	High	Associated with irrigated fields on the Eastside.
Open Water - Lakes, Rivers, and Streams	Generally Associated	Feeds	Moderate	none
Herbaceous Wetlands	Closely Associated	Feeds and Breeds	High	none
Total Habitat Associations with White-faced Ibis:	4			

The White faced ibis is most closely associated with the Herbaceous Wetlands habitat -- where it feeds and breeds. This habitat may be found on permanently or seasonally flooded wetlands. In general, this habitat is flat, usually with stream or river channels or open water present. Herbaceous wetlands are found in all terrestrial habitats except Subalpine Parkland, Alpine Grasslands, and Shrublands habitats (Crawford et al. nwhi.org/ibis 2004). Herbaceous wetland habitat is generally a mix of emergent herbaceous plants with a grass-like life form (graminoids). Various wetland communities are found in mosaics or in nearly pure stands of single species. Herbaceous cover varies from open to dense.

The breeding range of U.S. populations includes northern California, eastern Oregon, southern Idaho, northern Nevada, southern Alberta, Montana, eastern North and South Dakota, and northwest Iowa south to the Mexican states of Durango and Jalisco (Ryder and Manry 1994). Coastal Texas and Louisiana also support breeding white-faced ibis. Northernmost populations regularly migrate north-south to coastal Texas and Louisiana and Mexico. Birds may also be found wintering in southern California and the lower Colorado River Valley of Arizona. Birds in the Owyhee subbasin usually arrive on the breeding grounds in April and leave between September and October. In the Great Basin, the largest nesting colonies are usually in stands of hardstem bulrush (*Scirpus acutus*), Olney's bulrush (*S. olneyi*), and alkali bulrush (*S. paludosus*). Nests have been observed at Carson Lake, Nevada, and Malheur National Wildlife Refuge, Oregon, in hardstem bulrush. Although data are lacking, white-faced ibises are presumed to be monogamous and produce one clutch a year. Nests are usually constructed in emergent vegetation or low trees and shrubs over shallow water although they may be found on the ground on small islands. Nesting may be delayed by high water or habitat degredation (i.e., vegetation damaged by fire or herbivorous mammals). If an early nesting attempt fails, they may attempt to renest, but second clutches have been documented as less successful. Two to five eggs may be laid per clutch, and in Nevada, a mean clutch size of 3.21 (n = 140, Henny and Herron 1989) was calculated. Eighty-three percent (n = 42) of nests in the same area produced ≥ one 7-day-old chick. Annual reproductive success was 2.54 per successful nest (n = 150), but lifetime reproductive success is unknown. The oldest bird known in the wild was 14.5 yr-old but band recoveries in Utah (n = 111) documented all birds dying by nine years of age (Ryder and Manly 1994).

Threats to survival include exposure (particularly small nestlings) and predation (Ryder and Manry 1994). Predation on adults is probably negligible but on the feeding grounds, large raptors (e.g. peregrine falcons or red-tailed hawks) will occasionally take them. Eggs and small nestlings are at risk to avian and terrestrial nest predators. The main foods consumed by white-faced ibises include aquatic and moist-soil insects, crustaceans, and earthworms. Feeding sites are typically shallowly flooded pond margins, reservoirs, marshes, or flooded agricultural fields where vegetation is <5 to 90 cm high. Plant materials and seeds that have been consumed by white-faced ibis are believed to have been incidentally ingested. In Idaho, the importance of mudflats as a source of highly concentrated earthworms and chironomid larvae was stressed by Taylor et al. (1989). These areas enable ibises to increase fat reserves prior to fall migration.

White-faced ibises are highly mobile and will shift breeding areas between years, making population census efforts difficult in the absence of coordinated surveys with standardized techniques repeated at regular intervals (Ryder and Manry 1994). Annual or biannual censusing of breeding colonies occurs in Nevada, Oregon, and Texas but is sporadic and incomplete in Idaho and other states. Population surveys and status assessments require coordinated efforts between states, agencies, and other relevant parties. White-faced ibis surveys in the western BBS region (+22.3%, $P < 0.001$, n = 36) indicate populations have been increasing between 1966 and 2002 (Sauer et al. 2003). The Donabahba Yogee marsh on the Duck Valley Indian Reservation and within the Owyhee subbasin has a large colony of nesting white-faced ibis (>2000 birds in 1993, John Doremus pers. Com.). A pair of white-faced ibises was observed near the USAF Grasmere Study Area in 1996. Potential breeding habitat exists in Wickahoney and China Ponds near Grasmere (USAF 1998). Ibis also can be found in irrigated fields throughout the subbasin. White-faced ibis have been observed in areas near the Owyhee subbasin such as the Cedar Mesa Reservoir, Heil Reservoir, and Camas Slough Reservoir in the spring (BLM Jarbidge Resource Area, Klott 1996)(Table 2.2). White-faced ibis is protected by Idaho and Nevada and is classified as a type 4 sensitive species by the Idaho BLM (ICDC 2003). The heritage ranking of G5S2B qualifies white-faced ibis as globally secure but as a rare breeder in Idaho (ICDC 2003).

Limiting factors for white-faced ibis include pesticides and habitat deterioration. DDT continues to be used on the wintering grounds in Mexico, and contaminant concentrations (DDE) remain high in Great Basin white-faced ibis populations which can contribute to a decrease in productivity. Cattle grazing and trampling of nesting habitat, prescribed burning of emergent vegetation to enhance habitat for waterfowl, drought, and human disturbance to nesting colonies can all impact nesting success (Ryder and Manry 1994). Areas successfully mitigated by allocating limited water resources to prioritized breeding area(s).

2.2.2.11 California quail

Focal Habitat – Species Box
Agricultural Lands
California Quail

The California quail was selected by the Owyhee Subbasin planning group to be representative of agricultural lands (Image 2.19).

Image 2.19. California quail; photo credits Hugh P. Smith Jr.

The California quail and introduced species, is a small, plump bird with a short black beak. The male has a gray chest and brown back and wings. It has a black throat with white stripes and a brown cap on its head. The female has a gray or brown head and back and a lighter speckled chest and belly. Both the male and the female have a curved black crown feather on their foreheads. The male's crown feather is larger than the females. The California quail is sometimes called the valley quail.

The California quail occurs in seven habitat types in the Owyhee Subbasin -- based on current wildlife-habitat types (Table 2.16): The California Quail is generally associated with the following seven habitats:

- Western Juniper and Mountain Mahogany Woodlands
- Interior Canyon Shrublands
- Interior Grasslands
- Shrub-steppe
- Agriculture, Pastures, and Mixed Environs
- Urban and Mixed Environs
- Interior Riparian-Wetlands

Table 2.16.California Quail (Callipepla californica) association with all habitats occurring in the OWYHEE Subbasin: (Source: nwhi.org/ibis).

Wildlife-Habitat Type	Association Type	Activity Type	Confidence Level	Comments
Western Juniper and	Generally	Feeds	High	none

Mountain Mahogany Woodlands	Associated	and Breeds		
Interior Canyon Shrublands	Generally Associated	Feeds and Breeds	High	none
Interior Grasslands	Generally Associated	Feeds and Breeds	High	Uses this habitat if adjacent to urban, agriculture, or Eastside Riparian habitats.
Shrub-steppe	Generally Associated	Feeds and Breeds	High	Uses this habitat if adjacent to urban, agriculture, or eastside riparian habitats.
Agriculture, Pastures, and Mixed Environs	Generally Associated	Feeds and Breeds	High	none
Urban and Mixed Environs	Generally Associated	Feeds and Breeds	High	none
Interior Riparian-Wetlands	Generally Associated	Feeds and Breeds	High	Uses this habitat where adjacent to more open habitats.
Total Habitat Associations with California Quail:	7			

Habitat:
Grasslands, foothills, woodlands, canyons and the edge of deserts are area California Quail are associated with. They like areas with lots of brush. California quail are most commonly found in the west coast regions of the United States. California quail prefer living in open woodlands, bushy foothills, valleys with streams, and suburbs. They can also live in brushland and agricultural land (National Geographic 1999; Handbook of the Birds of the World, Volume 2).

Range:
The California quail can be found from southern Oregon to southern California and east into Nevada. Within the Owyhee Subbasin, populations exist in abundance on agricultural lands located below the Owyhee dam.

2.2.2.12 Grasshopper sparrow[13]

Focal Habitat – Species Box
Grasslands

[13] This species account is based in part on a draft by Paul Ashley, Stacy Stoval, Southeast Washington Ecoregional Assessment., January 2004.

Grasshopper Sparrow

The grasshopper sparrow (Image 2.20) was selected by the Owyhee Subbasin planning group to be representative of grasslands.

Image 2.20. Grasshopper sparrow; photo credits Alvin E. Staffan.

Grasshopper sparrows are active ground or low shrub searchers. Vickery (1996) states that exposed bare ground is the critical microhabitat type for effective foraging. Bent (1968) observed that grasshopper sparrows search for prey on the ground, in low foliage within relatively dense grasslands, and sometimes scratch in the litter.

Many of these steppe, grassland, species are declining in our area. BBS data (Robbins et al. 1986) have shown a decreasing long term trend for the grasshopper sparrow (1966-1998) (Sauer *et al.* 1999). Throughout the U.S., this sparrow has experienced population declines throughout most of its breeding range (Brauning 1992, Brewer *et al.* 1991, Garrett and Dunn 1981). In 1996, Vickery (1996) reported that grasshopper sparrow populations have declined by 69% across the U.S. since the late 1960s. In Oregon it is considered as a naturally rare, vulnerable species, and a state Heritage program status as imperiled.

The Grasshopper Swallow occurs in four habitat types in the Owyhee Subbasin -- based on current wildlife-habitat types (Table 2.17): The Grasshopper Swallow is closely associated with the following two habitats:

- Interior Grasslands
- Agriculture, Pastures, and Mixed Environs

Table 2.17. Grasshopper Sparrow (Ammodramus savannarum) association with all habitats occurring in the OWYHEE Subbasin (Source: nwhi.org/ibis).

Wildlife-Habitat Type	Association Type	Activity Type	Confidence Level	Comments
Interior Grasslands	Closely Associated	Feeds and Breeds	High	none
Shrub-steppe	Generally Associated	Feeds and Breeds	High	none
Dwarf Shrub-steppe	Generally Associated	Feeds and Breeds	High	none
Agriculture, Pastures, and Mixed Environs	Closely Associated	Feeds and Breeds	High	none
Total Habitat Associations with Grasshopper Sparrow:	4			

Habitat Requirements

Grasshopper sparrows prefer grasslands of intermediate height and are often associated with clumped vegetation interspersed with patches of bare ground (Bent 1968, Blankespoor 1980, Vickery 1996). Other habitat requirements include moderately deep litter and sparse coverage of woody vegetation (Smith 1963; Bent 1968; Wiens 1969, 1970; Kahl et al. 1985; Arnold and Higgins 1986). In east central Oregon grasshopper sparrows occupied relatively undisturbed native bunchgrass communities dominated by *Agropyron spicatum* and/or *Festuca idahoensis*, particularly north-facing slopes on the Boardman Bombing Range, Columbia Basin (Holmes and Geupel 1998).

In portions of Colorado, Kansas, Montana, Nebraska, Oklahoma, South Dakota, Texas, Wisconsin, and Wyoming, abundance of grasshopper sparrows was positively correlated with percent grass cover, percent litter cover, total number of vertical vegetation hits, effective vegetation height, and litter depth; abundance was negatively correlated with percent bare ground, amount of variation in litter depth, amount of variation in forb or shrub height, and the amount of variation in forb and shrub heights (Rotenberry and Wiens 1980).

Grasshopper sparrows have also been found breeding in Conservation Reserve Program (CRP) fields, pasture, hayland, airports, and reclaimed surface mines (Wiens 1970, 1973; Harrison 1974; Ducey and Miller 1980; Whitmore 1980; Kantrud 1981; Renken 1983; Laubach 1984; Renken and Dinsmore 1987; Bollinger 1988; Frawley and Best 1991; Johnson and Schwartz 1993; Klute 1994; Berthelsen and Smith 1995; Hull et al. 1996; Patterson and Best 1996; Delisle and Savidge 1997; Prescott 1997; Koford 1999; Jensen 1999; Horn and Koford 2000). In Alberta, Manitoba, and Saskatchewan, grasshopper sparrows are more common in grasslands enrolled in the Permanent Cover Program

(PCP) than in cropland (McMaster and Davis 1998). PCP was a Canadian program that paid farmers to seed highly erodible land to perennial cover; it differed from CRP in that haying and grazing were allowed annually in PCP.

Grasshopper sparrows occasionally inhabit cropland, such as corn and oats, but at a fraction of the densities found in grassland habitats (Smith 1963, Smith 1968, Ducey and Miller 1980, Basore et al. 1986, Faanes and Lingle 1995, Best *et al.* 1997). Grasshopper sparrows are also included as members of shrub-steppe communities, occupying the steppe habitats.

Limiting Factors for the Grasshopper Sparrow

The principal post-settlement conservation issues affecting bird populations include: habitat loss and fragmentation resulting from conversion to agriculture; and habitat degradation and alteration from historic improper livestock grazing, invasion of exotic vegetation, and alteration of historic fire regimes. Conversion of shrub-steppe lands to agriculture adversely affects landbirds in two ways:

- Native habitat is in most instances permanently lost, and
- Remaining shrub-steppe is isolated and embedded in a highly fragmented landscape of multiple land uses, particularly agriculture.

Fragmentation resulting from agricultural development or large fires fueled by cheatgrass can have several negative effects on landbirds. These include: insufficient patch size for area-dependent species, and increases in edges and adjacent hostile landscapes, which can result in reduced productivity through increased nest predation, nest parasitism, and reduced pairing success of males. Additionally, fragmentation of shrub-steppe has likely altered the dynamics of dispersal and immigration necessary for maintenance of some populations at a regional scale. In a recent analysis of neotropical migratory birds within the Interior Columbia Basin, most species identified as being of "high management concern" were shrub-steppe species (Saab and Rich 1997) which includes the grasshopper sparrow.

Approximately 6 million hectares of shrub-steppe have been converted to wheat fields, row crops, and orchards in the interior Columbia Basin (Quigley and Arbelbide 1997). Large scale reduction and fragmentation of sagebrush habitats have occurred due to a number of activities, including land conversion to tilled agriculture, urban and suburban development, and road and power-line rights of way. Range improvement programs remove sagebrush by burning, herbicide application, and mechanical treatment, replacing sagebrush with annual grassland.

2.2.2.13 California Bighorn sheep

Focal Habitat – Species Box
Canyon / Gorge

California bighorn sheep
Peregrine falcon

The California bighorn sheep is one of two species selected by the Owyhee Subbasin planning group to be representative of the Canyon / Gorge habitat (Image 2.21):

Image 2.21. California bighorn sheep; photo credits Michael H. Francis.

At one time, bighorn sheep roamed much of the western portion of North America. They existed in several subspecies and occupied from the Canadian Rockies of Alberta south to the mountain ranges of Mexico including portions of Oregon. In the mid-1800's they were quite numerous with an estimated population between 1.5 and 2 million (Seton 1953, Buechner 1960). As a result of the expansion of civilization without management protection, by 1900 they had been reduced to thousands and were extirpated from much of their former range (Oregon Department of Fish and Wildlife 2003)

Rocky Mountain bighorn sheep were extirpated from the Subbasin in the mid-1940's. As a result of transplant efforts, populations have been re-established. The Bighorn Sheep occurs in six habitat types in the Owyhee Subbasin -- based on current wildlife-habitat types (Table 2.18):

Bighorn Sheep are most closely associated with the following two habitats:

- Alpine Grasslands and Shrublands
- Interior Canyon Shrublands

Table 2.18. Bighorn Sheep (Ovis canadensis) association with all habitats occurring in the OWYHEE Subbasin (Source: nwhi.org/ibis).

Wildlife-Habitat Type	Association Type	Activity Type	Confidence Level	Comments
Montane Mixed Conifer Forest	Present	Feeds	Moderate	none
Interior Mixed Conifer Forest	Present	Feeds	Moderate	none
Alpine Grasslands and Shrublands	Closely Associated	Feeds and Breeds	High	none
Interior Canyon Shrublands	Closely Associated	Feeds and Breeds	High	none
Interior Grasslands	Generally Associated	Feeds and Breeds	High	none
Agriculture, Pastures, and Mixed Environs	Present	Feeds	High	May use unimproved pastures.
Total Habitat Associations with Bighorn Sheep:	6			

California bighorns historically were and still are the most abundant in Oregon (Toweill and Geist 1999).

Grasses are the major item in bighorn diets throughout most of the year. However, forbs and shrubs are seasonally important depending on type and availability. Bighorn sheep generally are not competitors for forage with domestic cattle and other big game species because they typically occupy rugged habitats not used by other big game species. Domestic sheep can compete with bighorn sheep for forage because open range operations frequently include trailing through remote, rugged habitat. (Oregon Department of Fish and Wildlife 2003).

Bighorn sheep habitat typically is comprised of rugged habitat that is used by the sheep for security from predation. This habitat can be in the form of Canyons characterized by rim rocks with grass interspersed in the steep slopes between the rocky outcrops, alpine habitat which can be high elevation lush meadows or rocky security cover, or steep grass covered slopes as winter habitat (Oregon Department of Fish and Wildlife 2003). Rocky Mountain bighorn sheep occupying alpine habitat generally use it for summer range and migrate to lower elevation grassy slopes or canyon habitat to winter. Bighorns living in canyon habitat most often occupy that same habitat year-round. In many cases, canyon habitat grasses dry out during August and September. As a result, sheep in these areas may become stressed for nutrition during autumns with little rainfall (Oregon Department of Fish and Wildlife 2003).

Currently there are three key factors which threaten the Rocky Mountain bighorn sheep:

- The continuing threat of disease transmission from domestic sheep and goats both in the high elevation areas of the subbasin and in the privately owned river bottom farmsteads that are oriented below the bighorn sheep habitat.
- A large portion of the core bighorn sheep habitat not being in protected status and vulnerable to land management changes negative to bighorn sheep.
- The continued threat of noxious weed invasion.

2.2.2.14 Peregrine falcon[14]

Focal Habitat – Species Box
Canyon / Gorge
California bighorn sheep
Peregrine falcon

Although the peregrine falcon (Image 2.22) occurs in all habitat types in the Owyhee Subbasin, it was one of two species selected by the Owyhee Subbasin planning group to be representative of the Canyon / Gorge habitat:

Image 2.22. Peregrine falcon; photo credits Tom McHugh.

The peregrine was described by Peterson (1988), as "the most efficient flying machine, the best-designed bird, and the fiercest and fastest bird – all these superlatives have been

[14] This species account is based on a draft by Keith Paul, US Fish & Wildlife Service, 04/13/04.

claimed for the peregrine." They are described as the fastest animal on the planet, reaching speeds in excess of 240 mi/hr (380 km/hr) in dives after prey (Henny and Pagel 2003). Pagel (Henny and Pagel 2003), notes that "they are one of Oregon's boldest raptors, and have been observed usurping active golden eagle nest sites, stealing fish from osprey and ground squirrels from red-tailed hawks, as well as regularly driving away adult bald eagles who stray into their territories."

Peregrines are medium-sized raptors, and share characteristics with all falcons: bill conspicuously toothed and notched, presence of a nasal cone, and pointed wings for swift flight (Henny and Pagel 2003). The male is smaller than the female (about the size of the American crow); the female about the size of a raven (Henny and Pagel 2003). The adult peregrine is described by Gabrielson and Jewett (1940) with sides of the head and neck black, in striking contrast to white or buffy throat and breast; the rest of the underparts deeper colored and spotted or barred with blackish color; lighter on rump, indistinctly barred with dusky color; wing quills blackish, inner webs of quills spotted regularly with buffy or yellowish brown; tail blackish, crossed by eight to ten light grayish bars, and with a narrow white tip.

The Peregrine Falcon occurs in sixteen habitat types in the Owyhee Subbasin -- based on current wildlife-habitat types (Table 2.19) the Peregrine Falcon is present in the following three habitats:

- Dwarf Shrub-steppe
- Desert Playa and Salt Scrub Shrublands
- Agriculture, Pastures, and Mixed Environs

The Peregrine Falcon is generally associated with the following thirteen habitats:

- Montane Mixed Conifer Forest
- Interior Mixed Conifer Forest
- Upland Aspen Forest
- Alpine Grasslands and Shrublands
- Western Juniper and Mountain Mahogany Woodlands
- Interior Canyon Shrublands
- Interior Grasslands
- Shrub-steppe
- Urban and Mixed Environs
- Open Water - Lakes, Rivers, and Streams
- Herbaceous Wetlands
- Montane Coniferous Wetlands
- Interior Riparian-Wetlands

Table 2.19 peregrine falcon (Falco peregrinus) association with all habitats occurring in the OWYHEE Subbasin (Source: nwhi.org/ibis).

Wildlife-Habitat Type	Association Type	Activity Type	Confidence Level	Comments
Montane Mixed Conifer Forest	Generally Associated	Feeds and Breeds	High	Requires suitable.cliffs for nesting.
Interior Mixed Conifer Forest	Generally Associated	Feeds and Breeds	High	Requires suitable.cliffs for nesting.
Upland Aspen Forest	Generally Associated	Feeds	Low	none
Alpine Grasslands and Shrublands	Generally Associated	Feeds and Breeds	High	Requires suitable.cliffs for nesting.
Western Juniper and Mountain Mahogany Woodlands	Generally Associated	Feeds and Breeds	High	Requires suitable.cliffs for nesting.
Interior Canyon Shrublands	Generally Associated	Feeds and Breeds	High	Requires suitable.cliffs for nesting.
Interior Grasslands	Generally Associated	Feeds and Breeds	High	Requires suitable.cliffs for nesting.
Shrub-steppe	Generally Associated	Feeds and Breeds	High	Requires suitable.cliffs for nesting.
Dwarf Shrub-steppe	Present	Feeds	Moderate	none
Desert Playa and Salt Scrub Shrublands	Present	Feeds	Moderate	none
Agriculture, Pastures, and Mixed Environs	Present	Feeds	High	none
Urban and Mixed Environs	Generally Associated	Feeds and Breeds	High	Requires suitable.buildings, bridges, or cliffs for nesting.
Open Water - Lakes, Rivers, and Streams	Generally Associated	Feeds	High	none
Herbaceous Wetlands	Generally Associated	Feeds	High	none
Montane Coniferous Wetlands	Generally Associated	Feeds	High	none
Interior Riparian-Wetlands	Generally Associated	Feeds and Breeds	High	Needs cliffs for nesting.
Total Habitat Associations with Peregrine Falcon:	16			

Diet

Peregrines hunt primarily at dusk and dawn. They strike and capture birds in mid-air, a strategy that requires open space. Thus, they often hunt over open water, marshes, valleys, fields, and tundra (WIDNR 2002).

A peregrine hunts from the wing or high from a perch. It spots prey with keen eyes and begins its stoop, a streamlined dive with tail and wings folded and feet lying back. The falcon hits its prey with its foot, stunning or killing it, and then swoops back around to catch it in mid-air. If they prey is too heavy to carry, the peregrine will let it fall to the ground and eat it there. Peregrines pluck their prey before eating it (WIDNR 2002).

Breeding Territory/Home Range

Cade (1960) found a minimum territory of about 300 ft (96 m) radius around nests in Alaska (CDFG 2004). White and Cade (1971) reported that mean spacing between nests was 6 mi (9.7 km) along Alaska rivers (CDFG 2004). Inland breeding site from California varied from 3-7 mi (5-12 km) apart (CDFG 2004). In the Rocky Mountains, home range included the area encompassed by a radius up to 14 mi (23 km) from cliff nests (CDFG 2004). In Sonoma County, California, home range was approximately 125 mi² (320 km²) (CDFG 2004). Typically, territory and home range size depends upon suitable.nesting habitat and prey availability.

Habitat Requirements

Peregrines nest on cliffs ranging in height from a 75 ft (23m) escarpment at a reclaimed quarry to monolithic 1,500 ft (457 m) high cliffs, as well as on structural features of bridges. Average occupied cliff size in the Cascade Mountains is 229 ft (70 m), and in the Siskiyou Mountains of Oregon and northern California 135 ft (41 m). Pagel (Henny and Pagel 2003) also described nests as located on ledges and potholes with and without protective overhang. Stick nests originally constructed by common ravens, golden eagles, and red-tailed hawks were recorded at five Oregon locations (Henny and Pagel 2003). At some nest sites, a clear preference was shown for the same nest ledge in successive years, whereas at other locations resident pairs have selected different nest ledges each year (Henny and Pagel 2003). The smallest nest ledge was 6 in (15 cm) deep by 12 in (30 cm) wide; the largest was 22 ft (6.7 m) wide and 9 ft (2.7 m) deep (Henny and Pagel 2003). Nest ledges are usually located within 40-80% of total cliff height (Henny and Pagel 2003).

<u>Threats other than environmental contaminants</u>
Threats to the peregrine include loss of wetland habitat of primary prey, poachers robbing nests, and shooting by hunters (NatureServe 2004).

Factors Affecting Population Status

Local and regional data document the continued presence and effects of persistent chemical compounds in North American Peregrines. Many studies have documented the relationship between concentrations of DDE (a metabolite of DDT) and eggshell thinning (Morse 1994, Steidl et al. 1991, Court et al. 1990, Hickey and Anderson 1968). Studies in Alaska show that mercury may be at levels that affect peregrine reproduction and that these mercury levels are actually increasing over time (Ambrose et al. 2000). While the U.S. has implemented regulations on the use of DDT and other pesticides, peregrines that winter in other countries still using those chemicals may be at risk of accumulating contaminants from their avian prey (Banasch et al. 1992; Johnstone et al. 1996), some of which return to nest in the north and are a potential source of contaminants for both migratory and non-migratory peregrines (Fyfe et al. 1990). The 1997 North American Regional Action Plan, which recommends that the U.S., Canada, and Mexico cooperate in a phased reduction in the use and distribution of DDT across the continent, has been very successful in reducing DDT use in Mexico.
Although peregrines are still accumulating contaminants from their prey, the levels are currently low enough to allow for successful reproduction and expansion of the population. Nonetheless, the continual introduction of anthropogenic chemicals to the environment far outpaces research on their effects on wildlife.
Objective

The peregrine monitoring plan is primarily designed to detect declines in territory occupancy, nest success, and productivity is six regions across the United States.

2.3 Out-of-Subbasin Effects[15]

From a holistic "big picture" perspective, three "out-of-subbasin" effects have had a major impact on the Owyhee River ecosystem:

(1) Effects on Terrestrial Focal Species;
(2) Dam and reservoir construction to support a an agrarian culture; and,
(3) Climatic Changes and Catastrophic events.

2.3.1 Effects on Terrestrial Focal Species

A number of the terrestrial focal species spend a portion of their life cycle outside the Brueau River subbasin's designated boundaries. Although most are nongame avian species, at least one upland game species and several big game species potentially migrate between State jurisdictions. Depending on the extent, location, and timing of seasonal movements, out of subbasin effects may range from limited to potentially substantial. Potentially limiting factors encountered outside the subbasin including hunting, environmental toxins, and habitat degradation may influence species occurrence,

[15] This section id dervved in part from Vigg et al. (2002).

annyal survival, reproductive success, and ultimately population growth within the subbasin..

Several of the Owyhee subbasin focal bird species display varying degrees of seasonal movements. Yellow warbler and white faced ibis, are primarily long-distant migrants; wintering south from Mexico to South America (Ryder and Manry 1994, Hughes 1999, Lowther et al. 1999, Sedgwick 2000). In contrast, sage grouse and beaver populations may move relatively short distances or remain resident (Squires and Reynolds 1997, Connelly et al. 2000): although seasonal movement likely includes locations outside the subbasin boundaries. Migration is considered energetically expensive, loss of habitat due to pesticides, herbicides, fragmentation, and decline in extent has been suggested as a potential cause of declining population of North American bird species (Ryder and Manry 1994, Hughes 1999, Connelly et al 2000, Sedqwick 2000). In general, insectivorous birds, birds in western North America, and birds migrating to Mexico and Central and South America are still contaminated with relatively high levels of organochlorines (primarily DDE; DeWeese et al. 1986). Seasonal movements, however, may not be limited to winter, as big game and sage grouse may move outside the subbasin during alternative seasons (Connelly 2000). However, independent of the timing of seasonal movements, the condition of habitats sought likely influences within subbasin population dynamics. For example, reduced sagebrush cover due to herbicide application, fire, and mechanical removal has been shown to be an important predictor of sage grouse occurrence and recruitment (Connely et al 2000). Isolating the causes of population declines requires a full understanding of species ecology in combination with long-term population monitoring data.

Terrestrial focal species identified for the Owyhee subbasin are managed by Oregon, Idaho and Nevada as game animals. Depending on seasonal movements exhibited by populations, State agencies may be managing the same animals from opposite sides of the fence. Proghorn antelope, mule deer, and sage grouse occurring in the subbasin can be hunted in Oregon, Idaho and Nevada, although hunting seasons, limits, and pressure are variable among years and locations. Although seasons primarily overlap, in all three instances there is the potential for individual from populations moving across State boundaries to be exposed to a longer hunting season. Coordination between the State agencies, including an understanding of the migratory ecology of potentially shared populations, is essential for proper management (Connelly et al. 2000)

2.3.1 Dam Construction and Elimination of Anadromous Salmonids

When the Pacific Northwest salmon resource was first exploited by European settlers in the late 1800's, the Columbia River Basin was the greatest producer of chinook salmon in the world (Craig and Hacker 1940). Anadromous fish runs in the Columbia River at that time were estimated to range from 10 to 16 million fish annually (NPPC 1996). In contrast, the estimated current average annual run size is about 2.5 million fish (Dauble et al. 2003). Hydroelectric dam construction began in basin the early 1900’s and continued through the mid-1980's. Although the exact amount of fish lost as a result of hydropower development is unknown, the development of the hydropower system clearly had a significant impact on anadromous fish abundance in the Columbia River (Dauble et al. 2003). Currently the Hells Canyon Complex (completed in 1967) and the Owyhee dam (completed in 1932) block fish passage The loss of anadromy into the Owyhee subbasin has likely had profound effects on at least one of the extant aquatic species. Although their influence on redband populations is unknown, it is probable that the elimination of steelhead from the Owyhee subbasin represented an impact to redband population connectively, genetic diversity, and/or refounding capacity (Vigg and Company 2000). Similarly, the loss of anadromous carcasses and juvenile fish has likely affected current nutrient cycling and prey availability (respectively) for extant aquatic species, most notably for redband trout.

The following five anadromous salmonid species (pictured below) inhabited the Snake River Basin within the past 50 years, and probably historically occurred in the Owyhee River system. In addition to the salmon and char species, the white sturgeon (originally anadromous) and the pacific lamprey (catadromous) may have inhabited the Owyhee as well.

During Owyhee Subbasin Planning meetings, chinook salmon was discussed at length as a focal species for river habitat, however, consensus could not be reached to include it . The following issue section provides background information regarding the ecological importance of anadromous salmonids in the Owyhee Subbasin.

Anadromous Salmonids in the Owyhee Subbasin

Anadromous fish were of particular value to native peoples since they had many uses. For instance, they might be used at the time of catch, processed for the future, or used as a trade commodity. In this discussion of anadromous fish, it should be noted that "**salmon**" was a term used for several species of anadromous fish including chinook and steelhead. Historical evidence indicates that Tribal fishing for anadromous salmonids occurred in the Owyhee River basin. Early diaries, oral histories and newspapers suggest that native people used the upper Owyhee River basin for fishing. Such sources also suggest that this fishing occurred in the headwaters over an extended period each year, and that salmon and steelhead were among the primary species sought.

It is documented that Indian fishing weirs were used in the mainstem Snake River. Certainly Native peoples could have fished the mainstem Owyhee River, as it would have been at least as fishable as the mainstem Snake River. There is a great deal of evidence that fishing the Snake River was a major activity of many tribes. The multi-tribe/band events in the Snake River area between the mouth of the Owyhee River and the mouth of the Weiser River were well known and well attended. This event typically occurred during late summer to late fall, and fishing was a primary activity. At least some of the Duck Valley people, such as the people of the White Knife Band, attended this event. The records confirming the Snake River resource use are more common than other records, as the Snake River plain had many of the major travel routes, and therefore the fisheries there often were observed in this narrow corridor.

It is uncertain how far downstream in the mainstem Owyhee that fishing occurred. Weirs were also identified by early explorers as landmarks in the Owyhee River basin. While locations are hard to pinpoint, Ogden mentions the "Indian Fish Weare" in the "Sandwich Island River," identified by historians as the Owyhee River; there are at least two such entries in his 1820s journals. In one of the diaries, it appears to be in the headwaters of the Owyhee; in another year's diary it appears to be near the mouth. In each instance, he uses the weir as a landmark.

There is no indication that low water periods inhibited Owyhee salmon runs or fisheries in the early days. To the contrary, the Robert McQuivey Collection (1998) shows that summer and fall fishing for salmon in the upper basin was common. "Columbia salmon" and "red salmon" are mentioned.

In the Owyhee basin, we find that native people fished for salmon and steelhead in many places in the watershed, depending upon the season. The following discussion provides several examples.

Spring Season. The spring fishing was likely done in the Owyhee headwaters. Steelhead bones were collected at the Pole Creek site of the upper basin. March, April and May newspaper articles from the 1860s-1880s (Robert McQuivey Collection, 1998) indicate that it was fairly easy to capture large migratory fish during spring in the upper South Fork Owyhee by "raking fish off the shoals" in the large valley areas of the upper basin. Clubs, spears, arrows and other methods were used. Oral histories and similar information published by the Elko County Historical Society indicate the native people typically used Jack Creek in the upper South Fork Owyhee and other locations in the upper basin to fish.

During periods of high discharge, the smaller streams of the headwaters would be more easily fished than lower reaches of the river. It is not surprising that in the spring, the Owyhee River near Duck Valley, the South Fork Owyhee River in the Independence Valley, and many tributaries to this part of the upper basin were known as fishing locations for native people and later for the miners (Robert McQuivey Collection, 1998). Oral histories indicate: " The salmon used to come up the Owyhee River in the spring and up into the smaller streams to spawn. They came up Jerrett Creek, … I remember the people coming out from town to spear salmon. It was great sport and easier to get them in the smaller streams" (Smith 1983). Streams such as Jarrett Creek, Jack Creek, Indian Creek near White Rock, Bull Run Creek, and Taylor Creek supplied anadromous fish in the spring (Smith 1983, Robert McQuivey Collection, 1998). One band of Indians had a camp each year on Jack Creek, where the fish were plentiful (Weinberg 1998). Spring harvest of fish right in Tuscarora occurred in the early days, with stories such as using a pitchfork to collect a 30-pound fish. Oral histories of the area say, "The Indians used to get them, too. They would work the country near the reservation and bring them to Tuscarora in wagon loads" (Gruell 1998).

Summer Season. Summer fisheries were also known in the upper basin. In early July of 1828, Mr. McKay, working at the time for Mr. Ogden of the Hudson's Bay Company, went to meet Sylvaille in the Owyhee River basin, and found him at the "Indian Fish Pen." It is unclear if this is in the upper or lower part of the watershed. In 1859, Scholl comments in late July: " The stream runs here through very high precipices; it abounds in large salmon" (Wallen 1860). While it is difficult to identify the precise location in the Owyhee River watershed where Scholl makes his observations, it is somewhere in the eastern part of the basin, some distance upstream from the Jordan Creek confluence (Wallen 1860). Salmon were present at Three Forks in late July of 1876 (Robert McQuivey Collection 1998). Later in the 1800s, there is evidence that salmon or steelhead were available all summer in the upper watershed (Robert McQuivey Collection 1998). In the fall, the Juniper Mountain region was a major rendezvous location for native people (Drew 1865). This is not far from several sites where there is evidence of the use of anadromous fish by native people. Steelhead remains have been identified in the Pole Creek/Deep Creek watershed, tributary to the upper mainstem of the Owyhee (sometimes referred to as the East Fork Owyhee River), indicating very early use of anadromous fish by native people (Plew 1980, 1986). Other evidence of salmon and the use of salmon by native people in the area come from the records of stockmen. The Juniper Mountain region, the North Fork Owyhee, and the lower East Fork were known as the ION country (Hanley 1988). This ION area was known as a place where Indians came to many small streams to process salmon (Hanley 1988).

Fall Season. Fall fisheries in the South Fork Owyhee River basin are noted in the newspapers of the mining community. For instance, in September, the salmon in the Independence River are described as follows:

"… the kingly salmon…, forced its passage over every obstacle through the Columbia and its tributary Lewis R Snake R to spawn in the cool, limpid waters of the Owyhee. Myriads of them annually fail to return to the ocean, but are incorporated into Indians and now-a-days do and henceforward may help make up prospectors and miners. Splendid fish, three feet long and estimated to exceed the weight of twenty pounds, were seen dashing through water scarcely ankle deep." (Robert McQuivey Collection 1998).

Late spring, summer and fall salmon must have been fairly easy to collect in the upper basin, as miners, who were new to the area, used techniques similar to those of native people. In the 1800s, miners, when "not having nets, tied willows together and using them as a seine, rake out upon the shore salmon weighing fifteen to twenty pounds" (The Robert McQuivey Collection, 1998). Pitchforks, clubs and crude rakes were also commonly used fishing devices. The upper meadows were an easy place to catch fish. In 1876, newspapers report the situation as follows: "Where the waters cover the meadows the fish leave the main stream and swim out among the grass and reeds, rendering their capture an easy manner."

Idaho Power Company (Chandler editor, 2001) estimates that during the pre-development era (pre-1860), the area above Hells Canyon Dam produced between 1 and 1.7 million adult Pacific salmon (Oncorhynchus spp.) and steelhead (Oncoryhynchus mykiss). This estimate includes:

- 0.76 to 1.19 million spring/summer chinook salmon;
- 135,000 to 214,000 fall chinook salmon;
- 117,000 to 225,700 steelhead; and,
- 14,400 to 57,400 sockeye salmon (O. nerka).

The Chandler (2001) study did not account for coho salmon (Oncoryhynchus kisutch) that were known to exist in the lower Snake River and believed to historically migrate up to production areas as far as the Clearwater River. Coho salmon from the Snake River system made up about one-third of the total upriver coho run (compared to the upper-Columbia mainstem) during 1962-79;and the number of adult coho salmon counted over Ice Harbor Dam averaged about 1,300 fish during 1967-79 (Horner and Bjornn 1981). By the early 1980's, when Ted Bjornn and his colleagues documented upriver salmon status for proposed ESA-listings, most of the native origin Snake River coho salmon were produced in the Wallowa River -- tributary to the Grand Ronde River. Endemic Snake River coho salmon populations are now functionally extinct.

The distribution and abundance of Pacific lamprey (Lampetra tridentata) in the Owyhee River basin is unknown, although the species was documented in the mainstem Snake River at Swan Falls Dam (Stanford 1942). Over a period of approximately 70 years, anadromous fish above the present-day Hells Canyon Dam on the Snake River were gradually extirpated from their historical distribution by the construction of federal and private dams and by habitats degraded by multiple land uses.

Mid-Snake Province – History of Anthropomorphic Impacts

Human development has had significant impacts on the middle Snake River – as it has throughout the Columbia Basin. Mining altered the landscape by moving tons of rock. Habitat losses began primarily with placer mining, which was distributed throughout the entire basin and literally turned over stream valleys, created water diversions, and input tons of sediment into stream channels. When the extraction of the ore included chemical processes, fuel was needed, and the wood in the area was harvested and burned by the smelters.

As mining activity increased, so did industries that could serve a growing population base. The Snake River basin was soon developed for agricultural production, timber harvest, and livestock production. Some of the most profound changes to aquatic habitats began with the development of irrigation systems and the grazing of livestock. In the mid 1800s, grazing began to modify the productivity of the landscape, an impact recorded by the stockmen. At first, livestock grazed on open range year round, though they were moved between summer and winter range locations. Later, raising stock required more expensive techniques. After a period of drought combined with overgrazing in the late 1880s, and a severe winter, the stockmen reduced the number in their herds/bands and began mowing wild hay for winter. Irrigation of wild grass also began as a technique to increase hay resources. Later, the practice of cultivating alfalfa to feed stock began.

Irrigation systems had the following impacts:

- decreased instream flows,
- increased instream temperatures,
- increased fine sediment inputs into aquatic habitats, and
- creation of partial or complete migration barriers.

Livestock grazing impacted riparian corridors by decreasing stream shading and increasing stream temperatures. These effects were especially pronounced in high-elevation desert basins such as the Malheur, Burnt, and Owyhee rivers. As irrigation systems expanded, construction of large storage reservoirs began to eliminate production of anadromous fish from specific river basins.

Bruneau Subbasin

The Bruneau River was the first basin eliminated when a dam was constructed in the lower 1.5 miles (mi). Constructed in 1890, the dam was originally built for placer mining but was soon used for irrigation purposes. It was a complete barrier to anadromous fish.

Swan Falls Dam - mainstem Snake River

In 1901, the Trade Dollar Mining Company of Silver City constructed the Swan Falls Dam. This dam was not constructed for irrigation, but to generate electricity for mines in the Owyhee Mountains. It became the upstream terminus for salmon in the Snake River, and, to a large extent, the dam was a barrier to steelhead.

Swan Falls Dam blocked approximately 157 mi (253 kilometers km) of mainstem Snake River, or approximately 25% of the entire anadromous section of the mainstem Snake River. In addition, the dam blocked fish access to Salmon Falls and Rock creeks, which were the uppermost basins to support spring/summer chinook in the Snake River basin. Also, many smaller tributaries were blocked with construction of Swan Falls Dam. Although a fish ladder was installed at Swan Falls Dam during the initial construction, it was not functional for salmon and was probably not functional for steelhead.

In 1922, after IPC had taken ownership of Swan Falls Dam, the ladder was reconstructed. Unfortunately, the ladder was still ineffective for passing salmon around the dam. But some steelhead were probably able to pass. There are reports that a small run of steelhead ascended the river to C.J. Strike Dam (constructed in 1952), which was a complete barrier. Pacific lamprey could apparently use the fish ladder to pass Swan Falls Dam: Stanford (1942)[16] reported that “Pacific lamprey…was taken in the spring as it made its way with apparent ease, over the fishway or attempted to climb the lower face of the dam.”

Boise and Payette Subbasins

Following construction of Swan Falls Dam, large irrigation dams continued to be constructed. Dams on the Boise and Payette rivers eliminated production of anadromous

[16] Stanford, L.M. 1942. Preliminary studies in the biology of the Snake River. Ph.D. dissertation. University of Washington, Seattle. 120 p.

fish in those basins. Black Canyon Dam, constructed in 1924 in the lower Payette River, eliminated the only sockeye salmon production area above Hells Canyon Dam.

Owyhee Subbasin

Affects of Mining on Riparian Habitats

Abrupt changes in aquatic habitats were noted shortly after mining and associated activities began. As early as 1870 there were complaints about the destruction of the salmon fishery near Mountain City (The Robert McQuivey Collection 1998). In May of 1887, the news reports that the absence of salmon "is attributable to tailings in the river extending down as far as Duck Valley, driving the fish into Indian Creek, where a great many are caught by White Rock people" (The Robert McQuivey Collection, 1998).

Placer mining, like the massive placer workings of the Owyhee River near Mountain City was just one of the early impacts on aquatic habitats. Mining used water, and the first diversions were for washing gold and serving mining communities with domestic water. Lode mining brought the use of chemical slurries; often these slurries were an in-stream activity.

The mining also brought the need to feed the miners the foods they were used to. Agricultural activities began as dry-land farming, and the impact was localized to cultivated grounds. Livestock were also brought to the area in large numbers, and grazing took place over large tracts see Upland Habitats. Until the beginning of irrigation and documentation of accelerated erosion due to livestock, impacts of agriculture on aquatic habitats were not well documented. Some intermittency was noted in the late 1800s, but how much of this was natural and how much was exacerbated by mining, irrigation, and other land uses remains unclear.

Affects of Mining, Grazing and Irrigation on Upland Habitats

Mining altered the landscape by moving tons of rock. When the extraction of the ore included chemical processes, fuel was needed, and the wood in the area was harvested and burned by the smelters. Near Tuscarora, Chinese crews made their living grubbing sagebrush and selling it as fuel to other miners. We did not find discussions about the impact of this rapid timber and sagebrush removal.
The impact of livestock included the removal of seeds that would typically be harvested by the Shoshone as a staple food. This occurred in several areas, not just the Owyhee, and was best documented by Madsen (1986) in connection with stock along the Oregon Trail.

Later in the 1800s, grazing modified the productivity of the landscape, an impact recorded by the stockmen. At first, livestock grazed on open range year round, though they were moved between summer and winter range locations. Later, raising stock required more expensive techniques. After a period of drought combined with overgrazing in the late 1880s, and a severe winter, the stockmen reduced the number in their herds/bands and began mowing wild hay for winter feeding (Gold Creek example described by Tremewan 1964). Irrigation of wild grass also began as a technique to increase hay resources. Later, the practice of cultivating alfalfa to feed stock began. Keen competition for feed and water continued into the early 1900s, at which time the Federal Forest Reserves and their associated regulations began, in part at the request of the stockmen. There had been complaints about the deteriorating condition of the range on the East Fork, South Fork and North Fork of the Owyhee River. Sheep mines were in use. Sheep mines were lands claimed as placer ground to obtain the right to the water so stockmen could water their animals. The stockmen who controlled the water controlled the range. Stockmen were in favor of the regulations as they paid less for grazing fees on the federal reserve lands than they paid for the bogus placer mining leases (Tremewan 1964). The condition of the range was no small problem. Tremewan (1964) provides this paraphrased description: The conditions in the Independence Mountains had gotten so bad that steers taken off the range in the fall had to be fed for several weeks before they could be driven to the railroad. These conditions existed from a combination of their feed, and the practice of stockmen running the herd back and forth trying to beat each other to the best camps. The Forest reserves eliminated a lot of this tramping back and forth by establishing trails and allotments.

Irrigation began early in the Duck Valley area, and white peoples' use of water upstream from the reservation encroached on the water (McKinney 1983). By the 1909-1928 period, the encroachments on the upper Blue Creek had so limited the water available to the Duck Valley people that in 1928 the tribes abandoned their developments on reservation land along that tributary (McKinney 1983).

Effects of Dams and Cumulative Impacts on Anadromous Fish

Patterson et al. (1969) says that until dams were built on the lower reaches of the South Fork Owyhee, all the streams flowing into the Owyhee were spawning grounds for salmon. They go on to say that from Tuscarora, from Mountain City and from the ranches, people gathered along the streams to spear salmon for winter menus. Although there was always trout to catch, in spring, salmon spearing was the favorite sport" (Patterson et al. 1969).

Chapman (1940) observed "The construction of the Owyhee Dam, some 21 miles from the mouth of the river, by the Bureau of Reclamation in 1933 completely and, as far as I can see, irrevocably eliminated it as a producer of anadromous fishes." … He further notes that even if anadromous fish used the lower 20-25 miles of the Owyhee River, "The Owyhee Canal, about 16 miles downstream from the dam where the river leaves the canyon, dries up the river except for two or three weeks in the spring. It would be expected that nearly all downstream migrants resulting from anadromous fish would be killed in this diversion."

Nonetheless, some anadromous fish were reported for several years after the construction of Owyhee Dam. "In spite of the handicaps river being dried up a fairly good run of steelhead still enters the river in the spring and at that time the steelhead fishing is good below the dam for a few miles" (Chapman 1940). Large rainbow trout were caught in irrigation canals and the siphon on the Owyhee Ditch into the late 1940s (Lockwood 1950).

By the mid-1950s, Oregon state agencies observed that there was no spawning steelhead or chinook in the Owyhee basin. The last known observation of chinook were some very small fish within the Owyhee River, but within the first mile upstream of the Snake River during 1954 (Fortune and Thompson 1959; Weinburg 1969).

Malheur, Burnt, and Powder Subbasins

The Malheur, Burnt, and Powder rivers all had large production areas eliminated by dams. In addition, land uses in the Malheur, Burnt, and Powder rivers had left even accessible areas of the basin unable to support anadromous fish.

The Hells Canyon Complex (HCC)

The Hells Canyon Complex (HCC), owned and operated by the Idaho Power Company, consists of the following mainstem Snake River Dams (year closed):

- Brownlee Dam (1958)
- Oxbow Dam (1961)
- Hells Canyon Dam (1967)

The HCC inundated approximately 93 mi (150 km) of mainstem Snake River habitat and blocked access to approximately 118 mi (190 km) of free-flowing Snake River up to Swan Falls Dam. A total of 211 mi (340 km), or 34%, of mainstem Snake River habitat was lost. This loss plus the loss above Swan Falls Dam accounted for approximately 59% of Snake River mainstem habitat.

Anadromous Fish Populations Still Existing in 1958

Brownlee -- finished in 1958 -- was the first dam of the Hells Canyon complex . At the time Brownlee Dam was constructed, relatively few tributary basins were still producing spring/summer chinook salmon and steelhead. Idaho Power Company estimates that by 1958:

- Approximately 75% of the anadromous production area above Hells Canyon Dam had been eliminated;
- Fall chinook salmon were limited to below Swan Falls Dam;
- Spring/summer chinook and steelhead production areas were primarily limited to the Weiser River, Eagle Creek (tributary to the lower Powder River), Wildhorse River, Pine Creek, and Indian Creek; and
- restricted steelhead production was occurring in smaller tributaries to the Burnt, Powder, and Snake rivers.

Idaho Power Company (Chandler, editor 2001) estimates that adult returns to the area above Hells Canyon Dam immediately before the dam's construction consisted of approximately:

- 16,400 fall chinook salmon,
- 1,900 spring chinook salmon, and
- 7,500 steelhead.

Sockeye salmon had been eliminated from the system by that time. Pacific lamprey were known to be present, however, their distribution and abundance at the time of closure by the dam is unknown. The construction of the HCC followed a long and confrontational competition between public and private power interests. In question was whether power would be privately or publicly produced, not whether or not dams would be built.

Mitigation for the HCC

Once the Federal Power Commission (now the Federal Energy Regulatory Commission) issued a permit for construction of the HCC, everything associated with fish passage went on a fast-track schedule. From issuance of permit (August 1955) to closure of Brownlee Dam (May 1958), only about 33 months were available to decide on mitigation techniques and to build the various passage facilities once passage was chosen. In August 1954, IPC was asking whether fish ladders or elevators should be constructed to permit adult fish passage and whether runs should be relocated in other streams.
The Federal Power Commission license (Article 34) required the licensee to carry out detailed studies of the project area's fishery resource and to devise means and measures for mitigating losses to that resource. In accord with that requirement, state and federal fishery agencies investigated or considered all known methods for mitigating losses to the anadromous runs. These methods included:

- juvenile and adult fish passage,
- adult salmon spawner translocation,
- artificial and semi-artificial propagation, and
- natural redistribution of fish in streams below the projects.

<u>Fish Passage</u>

Of the methods, fish passage appeared most promising for protecting the resource. It retained the possibility of restoring runs in the historic spawning and rearing areas and focused mitigation on natural production. The main emphasis by the agencies and by IPC was on successfully passing adult and juvenile salmon and steelhead at the HCC, not on operating fish hatcheries or translocating stocks. Adults were passed successfully above the projects using a trap-and-haul program. The adult migration at Brownlee Dam succeeded. From 1956 to 1964, adult chinook and steelhead were hauled successfully to a point 1.5 mi upstream of the dam. From there, the fish migrated through Brownlee Reservoir to the spawning grounds. However, passage of downstream migrating juveniles was much less certain. As early as fall 1953, a barrier net and gulper system was visualized as a means of passing juvenile fish. But how to pass juvenile salmon successfully through a deep reservoir, such as Brownlee Reservoir, was not known.
IPC developed the engineering concept for a mesh-barrier system to collect juveniles before they reached the dam. Fish were to be collected and transported by truck below

the dam. Fish management agencies expressed concern about the untried nature of the barrier-net system, but given both the fast-moving construction schedule and the understanding at that time that additional dams would be constructed downstream of the HCC, agencies felt forced to accept the approach. By 1962, it had become apparent that the barrier-net system would not work. Other factors causing mortality of out-migrating juvenile salmon and steelhead included: water temperature, dissolved oxygen (DO) levels, and inability of fish to find their way through the reservoir were more important factors.

Hatchery Mitigation Program

In December 1963, the Federal Power Commission ordered IPC to abandon the downstream collection efforts prior to the outmigration of 1964. The order also led to developing a hatchery mitigation program. With completion of Oxbow Dam (1962) and Hells Canyon Dam (1968), production areas for spring chinook and steelhead were lost in the Wildhorse River and Pine Creek. Indian Creek was primarily a steelhead production area, but may have supported low numbers of spring chinook.

Feasibility Study for Reintroduction of Anadromous Fish Above Hells Canyon Dam

The extinction of all anadromous fish above Brownlee Dam is mute testimony to the failure of salmon mitigation efforts. Consequently, the feasibility of reintroducing anadromous fish above Hells Canyon Dam has been discussed in numerous forums over the years. In the late 1980s a workshop initiated by Senator James McClure. The workshop participants concluded that reintroduction was possible if three prerequisites could be met:

- smolt passage problems at existing lower Snake and Columbia river dams were solved;
- flows in the lower Snake River reservoirs were improved to enable successful smolt passage; and
- a reintroduction program were not developed at the expense of existing fisheries programs in the Snake and Columbia rivers.

In the final recommendations to the National Marine Fisheries Service, the Snake River Salmon Recovery Team (Bevan et al. 1992) recommended that the issue of reintroduction for fall chinook salmon (Oncorhynchus tschawytscha) be examined again in the future, especially if smolt collectors that were harmless to the fish could be developed. The issue of the feasibility of reintroducing anadromous fish was also identified by regional interests represented in the Aquatic Resources Work Group as part of the relicensing process of the Hells Canyon Complex (HCC). In addition, the issues of anadromous fish passage and habitat availability continually arise in discussions relating to other Idaho Power Company (IPC) projects along the mainstem Snake River above the HCC that are also involved in the process of relicensing. benefit, risks, and likelihood of success of a reintroduction program.

The Idaho Power Company commissioned a study of the "*Feasibility of Reintroduction of Anadromous Fish Above or Within the Hells Canyon Complex*" (James A. Chandler, editor 2001). This study was intended to be the first phase toward addressing the question of feasibility; it was also intended to highlight the many uncertainties of reintroduction and to identify areas within the historical distribution that have the greatest potential for successful reintroduction. A second phase would require more research targeted to examine key uncertainties of the reintroduction alternatives showing the greatest promise.

Reintroducing anadromous fish above Hells Canyon Dam involves many considerations (Chandler, editor 2001):

- the historical perspective;
- present-day habitat quality;
- multiple land uses and their effects on habitat and passage;
- limitations of passage technology at tributary and mainstem dams;
- risks of deleterious pathogen introductions;
- limitations of smolt-to-adult returns below Hells Canyon Dam; and
- potential impacts to existing federally protected stocks.

2.3.3 Climatic Changes and catastrophic Events

Climate Changes at he the Turn of the Century

Dramatic climatic changes have occurred in the Owyhee Mountains in the last one hundred to one hundred and fifty years. The date of this climatic transition varies slightly depending on the source, but scientists generally agree that it occurred around the 1860s (Great Basin Riparian Ecosystems 2004). The area began to slowly change over time from a high precipitation tall grass area to a low precipitation desert plant community. When the first settlers began to move into the Owyhee Mountains in the 1860s and 1870s, they recorded grasses to their horse's shoulders. Other settlers' journals recorded looking over a sea of tall grass as far as the eye could see, taller than their wagon wheels.

As you review settlers' accounts around 1900, they began telling of drier and drier conditions occurring in the Owyhee Mountains. Heavy snow years did not happen every year, but only one year out of five. The annual precipitation was diminishing and the tall grasses had all but disappeared. The early settlers used the Owyhees to raise horses and sheep. They sold replacement horses to the Army and raised small bands of sheep for wool and meat. Sheep and horses were the primary livestock raised in the Owyhee until the early 1940s.

According to the Black's family journal and Paul Black born in 1908, the Indian bands would use the Antelope Trail and Desert Trail out of the high country of the Owyhee Mountains and the Lonesome Trail between Shoo Fly Creek and Little Jacks Creek in late spring and early summer each year to make their way to the annual encampment at the mouth of the Bruneau River. They would go to the Bruneau encampment to catch and dry their winter supply of salmon. The Indian Trails were used so heavily for so many years that they were beat deep into the earth and can still be seen to this day. There was an abundance of trout in the streams in the Upper Owyhee during the late 1800s.

According to the Black family, the earthquake of 1916 changed the Upper Owyhee country forever. For months after the earthquake, the springs and streams ran murky water and the stream and spring flows dropped off sharply. Many springs dried up, and water had to be hauled in for livestock in areas that always had water previously. As stream and spring flows continued to decrease in the 1920s, many homesteads had to be abandoned. Meadows in Camas Creek, Battle Creek, Big Springs, and Rock Creek no longer produced enough hay for the winter feeding of horses and the settlers were forced to move. Where there were large trout populations, they disappeared. Paul Black remembered how they would catch gunny sacks full of trout in Battle Creek; and Paul Black attributes that to the loss of water flow after the 1916 earthquake. Today, there are only limited populations of trout caught in short sections of streams that have enough water year around in the Owyhee Subbasin. A lawsuit was filed over water rights after the earthquake as the water supply dwindled (Burkhardt vs. Black-1981).

Current Climate

The climate of the Great Basin is semiarid, characterized by an mean annual temperature of 9°C (48.2°F) and between 100 and 200 mm (3.94-7.88 in.) of precipitation annually (Smith et al. 1997). The majority of this precipitation comes during the winter and spring. The current climatic conditions of Rome, OR on the Owyhee River at 3400 feet (1036 m) of elevation best reflect recent climatic conditions of the Owyhee uplands. Average annual precipitation over the last 50 years is 8.21 inches (20.85 cm). The average daily maximum temperature in the hottest month, which is July, is 92.0°F (33.3°C). The average daily minimum temperature for January, the coldest month of the year, is 18.1°F (-7.7°C). Data from further to the south at weather station McDermitt 26N (located 26 miles to the North of the Oregon/Nevada border along US 95) reflects similar conditions at 4500 feet (1371 m) of elevation. Average annual precipitation is 9.43 inches (23.95 cm). The temperature ranges from an average daily maximum of 91.1°F (32.8°C) in the month of July and the average daily minimum for Jan of 18.9°F (-7.3°C). The averages for this station are for the last 45 years (Western Regional Climate Center).

The environment of the Owyhee uplands is comparable to that of the Great Basin (interior drainage). The main difference between the two is hydrological. While the Owyhee uplands have drainage into the Pacific Ocean by way of streams and rivers, the Great Basin has internal drainage. The plant communities which can be found in the two regions are similar in the Owyhee Subbasin and Great Basin (Murphy and Murphy 1986:285). In turn animal communities are similar with the notable exception of different varieties of fish that inhabit the Owyhee River in comparison to inland lakes.

High winds come up in the morning and evening across the plateau regions of the Owyhee uplands. These winds, anabatic and katabatic, are driven by gravity and the heating and cooling associated with morning and evening, respectively (Christopherson

1997). In the evening as layers of the surface cool, the cold surface air is denser and sinks, moving down slope across the mesa. The downward movement is called a katabatic wind. The reverse happens in the morning as the air at lower elevations warms and rises, pushing air the opposite direction across the mesa as an anabatic wind.

2.4 Environment/Population Relationships

2.4.1 Aquatic

2.4.1.1Redband Trout Distribution

The distribution of redband trout in the Owyhee Subbasin is fragmented (Figure 2.22). Most streams supporting redband trout occur on the east side of the subbasin, primarily in Idaho. Within the Idaho portion of the Owyhee Subbasin, redband trout presently occur in 4,362 miles of streams. They were found in 1,623 miles of streams in the Nevada portion of the subbasin and in only 157 miles of streams in the Oregon portion. The wider distribution of redband trout in the Idaho portion of the subbasin may reflect the true distribution of the trout, or it may be related to sampling intensity. Sampling in the Idaho portion of the subbasin may be more intensive and extensive than in other regions of the subbasin. Nevertheless, redband trout currently exist in mostly isolated patches within the subbasin. There appears to be little connection between headwater demes and those in mainstream reaches.

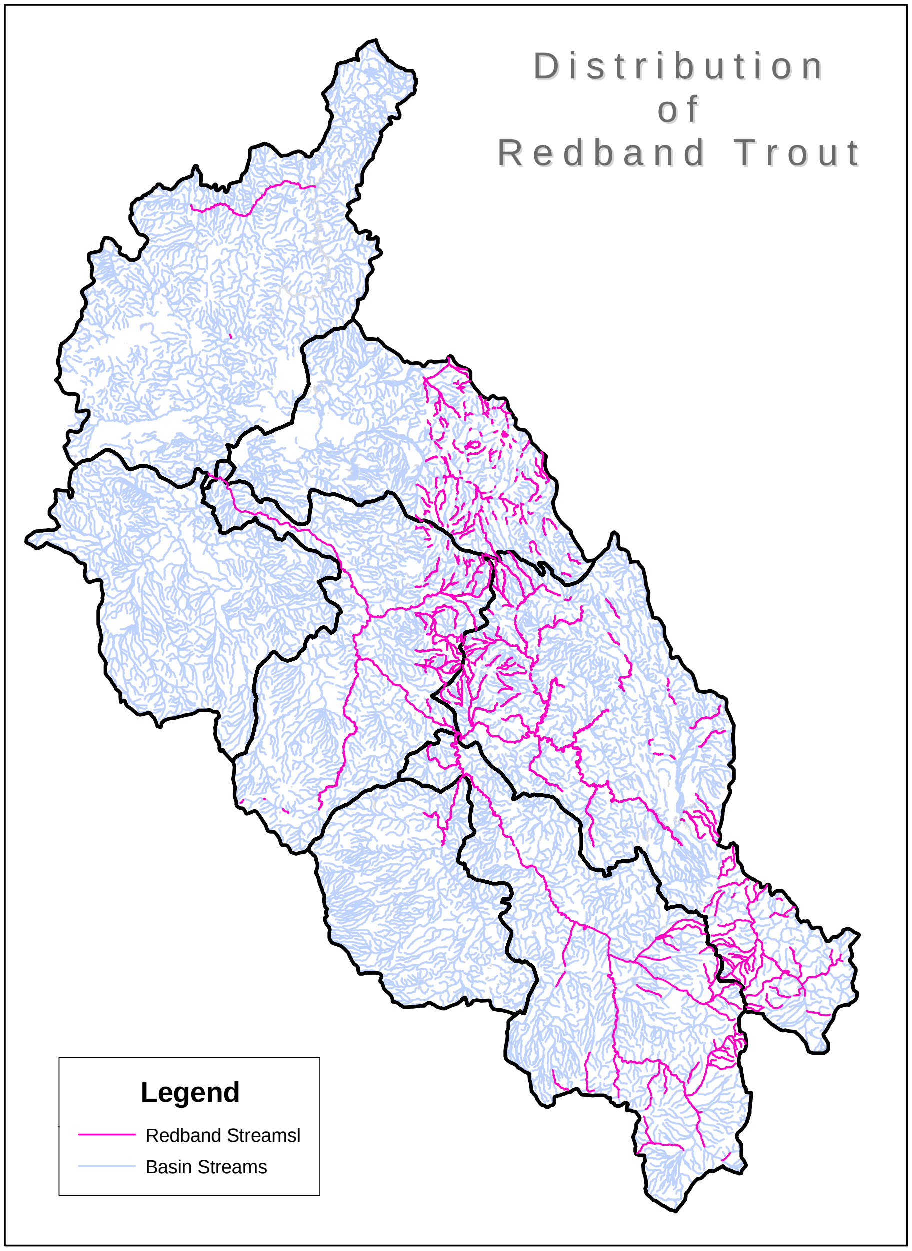


Figure 2.21. Current distribution of redband trout in the Owyhee Subbasin.

2.4.1.2 Redband Trout Habitat – Proper Functioning Condition

About 46% of the streams surveyed in the Owyhee Subbasin for Proper Functioning Condition (PFC) are rated as "Proper Functioning" (Table 2.20; Figure 2.22). That is, 54% of the streams surveyed in Oregon, Idaho, and Nevada (combined) are either non-functioning (10%) or are functioning at risk (44%).

Table 2.20. Miles of stream within the Owyhee Subbasin within different categories of Proper Functioning Condition (total miles of stream equals 1,065.7).

Portion of subbasin	Miles of streams				
	Functioning at risk downstream	Functioning at risk upstream	Functioning at risk (no trend)	Non-functioning	Proper functioning
Idaho	8.7	23.2	329.0	78.6	231.4
Oregon	6.2	1.7	65.8	2.8	251.6
Nevada	27.9	7.6	2.8	22.3	6.1
Total	42.8	32.5	397.6	103.7	489.1

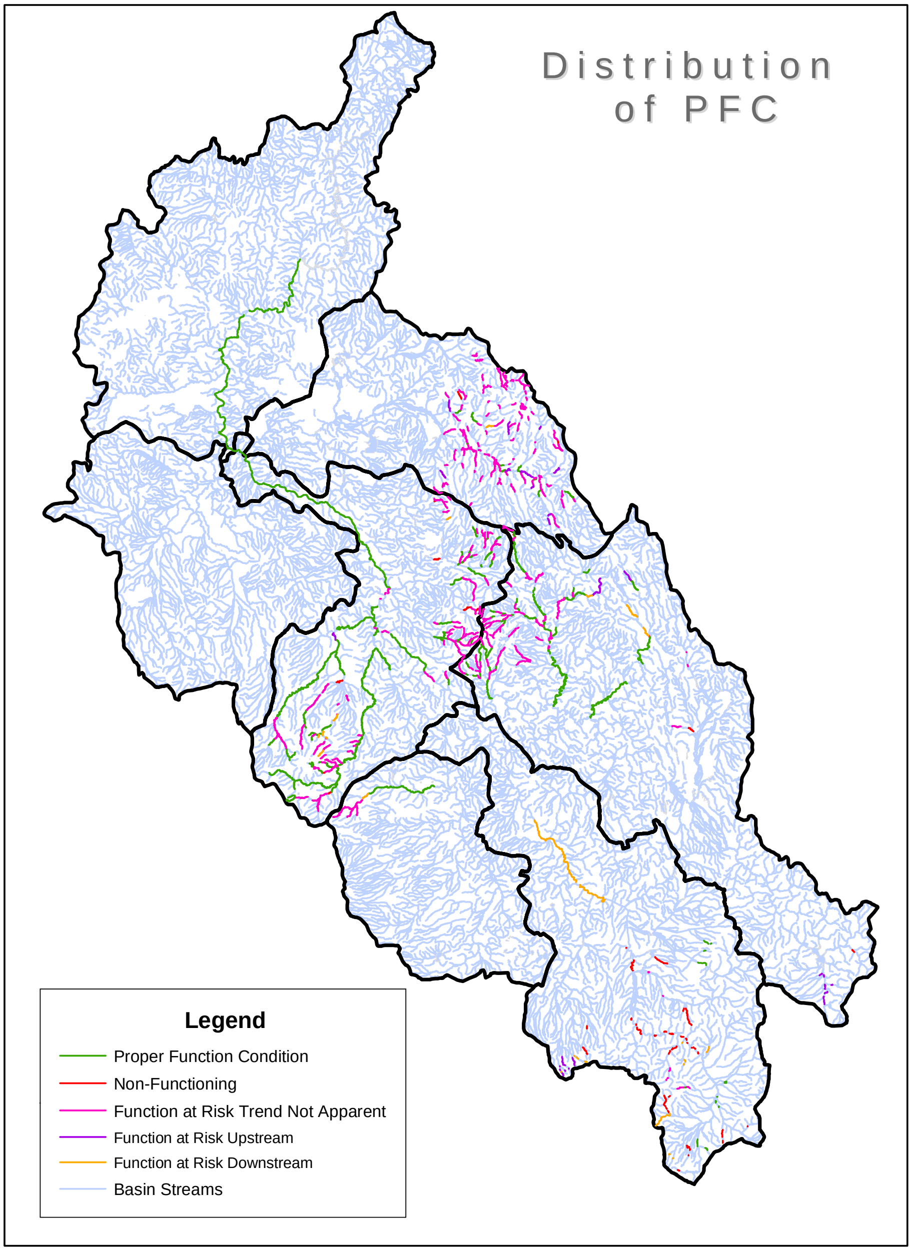


Figure 2.22. Distribution of Proper Functioning Conditions on streams in the Owyhee Subbasin.

2.4.1.3 Qualitative Habitat Assessment (QHA) for Redband Trout in the Owyhee Subbasin

The Qualitative Habitat Assessment tool (QHA) facilitates a structured ranking of stream reaches and attributes for subbasin planners. QHA relies on the expert knowledge of subbasin planners to describe physical conditions in the target stream and to create an hypothesis about how the habitat would be used by a focal species. The hypothesis is the "lens" through which physical conditions in the stream are viewed. The hypothesis consists of weights that are assigned to life stages and attributes, as well as a description of how reaches are used by different life stages. These result in a composite weight that is applied to a physical habitat score in each reach. This score is the difference between a rating of physical habitat in a reach under the current condition and the condition of the reach for the attribute in a reference condition. The result is that the current constraints on physical habitat in a stream are weighted and ranked according to how a focal species might use that habitat.

Description of Qualitative Habitat Assessment (QHA)

Qualitative Habitat Analysis (QHA) is a tool developed to assess habitat as part of subbasin planning for those fish species and subbasins where EDT rules have not been developed or there is insufficient time, resources, and/or data to use the Ecosystem Diagnosis and Treatment (EDT) tool17. QHA is primarily for use on resident salmonids in stream habitats on a watershed scale. QHA requires the user to rate 11 attributes: riparian condition, channel stability, habitat diversity, fine sediment, high and low flow, oxygen, high and low temperature, pollutants, and obstructions. These attributes are rated in both the current and reference conditions in each stream reach being rated. The user must then develop a hypothesis relating the importance of these attributes to a focal species on a reach-by-reach basis for each of four life stages (spawning/incubation, summer rearing, winter rearing, migration). QHA produces a series of tables that describe the physical habitat and identify where restoration and/or protection activities may be the most productive.

The Qualitative Habitat Assessment (QHA) technique was developed as a means to characterize the relationship between a fish population and its aquatic habitat. It was developed principally for resident salmonids, though it could potentially be adapted for use with other species. The QHA is intended for use in stream environments at a watershed or subbasin scale. QHA would not be particularly useful for an assessment covering only a few stream reaches or small watersheds. The minimum number of reaches or small watershed where QHA results would be meaningful is, perhaps, 20-30. The current version of QHA will only support up to 300 reaches. For subbasins with

[17] Chip McConnaha, of Mobrand Biometrics, Inc. was the principal creator of the QHA technique. Lars Mobrand, Bruce Watson, Phil Roger, and Drew Parkin contributed to the development of concepts and reviewed draft products. Bruce Marcot and Tom O'Neil provided advice on structuring ranking schemes. Several subbasin planners were kind enough to review the draft product. Chip McConnaha, Drew Parkin and Jeff Fryer authored the user's guide.

more reaches, we encourage dividing up the subbasin into different portions as we believe that it is going to be very difficult to interpret results from QHA analysis of large numbers of reaches.
While it is possible to integrate lake or reservoir assessment findings with QHA, as currently constructed this technique would be of limited use for areas where a lake or reservoir is the dominant fish habitat. QHA could, however, be used to support a lake assessment by characterizing fish/habitat relationships in lake tributaries.

QHA would be particularly useful in subbasins where there is local knowledge of habitat conditions but where systematic field research may be limited. It would also be useful in situations where time and financial resources may be limited.

The following explanation provides background on using "qualitative" biological assessment. Professional judgment (i.e., expert opinion) may be criticized for being subjective and lacking consistency. On the other hand, it is well recognized that a strictly quantitative approach may not always be possible, or even preferred. For example, using a quantitative approach may not make sense in areas where data are limited, when there is not enough time allotted to conduct a rigorous quantitative assessment, or where appropriate tools or expertise are not available. In these situations a more qualitative approach is indicated. The 2000 Template for Subbasin Assessment, for example, referenced the use of "opinions of local fish managers" as an analytical tool.

The QHA was designed to minimize problems associated with unstructured qualitative assessments. QHA is what we call a "structured qualitative assessment." In other words, it is a systematic and objective assessment of species habitat relationships that relies principally on existing local professional knowledge and judgment. QHA "structures" the process by:
(1) following a logical and replicable sequence,
(2) using the best available quantitative data as the basis for decisions,
(3) generating a product that is similar in form to products resulting from other more quantifiable approaches, and
(4) documenting the decision process.

QHA produces a series of tables that describe the physical habitat, identify where restoration and/or protection activities may be the most productive, and a series of summary tables. Taken as a whole, these tables offer a means to track and document the decision process.

Owyhee QHA Workshops

We conducted a series of QHA Workshops for each portion of the Owyhee Subbasin – Oregon, Idaho and Nevada. The first workshop was on November 6th 2003 in Vale, Oregon. The participants were: Jeff Fryer (TOAST), Tim Dykstra (Shoshone-Paiute Tribes), Jack Wenderoth (BLM hydrologist) and Steve Vigg (Consultant/Owyhee Subbasin Plan Coordinator). During this meeting we set up the initial version of the river reach system for the Oregon Portion of the Owyhee. On November 25th 2003, we conducted the second QHA workshop at the Vale BLM office. Participants were Cynthia Tait (BLM biologist), Brent Grasty (BLM GIS support), Jack Wenderoth, Ray Perkins (ODFW biologist), Jennifer Martin (OWC), Carl Hill (OWC), Tim Dykstra, Tom Dayley (NPCC) and Steve Vigg. During this meeting we finalized the river reach system for the Oregon portion of the Owyhee, and completed the redband trout habitat ratings.

The Idaho QHA workshops were initiated on January 14th-15th 2004 in Boise. The participants of the first meetings were Pam Druliner (BLM Biologist), Bonnie Hunt (BLM Resource Specialist), Tim Dykstra, Brad Nishitani (GIS consultant), and Steve Vigg. During these meetings we developed the initial version of the river reach system for the Idaho Portion of the Owyhee. Bruce Zoellick (BLM Biologist) provided additional input on the Owyhee-Idaho river reach system after the initial meeting.

The participation at the January 29th, 2004 QHA Workshop in Boise included the following technical and planning members:

- Bonnie Hunt BLM-Owyhee
- Pat Ryan BLM-Owyhee
- Jim Desmond Owyhee County, Natural Resources Committee
- Steven Vigg Steven Vigg & Co.
- Eric Leitzinger IDFG
- Jerry Hoagland Owyhee Watershed Council
- Jennifer Martin Owyhee Watershed Council
- Leonard Beitz Ash Grove
- Carl Hill Owyhee Watershed Council
- Pam Druliner BLM-Owyhee
- Bruce Zoellick BLM-Bruneau
- Randy Wiest DSL
- Guy Dodson Sr. Shoshone-Paiute Tribe
- Tim Dykstra Shoshone-Paiute Tribe
- David F. Ferguson Idaho Soil Conservation Service
- Duane LaFayette IACSD
- Bradley Nishitani BioAnalysts, Inc.
- Tracy Hillman BioAnalysts, Inc.
- Tom Dayley NPCC

During this workshop, redband trout habitat ratings were discussed and scoring was initiated for the Idaho Portion of the Owyhee Subbasin. Since the ratings were not completed for the entire river reach system, a third QHA Workshop was convened on February 5th 2004 in Boise. The participants at this workshop included the following fish & wildlife biologists and managers: Eric Leitzinger, Pam Druliner, Bonnie Hunt, Tim Dykstra, Guy Dodson, and Steve Vigg. Tom Dayley (NPPC Coordinator) also attended to provide Council guidance. During this third Idaho workshop, redband trout QHA ratings were completed for the Idaho Portion of the Owyhee Subbasin.

During March 9th and March 10th 2004, a QHA Workshop was conducted for the Nevada portion of the Owyhee Subbasin in Elko, Nevada. The participants were: Patrick Coffin (Fishery Biologist, NV-BLM), Robert Orr (Natural Resource Specialist, NV-BLM), Gary Johnson (Fish & Wildlife Biologist, NDOW), Tim Dykstra, Guy Dodson, and Steve Vigg. During the first day, we set-up the QHA river reach system for Nevada Portion of Owyhee and rated specific stream reaches for redband trout habitat "current" conditions versus "reference" conditions. On the second day of the workshop, we finished the habitat ratings and scored species range worksheet "current" vs. "reference". Ray Lister (Supervisory Biologist, NV-BLM) briefly attended the workshop, and later met with Steve Vigg regarding BLM documents that were relevant to the Owyhee Subbasin Planning process. We obtained both electronic and hardcopy documents from Ray Lister, BLM.

Results of Owyhee QHA

Species Hypothesis Worksheet

The “species hypothesis” worksheet provides subbasin planners with the opportunity to apply their understanding of biological systems to make decisions regarding the relative importance of each life stage of the focal species to fish productivity and sustainability. The first step is to rate the life stages according to overall importance in the subbasin (Table 2.20). While there are several ways to delineate life stages, the QHA model opted for the most simple case – spawning, summer rearing, winter rearing and migration. Note that “migration includes both juveniles and adults. Fish life stages are rated using a 4 to 1 scale, with 4 being most important. One may rate all life stages differently (1, 2, 3, 4) or give some or all life stages the same value. The difference in the weight assigned to given life stages — for example, 1 for “migration” and 4 for “summer rearing” — shows that summer rearing is much more important to redband trout production in the Owyhee system than is migration. In contrast, there is less difference in relative importance between “summer rearing” and “spawning/incubation” (rated 3). The reason for rating the life stages is to quantify how each phase of the redband trout’s life cycle will be used to evaluate the importance of the various habitat factors.

Table 2.21. Rank importance of life cycle stages to the focal species – redband trout in the Owyhee Subbasin

	Spawning/incubation	Summer Rearing	Winter Rearing	Migration
Life Stage Rank (1-4)	3.0	4.0	2.0	1.0
Redband Trout Sensitivity	2nd Most	Most Sensitive	3rd Most	Least

Thus, the Life Stage rank (Table 2.21) indicates a prioritization of habitat condition for use by a life stage of the focal species. Since a rank of 4= highest sensitivity and a rank of 1= lowest sensitivity (McConnaha et al. 2003) – the scores above indicate that redband trout populations in the Owyhee Subbasin are most sensitive summer rearing habitat conditions, second-most sensitive to spawning/incubation habitat conditions, third-most sensitive to winter rearing habitat, and least sensitive to migratory habitat conditions.

We also assigned a weight to each attribute relative to its importance to the specific life stage of redband trout (Table 2.22). The attribute scale (0-2) ranks the importance ascribed to each habitat attribute in regards to the life stage of the focal species; where "zero" is not important, "one" is moderately important, and "two" is very important.

Table 2.22. Weight assigned to each attribute relative to its importance to the specific life stage of redband trout.

	Spawning/incubation	Summer Rearing	Winter Rearing	Migration
Riparian Condition	2.0	2.0	1.0	0.5
Channel stability	2.0	2.0	1.0	1.0
Habitat Diversity	1.0	2.0	2.0	1.0
Fine sediment	2.0	1.5	1.0	0.5
High Flow	1.0	1.0	1.0	2.0
Low Flow	1.0	2.0	1.0	2.0
Oxygen	1.0	2.0	0.0	1.0
Low Temp	0.5	0.0	1.0	0.5
High Temp	1.0	2.0	0.0	1.0
Pollutants	0.5	0.5	0.5	0.5
Obstructions	0.5	0.5	0.5	2.0

Current and Reference Worksheets

The “reference” and “current” tables are the heart of the assessment. Using these tables subbasin planners characterize the physical condition of the subbasin. This is accomplished by supplying information concerning a range of habitat characteristics, with information arrayed by reach or small watershed.

Definition of Reference. In the “reference” conditions we consider what this subbasin would be like if the system were restored to the fullest extent possible short of disrupting infrastructure that is vital to modern society and that is likely to remain in place for the foreseeable future. In a subbasin with little cultural modification this reference condition might equate to "historic" conditions, that is, the conditions that were in place prior to European settlement – this is the case for the Owyhee Subbasin. By contrast, in a largely urbanized subbasin (for example, within the Portland metropolitan area) this might mean accepting the urban fabric but taking aggressive action to restore habitat within the confines of this urban fabric.

Definition of Current. In the "current" conditions (Table 2.24-2.26) we rate the condition of the aquatic environment as it is today. One caveat is a situation where significant habitat enhancement is currently underway that would significantly change habitat quality. In these cases the guidance is to characterize current conditions as if these enhancements were complete.

Defining River Reaches. A river reach (or segment) is a linear stretch of stream that is defined by hydrological or ecological characteristics. Reaches are be hydrologically defined, as is the case in the USGS/EPA river reach system where a reach is defined as the area between confluences. The optimum number of reaches is about 60 for the smallest subbasin and 300 for the largest. We attempted to define each hydrological reach based on ecological character, we reviewed the streams in the subbasin and divide them into meaningful ecologically-consistent segments.

Confidence Levels. Below the list of habitat characteristics is a row entitled "attribute confidence." In this row we rated the level of confidence for each stream reach, based on the following scale:

0 = speculative
1 = expert opinion
2 = well documented

Habitat Characteristics. In both the reference and current condition tables we look at 11 habitat characteristics, or attributes. These eleven are:

1. Riparian condition
2. Channel form
3. Habitat diversity
4. Fine sediment
5. High flow
6. Low flow
7. Oxygen
8. High temperature
9. Low temperature
10. Pollutants
11. Obstructions

These are the habitat characteristics that are generally thought to be the main "drivers" of fish production and sustainability. These habitat attributes are defined in Table 2.23.

Table 2.23. Key for QHA habitat attributes.

#	Attribute	Description
1.	Riparian Condition	Condition of the stream-side vegetation, land form and subsurface water flow.
2.	Channel stability	The condition of the channel in regard to bed scour and artificial confinement. Measures how the channel can move laterally and vertically and to form a "normal" sequence of stream unit types.
3.	Habitat Diversity	Diversity and complexity of the channel including amount of large woody debris (LWD) and multiple channels.
4.	Fine sediment load	Amount of fine sediment within the stream, especially in spawning riffles.
5.	High Flow	Frequency and amount of high flow events.
6.	Low Flow	Frequency and amount of low flow events.
7.	Oxygen	Dissolved oxygen in water column and stream substrate.
8.	Low Temperature	Duration and amount of low winter water temperatures that can be limiting to fish survival.
9.	High Temperature	Duration and amount of high summer water temperature that can be limiting to fish survival.
10.	Pollutants	Introduction of toxic (acute and chronic) substances into the stream.
11.	Obstructions	Dam, irrigation diversion, or natural geologic feature that blocks fish movement.
12.	Reach Confidence	Confidence Rating (0-1-2 scale), where: 0 = Speculative; 1 = Expert Opinion; and 2 = Well Documented.

QHA is basically intended to be rated using an ordinal scale because we should not imply high resolution scores to a method that is inherently imprecise. But 1/2 increments (0.5) are permissible, e.g., when the field biologist thinks more resolution is realistic or as a compromise between two expert opinions.

Table 2.24. Key for scoring habitat attributes in "Current" QHA tables below.

Score	Attribute Rating	Normative (definition)
0	0% of normative	Ideal conditions for similar stream in this ecological province. Note that this is more from a geomorphic perspective than a biological perspective.
1	25% of normative	
2	50% of normative	
3	75% of normative	
4	100% of normative	

Current Worksheets Scores – Oregon

The following river reach system and habitat ratings for redband trout were developed at two workshops in November, 2003 -- with input from BLM and State of Oregon fishery biologists, possessing extensive field experience in the specific stream reaches in the Owyhee Subbasin. The following scores summarized in Table 2.24 were determined during the November 25th workshop-- with primary input from Ray Perkins (ODFW) and Cynthia Tate (BLM).

Table 2.24. QHA scores for the Oregon portion of the Owyhee.

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Owyhee R-1	Mouth to Owyhee Ditch Co Dam (RM14)	3.5	2.5	2.5	1.0	1.0	1.0	0.5	2.0	1.5	3.0	3.0	1
Owyhee R-2	DC Dam to RM28	3.0	3.0	3.5	3.5	2.0	2.0	3.5	2.5	1.0	3.5	4.0	2
Owyhee R-3	Dam to Upstream High Water (RM80)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Dry Creek	Dry Creek upstream to Crowley Road	2.5	3.0	3.0	3.0	2.5	2.5	3.0	3.5	2.0	4.0	3.5	2
Owyhee R-4	High Water upstream to Jordan Cr	3.5	3.5	3.5	3.0	3.5	3.5	3.5	4.0	3.0	3.0	4.0	2
Rinehart Creek	Mouth to falls	3.5	3.5	3.5	3.0	3.5	3.5	3.5	4.0	4.0	4.0	3.5	1
Jordan Creek	Mouth to State Line	2.0	2.5	2.0	2.0	2.5	1.0	1.5	3.0	1.0	3.0	2.5	1
Cow Creek	Mouth to State Line	1.0	2.5	2.0	2.0	3.5	1.0	1.5	3.0	1.0	4.0	2.5	0.5
Owyhee R-5	Confl. Jordan Creek upstream to Sline	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4.0	3.0	4.0	4.0	2
NF Owyhee	Mouth to Sline	3.0	3.5	3.5	3.5	3.5	3.5	3.5	4.0	3.0	4.0	4.0	2
Middle Fork	Idaho Segment (?)	1.5	3.5	3.5	2.0	3.0	3.5	3.0	4.0	3.0	4.0	4.0	0
Antelope Creek R-1	Mouth upstream to corrals (~8 mi)	4.0	4.0	4.0	3.0	3.5	3.5	3.5	4.0	3.5	4.0	4.0	2
Antelope Creek R-2	Corrals upstream to Star Valley Road (dry segment)	3.5	3.5	3.5	3.0	3.5	3.5	3.5	4.0	4.0	4.0	4.0	2
Antelope Creek R-3	SV Road upstream to Headwaters	2.5	3.0	2.5	3.0	3.5	3.5	2.5	3.5	2.5	4.0	4.0	2
WLO R-1	Mouth	3.5	3.5	3.5	3.0	3.5	3.5	3.5	4.0	3.0	4.0	4.0	2

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
	upstream to Anderson Crossing												
WLO R-2	Anderson Crossing to headwaters	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4.0	3.0	4.0	4.0	2

Current Worksheets Scores – Idaho

The following river reach system and habitat ratings for redband trout have been developed via a series of workshops (January-February 2004) -- with input from BLM and State of Idaho fishery biologists -- with extensive field experience in the specific stream reaches in the Owyhee Subbasin. The following scores were determined at the January 29th and February 5th workshops (Table 2.25).

Table 2.26. QHA scores for the Idaho portion of the Owyhee.

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
HUC 17050108													
Jordan Cr.-1	Jordan Cr. From OR Boundary to BLM boundary section	1.0	1.0	1.0	2.0	3.0	1.0	1.0	1.0	1.0	1.0	4.0	0.5
Jordan Cr.-2	From end of #2 to Rail Creek	1.5	2.0	1.0	2.0	2.5	2.0	2.5	2.0	2.0	1.0	4.0	1.5
Jordan Cr.-3	Rail Cr. Confluence to BLM boundary	2.0	2.0	2.0	3.0	3.0	1.0	2.5	2.0	2.0	1.0	4.0	0.5
Jordan Cr.-4	BLM boundary near Buck Cr. to BLM boundary	1.5	2.0	1.0	2.0	2.5	2.0	2.5	2.0	2.0	1.0	4.0	0.5
Jordan Cr.-5	BLM boundary section line to BLM boundary upstream of Louse Cr.	2.0	2.0	2.0	3.0	3.0	2.0	2.0	2.0	2.0	1.0	4.0	0.5
Jordan Cr.-6	BLM boundary upstream of Louse Cr. To BLM boudary section	3.0	3.0	2.5	3.0	2.5	2.0	2.5	2.0	2.0	1.0	4.0	0.5
Jordan Cr.-7	BLM Boundary to state land section boundary	2.0	2.0	2.0	3.0	3.0	3.0	2.5	2.0	2.0	1.0	4.0	0.5
Jordan Cr.-8	State linelands boundary to headwaters of Jordan Cr.	2.5	2.5	2.5	2.0	3.0	2.5	2.5	2.5	2.5	1.0	4.0	0.5
Williams Cr.	BLM segments	2.5	2.0	2.0	2.5	2.5	2.0	2.5	2.0	2.0	2.5	4.0	1.5
Williams Cr.	Including Pole Bridge Cr. And	2.5	2.5	2.0	3.0	4.0	3.0	2.5	2.0	2.0	2.5	4.0	0.5

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
	West Cr.												
Duck Cr.	All	1.5	1.5	2.0	1.5	2.5	2.0	2.0	2.0	2.0	2.0	4.0	1.5
Old Man Cr.	All	1.0	2.0	1.0	2.0	3.0	0.0	2.0	2.0	2.0	2.0	1.0	0.5
South Mountain Creek	Lower BLM upper put state includes Howl Cr. Cyote Cr.	1.5	1.5	1.0	1.5	2.5	2.0	2.0	2.0	2.5	2.0	4.0	0.5
Rail Cr.	All	2.0	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.0	2.0	4.0	1
Washington Gulch	All	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.5	2.0	2.5	4.0	1
Flint Cr.1	Lower	2.8	2.5	3.0	1.5	2.5	2.5	3.0	3.0	2.0	1.5	4.0	0.5
Flint Cr.2	Upper Includes East Cr.	2.8	2.5	3.0	1.5	2.5	2.5	3.0	3.0	2.0	1.5	4.0	2
South Boulder Cr.	From confluence with North Boulder Cr. To confluence with Mill Cr.	2.5	3.0	2.5	2.3	3.0	2.8	2.5	2.5	1.5	2.0	4.0	1.5
Upper South Boulder Creek	Mill Creek confluence to headwaters	2.0	2.0	2.0	2.0	2.0	2.5	2.5	2.5	1.5	2.0	3.5	0.5
Indian Cr.	Bogus Cr. (Lower) - confluence with South Fork Boulder to Section 10	1.0	2.0	1.0	2.0	3.0	0.0	2.0	2.0	2.0	2.0	4.0	0.5
Bogus Cr.	Upper above section 10 and above	2.5	2.5	2.5	2.5	3.0	3.0	3.0	3.0	2.5	3.0	4.0	1
Combination Cr.	Lower reach of stream	1.5	2.0	2.0	2.5	3.0	2.5	1.5	2.5	2.5	2.5	4.0	1
Rose Cr.	Up to state section.	2.8	3.0	2.5	3.0	3.0	2.5	2.0	3.0	2.5	3.0	4.0	1.5
Josephine	includes Wickiup and Long Valley and Headwater Josephine	2.8	3.0	2.5	3.0	1.5	2.0	3.0	3.0	2.0	2.5	4.0	1.5

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Louisa Cr.	From confluence with Rock Cr.	1.5	1.5	2.0	1.5	1.0	1.0	2.5	1.5	1.5	1.5	0.0	1.5
Lower Rock Cr.-1	From confluence of North Boulder to Meadow Creek.	3.0	3.0	3.0	2.5	1.5	1.5	2.5	3.0	2.0	3.0	4.0	1.5
Rock Cr.-2	From Meadow Creek to BLM	1.0	1.0	1.0	2.0	3.0	1.0	1.0	1.0	1.0	2.0	4.0	0.5
Rock Cr.-3	BLM portion in Section 26	3.0	3.0	2.5	2.5	1.5	1.5	2.0	3.0	2.0	2.0	4.0	0.5
Rock Cr.-4	From BLM/PVT boundary in Sec. 26 to above Triangle Reservoir.	1.0	1.0	1.0	2.0	3.0	1.0	1.0	1.0	1.0	2.0	4.0	0.5
Rock Cr. 5	BLM reach above Triangle Reservoir to Sheep Creek/private boundary	3.0	3.0	2.5	2.5	3.0	2.0	2.5	3.0	2.0	2.0	4.0	1.5
Rock Cr. 6	From Sheep Creek/private boundary to headwaters	2.0	2.0	2.0	3.0	4.0	3.0	3.0	3.0	2.0	2.0	4.0	0.5
Meadow Cr.	Headwaters to confluence with Rock Cr.	1.5	1.5	1.0	2.0	3.0	1.5	2.5	3.0	1.5	3.0	4.0	0.5
Deer Cr.	Confluence with Big Boulder to state section 36	2.8	2.8	2.5	2.0	2.5	2.5	2.5	3.0	2.5	3.0	2.0	1.5
Owl Cr.	Includes Minear Cr. (Confluence of Lone Tree to headwaters)	2.5	2.5	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0	1
North Boulder-1	From confluence with Big	3.5	3.5	3.0	3.0	3.0	3.0	3.0	3.0	2.0	3.0	4.0	1.5

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
	Boulder; BLM reach to Private												
North Boulder-2	From confluence with Mamouth Cr. To headwaters	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	3.0	4.0	1.5
Louse Cr.	Includes Cottonwood Cr. From confluence of Jordan Cr. To headwaters	1.5	2.0	1.0	2.0	3.0	1.0	2.0	2.0	2.5	2.0	4.0	1
Upper Trout Cr.	From Split Rock Canyon to headwaters, including Nichols, Wood Canyon creeks	2.0	2.0	1.8	2.0	3.0	1.5	2.0	2.5	2.5	2.0	3.0	1
Split Rock Canyon	Confluence with Trout Creek to headwaters.	2.5	2.0	2.0	2.0	3.0	2.5	2.5	2.5	3.0	2.5	4.0	1.5
Cow Cr.-2	From confluence with Wildcat Canyon Cr. To headwaters	2.0	2.0	2.0	2.0	3.0	2.5	3.0	3.0	2.0	2.0	4.0	1.5
Soda Cr.	From confluence of Cow Cr. To headwaters	2.5	2.5	2.0	2.0	3.0	3.0	2.0	3.0	2.0	2.0	4.0	1.5
HUC 17050107													
NF Owyhee 1	Lower; From the Oregon State line to the confluence of Juniper Cr.	3.0	3.0	3.0	2.5	3.5	2.0	3.0	3.0	2.0	3.0	4.0	1.5
NF Owyhee 2	Upper; Headwaters of North Fork , Lower Noon	3.0	3.0	3.0	3.0	3.5	2.5	3.0	3.0	2.5	3.0	4.0	1.5

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
	Cr. And Lower Pleasant Valley Cr.												
Upper Pleasant Valley Cr.	From the top of Sec. 7 to headwaters	2.0	1.0	1.5	1.5	3.5	1.5	3.0	3.0	2.0	2.0	3.0	1.5
Cabin Cr.	From the confluence with Juniper Cr. To the headwaters	2.0	2.0	2.5	2.0	3.0	2.5	3.0	3.0	2.0	2.0	4.0	1.5
Juniper Cr. 1	From the confluence with the North Fork Owyhee to lower private boundary	2.8	3.0	3.0	2.5	3.0	2.5	3.0	3.0	2.0	2.0	4.0	1.5
Juniper Cr. 2	From the start of the private up to the headwaters	2.0	3.0	2.0	2.0	3.0	1.0	3.0	3.0	2.0	2.0	4.0	0.5
Lone Tree Cr.	From Oregon State line to headwaters	2.0	2.0	1.5	2.0	3.0	2.5	3.0	3.0	2.0	2.0	4.0	0.5
Cottonwood Cr.	From the upper private boundary (section 18) to headwaters	2.0	2.0	2.0	2.0	3.0	1.5	3.0	3.0	2.0	3.0	3.0	1.5
Squaw Cr. 1	From Oregon State line to lower private boundary (section 13)	3.0	3.0	3.0	2.5	3.5	2.5	3.0	3.0	2.0	3.0	3.0	1.5
Squaw Cr. 2	From the start of private in section 14 to the BLM in the northwest corner of section 31	3.0	4.0	3.0	3.0	4.0	2.0	3.0	3.0	2.0	3.0	4.0	0.5
Squaw Cr. 3	From private to headwaters	2.0	2.0	2.0	2.0	3.5	2.0	3.0	3.0	2.0	2.5	4.0	0.5

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Pole Cr.	Oregon State line to headwaters	3.0	3.0	3.0	2.5	3.5	3.0	3.0	3.0	3.0	3.0	4.0	2
Middle Fork Owyhee	Oregon State line to headwaters	0.5	1.5	1.5	2.0	3.5	1.5	2.0	1.5	1.0	2.0	4.0	2
HUC 17050106													
Little Owyhee	From the Nevada State line to the confluence with South Fork Owyhee	2.0	2.3	1.0	2.0	3.0	1.5	1.0	1.0	1.0	1.0	4.0	1
HUC 17050105													
South Fork Owyhee	From Nevada State line to the confluence with Owyhee River	2.8	3.0	2.5	2.0	2.5	1.5	2.5	3.0	1.5	3.0	3.0	1.5
HUC 17050104													
Blue Cr.-3	Blue Cr. Reservoir to headwaters	1.5	2.0	3.0	3.0	2.0	1.0	3.0	2.0	2.0	3.0	2.0	1.5
Shoofly Cr.-1	Confluence to BLM boundary	1.0	2.0	1.0	2.0	2.0	1.0	3.0	2.0	2.0	3.0	4.0	1.5
Shoofly Cr.-2	Private/BLM boundary to Bybee reservoir	2.0	3.0	2.0	3.0	1.0	1.0	3.0	3.0	2.0	3.0	1.0	1.5
Shoofly Cr.-3	Bybee reservoir to headwaters	2.0	3.0	2.0	3.0	3.5	2.5	3.0	3.0	2.0	3.0	3.0	0
Owyhee River	DV reservoir border to confluence	3.0	3.0	3.0	3.0	3.0	3.5	3.0	3.5	2.0	4.0	4.0	1.5
Owyhee River DVIR portion	Mouth of canyon to NV state line	1.0	1.0	1.0	2.0	3.0	1.0	2.0	2.0	1.0	3.0	4.0	1
Battle Cr.-1	Confluence to private in sec. 10 (cottonwood draw)	3.0	3.0	2.0	3.0	3.0	3.0	2.5	3.0	1.0	3.0	4.0	2

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Battle Cr.-2	Section 10 to above state section 36	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0	0
Battle Cr.-3	State section 36 to headwaters	1.5	2.0	1.0	2.0	3.5	1.0	3.0	2.0	2.0	2.0	3.0	1.5
Dry Cr.-1	confluence to reservoir	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0
Dry Cr.-2	Reservoir to headwaters	1.0	1.0	1.0	2.0	4.0	1.0	3.0	2.0	1.0	3.0	1.0	1.5
Big Springs Cr.-1	confluence to reservoir	1.5	2.0	2.0	2.0	4.0	2.0	3.0	2.0	1.0	3.0	3.0	1.5
Big Springs Cr.-3	BLM boundary to private	1.0	2.0	2.0	2.0	4.0	2.0	3.0	2.0	1.0	2.0	4.0	1.5
Deep Cr.-1	Confluence to private	3.0	2.5	2.5	1.0	3.5	2.0	1.0	3.0	1.0	4.0	4.0	2
Deep Cr.-2	Private to mid section 10	2.0	1.5	1.5	1.0	3.5	2.0	1.0	3.0	1.0	4.0	4.0	2
Deep Cr.-3	section 10 to Stoneman Cr. Confluence	3.0	1.5	1.5	1.0	3.5	2.0	2.0	3.0	2.0	4.0	4.0	2
Deep Cr.-4	headwaters including:	1.0	1.0	1.5	1.0	3.5	2.0	2.0	3.0	2.0	3.0	4.0	2
Stoneman Cr.	Confluence to headwaters	2.0	1.0	2.0	2.0	3.0	1.0	3.0	3.0	2.0	3.0	3.0	2
Current Cr.	Confluence to headwaters	2.0	1.0	2.0	2.0	3.0	1.0	3.0	2.0	2.0	3.0	3.0	2
Nickel Cr.	Confluence to headwaters including:	2.0	3.0	3.0	1.0	3.5	2.0	3.0	3.0	2.5	3.0	4.0	2
Smith Cr.	Confluence to headwaters including:	2.0	2.0	2.0	1.0	3.5	2.0	3.0	3.0	2.0	3.0	4.0	2
Castle Cr.	Confluence to headwaters including:	1.0	2.0	2.0	1.0	1.0	1.0	2.0	2.0	1.0	3.0	1.0	2
Beaver Cr.	Confluence to headwaters including:	2.0	3.0	3.0	2.0	3.0	2.0	3.0	3.0	3.0	3.0	4.0	2

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Red Canyon Cr.	Confluence to headwaters including:	1.5	2.0	2.0	2.0	3.5	2.0	3.0	3.0	1.0	3.0	4.0	2
Petes Cr.	Confluence to headwaters including:	1.5	1.5	1.5	1.5	3.5	2.0	3.0	3.0	1.0	2.0	4.0	2
Dickshooter Cr.	Confluence to headwaters	3.0	3.0	3.0	2.0	3.0	3.0	3.0	3.5	3.0	3.0	4.0	1.5
Pole Cr.-1	Confluence to Camas Cr. Confluence including Camel Cr.	2.5	3.0	3.0	2.0	3.0	2.0	3.0	3.0	1.0	3.0	4.0	1.5
Pole Cr.-2	Camas confluence to headwaters	2.0	2.5	2.5	2.0	3.5	1.0	3.0	3.0	1.0	3.0	3.0	1.5
Camas Cr.	Confluence to headwaters	3.0	3.0	2.5	2.0	3.5	2.0	3.0	3.0	2.0	3.0	4.0	1.5

Current Worksheets Scores – Nevada

The following river reach system and habitat ratings for redband trout have been developed via workshops (March 9th-10th in Elko, Nevada) with input from Nevada fishery biologists – Pat Coffin (BLM) and Gary Johnson (NDOW) – with extensive field experience in the specific stream reaches in the Owyhee Subbasin. The following scores were derived from the Nevada QHA workshops (Table 2.26).

Table 2.26. QHA scores for the Nevada portion of the Owyhee.

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12
							HUC 17050104						
E.F. Owyhee ID-NV state line to Paradise Point Diversion	Irrigated hay fields, No RBT habitat	2.5	1.0	2.0	1.5	1.5	1.0	2.0	2.5	2.5	1.0	1.0	1
Boyle Cr	Starts in NV and enters Owyhee in ID	1.5	2.0	2.0	2.0	3.5	3.5	3.0	2.5	2.5	3.0	3.5	0.5
S.F of Boyle Cr		1.5	2.0	2.0	2.0	3.5	3.5	3.0	2.5	2.5	3.0	3.5	0.5
E.F. Owyhee Paradise Point to Duck Valley Indian Res border	DVIR	2.0	0.5	0.5	1.5	3.0	2.5	2.0	2.5	2.5	1.0	4.0	1
Skull Cr		1.5	2.0	2.0	2.0	3.5	3.5	3.0	3.0	2.5	3.0	3.5	0.5
N.F. of Skull Cr		1.5	2.0	2.0	2.0	3.5	3.5	4.0	3.0	2.5	3.0	3.5	0.5
E.F. of Skull Cr		1.5	2.0	2.0	2.0	3.5	3.5	4.0	3.0	2.5	3.0	3.5	0.5
Reed Cr		1.5	2.0	2.0	2.0	3.5	3.5	3.0	2.5	2.5	3.0	3.5	0.5
Summit Cr		1.5	2.0	2.0	2.0	3.5	3.5	3.0	2.5	2.5	3.0	3.5	0.5
Fawn Cr	USFS RBT occupied for sure 4.8miles	2.5	3.0	3.0	3.0	4.0	4.0	4.0	3.0	2.5	3.0	4.0	1.5
Jones Cr		1.5	2.0	2.0	2.0	3.5	3.5	3.0	2.5	2.5	3.0	3.5	0.5
Granite	probably fishless	1.5	2.0	2.0	2.0	3.5	3.5	3.0	2.5	2.5	3.0	3.5	0.5
E.F. Owyhee Duck Valley Indian Res border to Patsville (Mill Cr)	U.S.F.S.	2.0	2.0	1.0	2.0	3.0	2.5	2.5	2.5	2.5	0.5	4.0	1.5
Slaughter House Cr	Occupied RBT 2 miles	3.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
Brown's Gulch (Slaughter house Trib	2.4 miles RBT occupied	3.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
Miller Cr.	3 mile occupied RBT	2.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
West Fr. (of Slaughterhouse Cr)	1.5 miles occupied RBT	3.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
California Cr	Min. occupied RBT by headwater of Cr.	2.0	2.0	2.0	2.0	3.0	1.0	3.5	3.0	1.5	4.0	3.0	2
North Fr (trib of	No RBT, lack of	2.0	2.0	2.0	2.0	3.0	3.0	3.5	3.0	1.5	4.0	3.0	2

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12
California Cr)	flow(Drought yr)												
Dip Cr	1 mile RBT occupied	3.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
Big Springs Cr	Unoccupied (insufficient flow)	3.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
South Fr.	2 mile RBT occupied	2.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
Pixley	1 mile RBT occupied	3.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0	2
E.F. Owyhee Mill Cr.to Badger Cr	U.S.F.S.	2.5	1.5	1.0	2.0	3.0	2.5	3.0	2.5	3.0	3.0	2.5	1.5
Lower Mill Cr to S.F Owyhee River	Unoccupied, pollution, mine tailings	0.5	2.0	0.5	2.0	3.0	3.0	2.0	2.0	2.0	0.5	4.0	2
Upper Mill Cr to Rio tinto Mine	occupied RBT whole distance in none drought years	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
McCall Cr.	5.5 miles occupied RBT	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Allegheny	Native Dace only	2.0	2.0	2.0	2.0	3.0	1.0	3.5	3.0	1.5	4.0	3.0	2
Cold Spring (trib to Allegheny)	Native Dace only	2.0	2.0	2.0	2.0	3.0	1.0	3.5	3.0	1.5	4.0	3.0	2
Trail Cr	8.2 occupied RBT, Brook Trout(MGT concern)	3.0	3.0	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	2.0	2
Van Duzer Cr. (Trib to Trail Cr)	5 mile occupied, Brook Trout (MGR concen)	3.0	2.5	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	2.0	2
Lime Cr (trib to Van Duzer)	.3 occupied by RBT, Brook Trout prsnt	3.0	2.5	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Cobb Cr (trib to Van Duzer)	4.5 RBT occupied	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Deer Cr (trib to Trail Cr.)	min. occupied RBT in a single pool	2.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0	2
Springs Cr.	0.1 mile RBT occupied, Brook trout	2.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0	2
Wood Gulch	Mine prsnt, 2 mile RBT occupied	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
Hutch Cr	1mile RBT occupied, Brook Trout	2.5	2.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0	2
Timber Gulch	0.35 RBT occupied, Brook Trouth	2.5	2.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0	2
Sheep cr	2 mile RBT	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12
	occupied, Brook Trout												
Road Canyon	1.2 RBT occupied	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
Gravel Cr	Lower 0.1 RBT occupied (spawning ground)	2.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
E.F. Owyhee Badger Cr. To Wildhorse Res.	U.S.F.S.	3.5	3.0	3.0	3.0	2.5	2.0	2.5	2.0	3.0	3.0	1.0	2
Badger Cr.	7 miles RBT occupied, some livestock concerns, fair condition, 1600 fish	2.5	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Beaver Cr.	All occupied by RBT	2.5	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Wildhorse Res		3.0	3.0	3.0	3.0	3.0	1.0	2.0	3.0	2.0	2.0	1.0	2
Hendricks Cr	RBT appearing (questionalble genetics,rainbow ?)	2.5	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Warm Cr (Trib of Hendricks)	not RBT occupied, warm water temp, soil type/erosion, agriculture	2.5	2.5	4.0	4.0	4.0	2.5	3.0	3.0	3.0	4.0	3.5	2
Penrod	RBT occupied entire way	2.5	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Hay meadow Cr	only native dace present	2.0	2.0	2.0	2.0	3.0	1.0	3.5	3.0	1.5	4.0	3.0	2
Thompson Cr (hay meadow trib)	no fish present in drough yrs	2.0	2.0	2.0	2.0	3.0	1.0	3.5	3.0	1.5	4.0	3.0	2
Martin Cr. (trib to Penrod)	4.5 RBT occupied, Brook Trout	3.0	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.5	2
Gold Cr. (trib to Martin Cr)	1.8 RBT occupied	2.5	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Sweet Cr	0.5 RBT occupied	2.0	2.0	2.0	2.0	3.0	1.0	3.5	3.0	1.5	4.0	3.0	2
Rosebud Cr	Native Dace only	2.0	2.0	2.0	2.0	3.0	1.0	3.5	3.0	1.5	4.0	3.0	2
Deep Cr trib to Wildhorse (E.F. Owyhee)	1.5 miles occupied RBT, some on prvt land?	3.0	3.0	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	3.0	2
Clear Cr trib to (Deep Cr)	no fish present in drough yrs	3.0	3.0	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	4.0	2
Riffe Cr (Deep Cr)	3 mile occupied RBT, beaver ponds	3.0	3.0	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	4.0	2

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12
N.F. of Deep Cr	No RBT, lack of flow(Drought yr)	3.0	3.0	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	4.0	2
Middle Fork of Deep Cr	2 mile occupied RBT	3.0	3.0	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	4.0	2
S.F of Deep Cr	3 miles RBT occupied	3.0	3.0	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	4.0	2
E. F. Owyhee Above Wildhorse Res to head waters	Spotted Frog habitat	2.5	2.5	3.0	1.0	3.0	1.5	2.0	3.0	2.0	3.0	3.0	2
Clear Cr trib to Upper E.F Owyhee	Historic potential habitat, poisioning in 1988 to remove chub, killed Trout	3.0	3.0	3.0	3.0	4.0	3.0	4.0	4.0	3.0	3.0	3.0	2
Hanks Cr trib to Upper E.F Owyhee	Dace prsnt, habitat concerns (livestocke) no RBT	1.5	2.0	2.0	2.0	3.0	3.0	4.0	3.0	2.0	2.0	4.0	2
HUC 17050105													
State line to Petan ranch	Red Band prsnt seasonally(Sprin g) during good water yrs when sutiable water temps	2.5	4.0	2.5	3.0	2.0	4.0	4.0	2.5	3.0	3.5	2	2. 5
Lower boundry of Petan Ranch to Red Cow Cr.	Red Band prsnt seasonally(Sprin g) during good water yrs when sutiable water temps	2.0	2.0	2.5	3.0	2.0	4.0	4.0	2.5	3.0	3.5	2	2. 5
From Red Cow to Hot cr.	RBT Occupied yr round, low density	2.5	3.0	2.5	3.0	2.0	4.0	4.0	2.5	3.0	4.0	2	2. 5
hot creek to McCann	Prvt Land, Brook Trout prsnt in Spring Heads, RBT are seasonal, White Fish yr round	2.5	2.0	2.5	3.0	2.0	4.0	4.0	3.0	3.0	3.0	1	2. 5
Four mile cr from S.F. to Chimney Res.	RBT Down migration during good water yrs, dry 10months of yr, flow controlled by Chimney	2.0	1.5	3.0	2.0	1.0	3.0	3.0	2.0	4.0	2.0	1	2. 0
Chimney Cr. Res to T41N R49E sec4	RBT Down migration during good water yrs, dry 10months of yr, flow controlled by	1.5	1.5	2.0	4.0	4.0	4.0	4.0	2.0	4.0	4.0	2	1. 0

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12
	Chimney												
T41N R49E sec4 to Head Waters	Occupied by RBT year round, 3miles of reach occupied	2.5	2.0	2.5	4.0	4.0	4.0	4.0	2.0	4.0	4.0	2	2.0
Chimney Cr Res. To Winters Cr.	Int/Dry 10mnths/yr, no RBT	1.5	1.5	2.0	4.0	4.0	4.0	4.0	2.0	4.0	4.0	1	1.0
Winters Cr.	Recently occupied, but not currently, historic habitat (no record), stocked in 1972 with RBT, ceased in 2000due to fire/livestock grazing	2.5	2.0	2.5	4.0	4.0	4.0	4.0	2.0	4.0	2.5	2	2.0
Sheep Creek- S.F. Owyhee to Sheep Cr. Res		1.5	1.5	2.0	4.0	4.0	4.0	4.0	2.0	4.0	1.0	0.5	1.0
Sheep Cr. Res to T46n R51E sec 11	Int/Dry, no RBT, spring down migration	1.5	1.5	2.0	4.0	4.0	4.0	4.0	2.0	4.0	4.0	0.5	1.0
T46n R51e sec 11 to head waters		1.5	1.5	2.0	4.0	4.0	4.0	4.0	2.0	4.0	4.0	0.5	1.5
Indian Cr. (Trib to S.F. Owyhee)	Occupied RBT through National Forest	3.0	3.0	3.0	3.0	3.0	4.0	4.0	3.0	4.0	1.0	1.5	3.0
Winters Cr. Trib to Indian Cr	2 miles occupied RBT through National Forest	3.0	3.0	3.0	3.0	3.0	4.0	4.0	3.0	4.0	4.0	1.5	3.0
Mitchell Cr. Trib to Indian Cr	2 miles occupied RBT through National Forest	3.0	3.0	3.0	3.0	3.0	4.0	4.0	3.0	4.0	4.0	1.5	3.0
Wall Cr. Trib to Indian Cr	1 Mile occupied RBT through National Forest	3.0	3.0	3.0	3.0	3.0	4.0	4.0	3.0	4.0	4.0	1.5	3.0
Silver Cr. (Trib to S.F. Owyhee)	2 miles occupied RBT through National Forest	2.0	3.0	2.5	3.0	2.5	4.0	4.0	3.0	4.0	3.0	1.5	3.0
White Rock Cr.	Unoccupied, probably historic, mining influence	3.0	3.0	3.0	3.0	2.5	4.0	4.0	3.0	4.0	3.0	1.5	3.0
Cottonwood Canyon Cr.	Unoccupied, probably historic, mining influence	3.0	3.0	3.0	3.0	2.5	4.0	4.0	3.0	4.0	3.0	1.5	3.0
Breakneck Cr	2 miles occupied RBT	3.0	3.0	3.0	4.0	4.0	4.0	4.0	3.0	4.0	3.0	1.5	3.0
Bull Run Cr.-S.F. Owyhee to Bull Run Canyon	Diverted for Agriculture use	2.0	3.0	2.5	3.0	2.5	4.0	4.0	3.0	4.0	3.0	0.5	3.0

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12
Mouth of Bull Run Canyon to Cap Winn Cr.	probably recruitment from upstream tribs	3.0	3.0	3.0	3.0	3.0	4.0	4.0	3.0	4.0	2.0	1.5	3.0
Frost Cr.	Low number of RBT	2.5	2.0	2.0	4.0	4.0	4.0	3.0	3.0	4.0	4.0	2	1.0
Cap Winn Cr	Occupied RBT,	3.0	2.0	2.0	4.0	4.0	4.0	3.0	3.0	4.0	4.0	2	1.5
Doby George	Occupied RBT,	3.0	2.0	2.0	4.0	4.0	4.0	3.0	3.0	4.0	4.0	2	2.0
Columbia Cr	Occupied RBT, Low number (200's), Brook Trout abundant	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Blue Jacket Cr	Occupied RBT (700), Brook Trout	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	2	3.0
Deep Cr. Trib to S.F. Owyhee		2.0	2.0	1.5	2.5	2.0	4.0	3.0	3.0	4.0	2.0	2	1.5
S.F Owyhee to Head Waters	Unoccupied, RBT probably present historically												
Red Cow Cr.	Occupied 1mile by RBT	2.0	1.0	3.0	3.0	2.0	4.0	3.0	3.0	4.0	4.0	2	1.5
Amazon	Ephemeral, no record of RBT, probably historic	2.0	1.0	3.0	3.0	2.0	4.0	3.0	3.0	4.0	4.0	1	1.5
Big Cottonwood Trib	1mile occupied by RBT	2.0	1.0	3.0	3.0	2.0	4.0	3.0	3.0	4.0	4.0	2	1.5
Harrington Cr	Unsurveyed, Prvt Land, Probable RBT	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	1	3.0
Marsh Cr.	Occupied RBT	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Boyd Cr	Occupied RBT	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Scoonover Cr.	Occupied RBT	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Dorsey	Occupied RBT	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Coffin Cr.	Occupied RBT	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Jack Cr	Occupied RBT, no brook trout surveyed in last 2yrs(used to be abundant)	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Chicken Cr	Occupied RBT,	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Mill Cr	Occupied RBT, Brook trout, included 3 forks	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12
Niagra Cr	No Surveyed Data	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	0.5	3.0
Snow Canyon Cr	Occupied RBT, 5 mi occupied	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Jarritt Canyon	Int/Dry, Unoccupied, Historic Salmon	2.5	2.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	1.5	2.5
Burns Cr.(Trib to Jarritt Canyon0	1.5 mile occupied on National Forest, Trout Prsnt	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Schmidtt Cr.	4 miles occupied	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
McCann Cr	5 mile occupied RBT, low density RBT	2.5	2.0	2.5	3.0	2.0	4.0	3.0	3.0	4.0	3.0	2	2.0
Taylor Canyon Cr (trib to S.F. Owyhee)	2 miles occupied RBT, BT common	3.0	4.0	3.5	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2	4.0
Water Pipe Canyon (trib to Taylor Canyon)	2.5 mile occupied RBT	2.5	3.0	3.0	4.0	4.0	4.0	4.0	3.0	4.0	3.0	2	2.0

Owyhee Subbasin QHA Limiting Factors Analysis

The Qualitative Habitat Assessment (QHA) provided a ranking of habitat attributes with respect to redband trout productivity. The factor with the lowest habitat score for the current habitat condition was considered to be the limiting factor for a given reach.

In cases of tie scores, the rank list below was used to determine singular Limiting Factor. For example, if three QHA Attribute scores were the same for a given stream reach (e.g., high temp, low flow, and riparian all had scores of 1.5 – which was the minimum score for the reach); then the following list would be used to determine that low flow was the limiting factor.

Trump Rank as Limiting Factor	Attribute
1.	Pollutants
2.	Obstructions
3.	Low Flow
4.	High Temperature
5.	Fine sediment load
6.	Riparian Condition
7.	Oxygen
8.	High Flow

9.	Low Temperature
10.	Channel stability
11.	Habitat Diversity

In other words, the rank listed above was used to determine which potential Limiting Factor would "trump"the others. The rationale is that (for example) if there was a significant problem with pollutants, then alleviating a high temperature or sediment problem would not fix the habitat condition – and pollutants would still be limiting the reach with respect to redband trout production. Thus, a given attribute in the list would "trump" all the attribute scores below it.

The limiting factors by reach are presented in Tables 2.28, 2.29 and 2.30 below. The link between the limiting factors analysis and the "bottom-up" development of Objectives and strategies for redband trout in the Owyhee Subbasin Management Plan are presented in Appendix 4.2.

Table 2.28. Limiting factors analysis based on minimum QHA scores, by specific reach, for the Oregon portion of the Owyhee.

4th Field HUC/ Reach Name	Description	Reach Confidence (0-2)	Min. QHA Score ↦ Limiting Factor(s)
Owyhee R-1	Mouth to Owyhee Ditch Co Dam (RM14)	1	1.0: Oxygen
Owyhee R-2	DC Dam to RM28	2	1.0: H. Temp.
Owyhee R-3	Dam to Upstream High Water (RM80)		NA
Dry Creek	Dry Creek upstream to Crowley Road	2	2.0: H. Temp.
Owyhee R-4	High Water upstream to Jordan Cr	2	3.0: F. Sediment H. Temp. Pollutants
Rinehart Creek	Mouth to falls	1	3.0: F. Sediment
Jordan Creek	Mouth to State Line	1	1.0: L. Flow

			H. Temp.
Cow Creek	Mouth to State Line	0.5	1.0: Riparian L. Flow H. Temp.
Owyhee R-5	Confl. Jordan Creek upstream to Sline	2	3.0: H. Temp.
NF Owyhee	Mouth to Sline	2	3.0: Riparian H. Temp.
Middle Fork	Idaho Segment	0	1.5: Riparian
Antelope Creek R-1	Mouth upstream to corrals (~8 mi)	2	3.0: F. Sediment
Antelope Creek R-2	Corrals upstream to Star Valley Road (dry segment)	2	3.0: F. Sediment
Antelope Creek R-3	SV Road upstream to Headwaters	2	2.5: Riparian H. Diversity Oxygen H. Temp.
WLO R-1	Mouth upstream to Anderson Crossing	2	3.0: F. Sediment H. Temp.
WLO R-2	Anderson Crossing to headwaters	2	3.0: H. Temp.

Table 2.29. Limiting factors analysis based on minimum QHA scores, by specific reach, for the Idaho portion of the Owyhee.

4th Field HUC/ Reach Name	Description	Reach Confidence (0-2)	Min. QHA Score ↦ Limiting Factor(s)
HUC 17050108			
Jordan Cr.-1	Jordan Cr. From OR Boundary to BLM boundary section	0.5	1.0: Riparian C. Stability H. Diversity L. Flow Oxygen L. Temp. H. Temp. Pollutants
Jordan Cr.-2	From end of #2 to Rail Creek	1.5	1.0: H. Diversity Pollutants
Jordan Cr.-3	Rail Cr. Confluence to BLM boundary	0.5	1.0: L. Flow Pollutants
Jordan Cr.-4	BLM boundary near Buck Cr. to BLM boundary	0.5	1.0: H. Diversity Pollutants
Jordan Cr.-5	BLM boundary section line to BLM boundary upstream of Louse Cr.	0.5	1.0: Pollutants
Jordan Cr.-6	BLM boundary upstream of Louse Cr. To BLM boudary section	0.5	1.0: Pollutants
Jordan Cr.-7	BLM Boundary to state land section boundary	0.5	1.0: Pollutants
Jordan Cr.-8	State linelands boundary to headwaters of Jordan Cr.	0.5	1.0: Pollutants
Williams Cr.	BLM segments	1.5	2.0: C. Stability H. Diversity L. Flow L. Temp. H. Temp.
Williams Cr.	Including Pole Bridge Cr. And West Cr.	0.5	2.0 H. Diversity L. Temp.

4th Field HUC/ Reach Name	Description	Reach Confidence (0-2)	Min. QHA Score ↦ Limiting Factor(s)
			H. Temp.
Duck Cr.	All	1.5	1.5: Riparian C. Stability F. Sediment
Old Man Cr.	All	0.5	1.0: L. Flow
South Mountain Creek	Lower BLM upper put state includes Howl Cr. Cyote Cr.	0.5	1.0: H. Diversity
Rail Cr.	All	1	2.0: Riparian C. Stability H. Diversity F. Sediment H. Temp. Pollutants
Washington Gulch	All	1	2.0: Riparian C. Stability H. Diversity H. Temp.
Flint Cr.1	Lower	0.5	1.5: F. Sediment Pollutants
Flint Cr.2	Upper Includes East Cr.	2	1.5: F. Sediment Pollutants
South Boulder Cr.	From confluence with North Boulder Cr. To confluence with Mill Cr.	1.5	1.5: H. Temp.
Upper South Boulder Creek	Mill Creek confluence to headwaters	0.5	1.5: H. Temp.
Indian Cr.	Bogus Cr. (Lower) - confluence with South Fork Boulder to Section 10	0.5	1.0: L. Flow
Bogus Cr.	Upper above section 10 and above	1	2.5: Riparian C. Stability H. Diversity F. Sediment

4th Field HUC/ Reach Name	Description	Reach Confidence (0-2)	Min. QHA Score ↦ Limiting Factor(s)
			H. Temp.
Combination Cr.	Lower reach of stream	1	1.5: Riparian Oxygen
Rose Cr.	Up to state section.	1.5	2.0: Oxygen
Josephine	includes Wickiup and Long Valley and Headwater Josephine	1.5	1.5: H. Flow
Louisa Cr.	From confluence with Rock Cr.	1.5	1.0: Obstruction
Lower Rock Cr.-1	From confluence of North Boulder to Meadow Creek.	1.5	1.5: H. Flow L. Flow
Rock Cr.-2	From Meadow Creek to BLM	0.5	1.0: Riparian C. Stability H. Diversity L. Flow Oxygen L. Temp. H. Temp.
Rock Cr.-3	BLM portion in Section 26	0.5	1.5: H. Flow L. Flow
Rock Cr.-4	From BLM/PVT boundary in Sec. 26 to above Triangle Reservoir.	0.5	1.0: Riparian C. Stability H. Diversity L. Flow Oxygen L. Temp. H. Temp.
Rock Cr. 5	BLM reach above Triangle Reservoir to Sheep Creek/private boundary	1.5	2.0: L. Flow H. Temp. Pollutants
Rock Cr. 6	From Sheep Creek/private boundary to headwaters	0.5	2.0: Riparian C. Stability H. Diversity H. Temp. Pollutants

4th Field HUC/ Reach Name	Description	Reach Confidence (0-2)	Min. QHA Score ↦ Limiting Factor(s)
Meadow Cr.	Headwaters to confluence with Rock Cr.	0.5	1.0: H. Diversity
Deer Cr.	Confluence with Big Boulder to state section 36	1.5	2.0: F. Sediment Obstruction
Owl Cr.	Includes Minear Cr. (Confluence of Lone Tree to headwaters)	1	2.0: H. Diversity F. Sediment
North Boulder-1	From confluence with Big Boulder; BLM reach to Private	1.5	2.0: H. Temp.
North Boulder-2	From confluence with Mamouth Cr. To headwaters	1.5	2.0: H. Temp.
Louse Cr.	Includes Cottonwood Cr. From confluence of Jordan Cr. To headwaters	1	1.0: H. Diversity L. Flow
Upper Trout Cr.	From Split Rock Canyon to headwaters, including Nichols, Wood Canyon creeks	1	1.5: L. Flow
Split Rock Canyon	Confluence with Trout Creek to headwaters.	1.5	2.0: C. Stability H. Diversity F. Sediment
Cow Cr.-2	From confluence with Wildcat Canyon Cr. To headwaters	1.5	2.0: Riparian C. Stability H. Diversity F. Sediment H. Temp. Pollutants
Soda Cr.	From confluence of Cow Cr. To headwaters	1.5	2.0: H. Diversity F. Sediment Oxygen H. Temp. Pollutants
HUC 17050107			
NF Owyhee 1	Lower; From the Oregon State line to the	1.5	2.0: L. Flow

4th Field HUC/ Reach Name	Description	Reach Confidence (0-2)	Min. QHA Score ↦ Limiting Factor(s)
	confluence of Juniper Cr.		H. Temp.
NF Owyhee 2	Upper; Headwaters of North Fork , Lower Noon Cr. And Lower Pleasant Valley Cr.	1.5	2.5: L. Flow H. Temp.
Upper Pleasant Valley Cr.	From the top of Sec. 7 to headwaters	1.5	1.0: C. Stability
Cabin Cr.	From the confluence with Juniper Cr. To the headwaters	1.5	2.0: Riparian C. Stability F. Sediment H. Temp. Pollutants
Juniper Cr. 1	From the confluence with the North Fork Owyhee to lower private boundary	1.5	2.0: H. Temp. Pollutants
Juniper Cr. 2	From the start of the private up to the headwaters	0.5	1.0: L. Flow
Lone Tree Cr.	From Oregon State line to headwaters	0.5	1.5: H. Diversity
Cottonwood Cr.	From the upper private boundary (section 18) to headwaters	1.5	1.5: L. Flow
Squaw Cr. 1	From Oregon State line to lower private boundary (section 13)	1.5	2.0: H. Temp.
Squaw Cr. 2	From the start of private in section 14 to the BLM in the northwest corner of section 31	0.5	2.0: L. Flow H. Temp.
Squaw Cr. 3	From private to headwaters	0.5	2.0: Riparian C. Stability H. Diversity F. Sediment L. Flow H. Temp.
Pole Cr.	Oregon State line to headwaters	2	2.5: F. Sediment

4th Field HUC/ Reach Name	Description	Reach Confidence (0-2)	Min. QHA Score ↦ Limiting Factor(s)
Middle Fork Owyhee	Oregon State line to headwaters	2	0.5: Riparian
HUC 17050106			
Little Owyhee	From the Nevada State line to the confluence with South Fork Owyhee	1	1.0: H. Diversity Oxygen L. Temp. H. Temp. Pollutants
HUC 17050105			
South Fork Owyhee	From Nevada State line to the confluence with Owyhee River	1.5	1.5: L. Flow H. Temp.
HUC 17050104			
Blue Cr.-3	Blue Cr. Reservoir to headwaters	1.5	1.0: L. Flow
Shoofly Cr.-1	Confluence to BLM boundary	1.5	1.0: Riparian H. Diversity L. Flow
Shoofly Cr.-2	Private/BLM boundary to Bybee reservoir	1.5	1.0: H. Flow L. Flow Obstruction
Shoofly Cr.-3	Bybee reservoir to headwaters	0	2.0: Riparian H. Diversity H. Temp.
Owyhee River	DV reservoir border to confluence	1.5	2.0: H. Temp.
Owyhee River DVIR portion	Mouth of canyon to NV state line	1	1.0: Riparian C. Stability H. Diversity L. Flow H. Temp.
Battle Cr.-1	Confluence to private in sec. 10 (cottonwood draw)	2	1.0: H. Temp.
Battle Cr.-2	Section 10 to above state section 36	0	1.0: H. Temp.

4th Field HUC/ Reach Name	Description	Reach Confidence (0-2)	Min. QHA Score ↦ Limiting Factor(s)
Battle Cr.-3	State section 36 to headwaters	1.5	1.0: H. Diversity L. Flow
Dry Cr.-1	confluence to reservoir	0	2.0: Riparian C. Stability H. Diversity F. Sediment H. Flow L. Flow Oxygen L. Temp. H. Temp. Pollutants
Dry Cr.-2	Reservoir to headwaters	1.5	1.0: Riparian C. Stability H. Diversity L. Flow H. Temp. Obstruction
Big Springs Cr.-1	confluence to reservoir	1.5	1.0: H. Temp.
Big Springs Cr.-3	BLM boundary to private	1.5	1.0: Riparian H. Temp.
Deep Cr.-1	Confluence to private	2	1.0: F. Sediment Oxygen H. Temp.
Deep Cr.-2	Private to mid section 10	2	1.0: F. Sediment Oxygen H. Temp.
Deep Cr.-3	section 10 to Stoneman Cr. Confluence	2	1.0: F. Sediment
Deep Cr.-4	headwaters including:	2	1.0: Riparian C. Stability F. Sediment
Stoneman Cr.	Confluence to headwaters	2	1.0: C. Stability L. Flow

4th Field HUC/ Reach Name	Description	Reach Confidence (0-2)	Min. QHA Score ↦ Limiting Factor(s)
Current Cr.	Confluence to headwaters	2	1.0: C. Stability L. Flow
Nickel Cr.	Confluence to headwaters including:	2	1.0: F. Sediment
Smith Cr.	Confluence to headwaters including:	2	1.0: F. Sediment
Castle Cr.	Confluence to headwaters including:	2	1.0: Riparian F. Sediment H. Flow L. Flow H. Temp. Obstruction
Beaver Cr.	Confluence to headwaters including:	2	2.0: Riparian F. Sediment L. Flow
Red Canyon Cr.	Confluence to headwaters including:	2	1.0: H. Temp.
Petes Cr.	Confluence to headwaters including:	2	1.0: H. Temp.
Dickshooter Cr.	Confluence to headwaters	1.5	2.0: F. Sediment
Pole Cr.-1	Confluence to Camas Cr. Confluence including Camel Cr.	1.5	1.0: H. Temp.
Pole Cr.-2	Camas confluence to headwaters	1.5	1.0: L. Flow H. Temp.
Camas Cr.	Confluence to headwaters	1.5	2.0: F. Sediment L. Flow H. Temp.

Table 2.30. Limiting factors analysis based on minimum QHA scores, by specific reach, for the Nevada portion of the Owyhee Subbasin.

4th Field HUC/ Reach Name	Description	Reach Confidence (0-2)	Min. QHA Score ↦ Limiting Factor(s)
HUC 17050104			
E.F. Owyhee ID-NV state line to Paradise Point Diversion	Irrigated hay fields, No RBT habitat	1	1.0: C. Stability L. Flow Pollutants Obstruction
Boyle Cr	Starts in NV and enters Owyhee in ID	0.5	1.5 Riparian
S.F of Boyle Cr		0.5	1.5 Riparian
E.F. Owyhee Paradise Point to Duck Valley Indian Res border	DVIR	1	0.5: C. Stability H. Diversity
Skull Cr		0.5	1.5 Riparian
N.F. of Skull Cr		0.5	1.5 Riparian
E.F. of Skull Cr		0.5	1.5 Riparian
Reed Cr		0.5	1.5 Riparian
Summit Cr		0.5	Riparian
Fawn Cr	USFS RBT occupied for sure 4.8miles	1.5	2.5: Riparian H. Temp.
Jones Cr		0.5	1.5 Riparian
Granite	probably fishless	0.5	1.5 Riparian
E.F. Owyhee Duck Valley Indian Res border to Patsville (Mill Cr)	U.S.F.S.	1.5	0.5: Pollutants
Slaughter House Cr	Occupied RBT 2 miles	2	3.0: C. Stability H. Diversity F. Sediment Obstruction
Brown's Gulch (Slaughter house Trib	2.4 miles RBT occupied	2	3.0:

			C. Stability H. Diversity F. Sediment Obstruction
Miller Cr.	3 mile occupied RBT	2	2.0 C. Stability H. Diversity F. Sediment Obstruction
West Fr. (of Slaughterhouse Cr)	1.5 miles occupied RBT	2	3.0: C. Stability H. Diversity F. Sediment Obstruction
California Cr	Min. occupied RBT by headwater of Cr.	2	1.0: L. Flow
North Fr (trib of California Cr)	No RBT, lack of flow(Drought yr)	2	1.5 H. Temp.
Dip Cr	1 mile RBT occupied	2	3.0: C. Stability H. Diversity F. Sediment Obstruction
Big Springs Cr	Unoccupied (insufficient flow)	2	3.0: C. Stability H. Diversity F. Sediment Obstruction
South Fr.	2 mile RBT occupied	2	2.5: Riparian
Pixley	1 mile RBT occupied	2	1.0: Obstruction
E.F. Owyhee Mill Cr.to Badger Cr	U.S.F.S.	1.5	1.0: H. Diversity
Lower Mill Cr to S.F Owyhee River	Unoccupied, pollution, mine tailings	2	0.5: Riparian H. Diversity Pollutants
Upper Mill Cr to Rio tinto Mine	occupied RBT whole distance in none drought years	2	3.0: Riparian C. Stability H. Diversity F. Sediment
McCall Cr.	5.5 miles occupied RBT	2	3.0: Riparian C. Stability H. Diversity

			F. Sediment
Allegheny	Native Dace only	2	1.0: L. Flow
Cold Spring (trib to Allegheny)	Native Dace only	2	1.0: L. Flow
Trail Cr	8.2 occupied RBT, Brook Trout(MGT concern)	2	2.0 L. Flow Obstruction
Van Duzer Cr. (Trib to Trail Cr)	5 mile occupied, Brook Trout (MGR concen)	2	2.0 L. Flow Obstruction
Lime Cr (trib to Van Duzer)	.3 occupied by RBT, Brook Trout prsnt	2	2.5: C. Stability
Cobb Cr (trib to Van Duzer)	4.5 RBT occupied	2	3.0: Riparian C. Stability H. Diversity F. Sediment
Deer Cr (trib to Trail Cr.)	min. occupied RBT in a single pool	2	1.0: Obstruction
Springs Cr.	0.1 mile RBT occupied, Brook trout	2	1.0: Obstruction
Wood Gulch	Mine prsnt, 2 mile RBT occupied	2	3.0: Riparian C. Stability H. Diversity F. Sediment Obstruction
Hutch Cr	1mile RBT occupied, Brook Trout	2	1.0: Obstruction
Timber Gulch	0.35 RBT occupied, Brook Trouth	2	1.0: Obstruction
Sheep cr	2 mile RBT occupied, Brook Trout	2	3.0: Riparian C. Stability H. Diversity F. Sediment Obstruction
Road Canyon	1.2 RBT occupied	2	3.0: Riparian C. Stability H. Diversity F. Sediment Obstruction
Gravel Cr	Lower 0.1 RBT occupied (spawning ground)	2	2.5: Riparian

E.F. Owyhee Badger Cr. To Wildhorse Res.	U.S.F.S.	2	1.0: Obstruction
Badger Cr.	7 miles RBT occupied, some livestock concerns, fair condition, 1600 fish	2	2.5: Riparian C. Stability
Beaver Cr.	All occupied by RBT	2	2.5: Riparian C. Stability
Wildhorse Res		2	1.0: L. Flow Obstruction
Hendricks Cr	RBT appearing (questionalble genetics,rainbow?)	2	2.5: Riparian C. Stability
Warm Cr (Trib of Hendricks)	not RBT occupied, warm water temp, soil type/erosion, agriculture	2	2.5: Riparian C. Stability L. Flow
Penrod	RBT occupied entire way	2	2.5: Riparian C. Stability
Hay meadow Cr	only native dace present	2	1.0: L. Flow
Thompson Cr (hay meadow trib)	no fish present in drough yrs	2	1.0: L. Flow
Martin Cr. (trib to Penrod)	4.5 RBT occupied, Brook Trout	2	2.5: C. Stability
Gold Cr. (trib to Martin Cr)	1.8 RBT occupied	2	2.5: Riparian C. Stability
Sweet Cr	0.5 RBT occupied	2	1.0: L. Flow
Rosebud Cr	Native Dace only	2	1.0: L. Flow
Deep Cr trib to Wildhorse (E.F. Owyhee)	1.5 miles occupied RBT, some on prvt land?	2	2.0: L. Flow
Clear Cr trib to (Deep Cr)	no fish present in drough yrs	2	2.0: L. Flow
Riffe Cr (Deep Cr)	3 mile occupied RBT, beaver ponds	2	2.0: L. Flow
N.F. of Deep Cr	No RBT, lack of flow(Drought yr)	2	2.0: L. Flow
Middle Fork of Deep Cr	2 mile occupied RBT	2	2.0: L. Flow
S.F of Deep Cr	3 miles RBT occupied	2	2.0:

			L. Flow
E. F. Owyhee Above Wildhorse Res to head waters	Spotted Frog habitat	2	1.0: F. Sediment
Clear Cr trib to Upper E.F Owyhee	Historic potential habitat, poisioning in 1988 to remove chub, killed Trout	2	3.0: Riparian C. Stability H. Diversity F. Sediment L. Flow H. Temp. Pollutants Obstruction
Hanks Cr trib to Upper E.F Owyhee	Dace prsnt, habitat concerns (livestocke) no RBT	2	1.5 Riparian
HUC 17050105			
State line to Petan ranch	Red Band prsnt seasonally(Spring) during good water yrs when sutiable water temps	2.5	2.0: H. Flow Obstruction
Lower boundry of Petan Ranch to Red Cow Cr.	Red Band prsnt seasonally(Spring) during good water yrs when sutiable water temps	2.5	2.0: Riparian C. Stability H. Flow Obstruction
From Red Cow to Hot cr.	RBT Occupied yr round, low density	2.5	2.0: H. Flow Obstruction
hot creek to McCann	Prvt Land, Brook Trout prsnt in Spring Heads, RBT are seasonal, White Fish yr round	2.5	1.0: Obstruction
Four mile cr from S.F. to Chimney Res.	RBT Down migration during good water yrs, dry 10months of yr, flow controlled by Chimney	2.0	1.0: H. Flow Obstruction
Chimney Cr. Res to T41N R49E sec4	RBT Down migration during good water yrs, dry 10months of yr, flow controlled by Chimney	1.0	1.5 Riparian C. Stability
T41N R49E sec4 to Head Waters	Occupied by RBT year round, 3miles of reach occupied	2.0	2.0: C. Stability Obstruction
Chimney Cr Res. To Winters Cr.	Int/Dry 10mnths/yr, no RBT	1.0	1.0: Obstruction

Winters Cr.	Recently occupied, but not currently, historic habitat (no record), stocked in 1972 with RBT, ceased in 2000due to fire/livestock grazing	2.0	2.0: C. Stability L. Temp. Obstruction
Sheep Creek-S.F. Owyhee to Sheep Cr. Res		1.0	0.5 Obstruction
Sheep Cr. Res to T46n R51E sec 11	Int/Dry, no RBT, spring down migration	1.0	0.5 Obstruction
T46n R51e sec 11 to head waters		1.5	0.5 Obstruction
Indian Cr. (Trib to S.F. Owyhee)	Occupied RBT through National Forest	3.0	1.0: Pollutants
Winters Cr. Trib to Indian Cr	2 miles occupied RBT through National Forest	3.0	1.5 Obstruction
Mitchell Cr. Trib to Indian Cr	2 miles occupied RBT through National Forest	3.0	1.5 Obstruction
Wall Cr. Trib to Indian Cr	1 Mile occupied RBT through National Forest	3.0	1.5 Obstruction
Silver Cr. (Trib to S.F. Owyhee)	2 miles occupied RBT through National Forest	3.0	1.5 Obstruction
White Rock Cr.	Unoccupied, probably historic, mining influence	3.0	1.5 Obstruction
Cottonwood Canyon Cr.	Unoccupied, probably historic, mining influence	3.0	1.5 Obstruction
Breakneck Cr	2 miles occupied RBT	3.0	1.5 Obstruction
Bull Run Cr.-S.F. Owyhee to Bull Run Canyon	Diverted for Agriculture use	3.0	0.5 Obstruction
Mouth of Bull Run Canyon to Cap Winn Cr.	probably recruitment from upstream tribs	3.0	1.5 Obstruction
Frost Cr.	Low number of RBT	1.0	2.0 C. Stability H. Diversity Obstruction
Cap Winn Cr	Occupied RBT,	1.5	2.0: C. Stability H. Diversity Obstruction
Doby George	Occupied RBT,	2.0	2.0: C. Stability H. Diversity Obstruction

Columbia Cr	Occupied RBT, Low number (200's), Brook Trout abundant	3.0	2.0: Obstruction
Blue Jacket Cr	Occupied RBT (700), Brook Trout	3.0	2.0: Obstruction
Deep Cr. Trib to S.F. Owyhee		1.5	1.5 H. Diversity
S.F Owyhee to Head Waters	Unoccupied, RBT probably present historically		
Red Cow Cr.	Occupied 1mile by RBT	1.5	1.0: C. Stability
Amazon	Ephemerial, no record of RBT, probably historic	1.5	1.0: C. Stability Obstruction
Big Cottonwood Trib	1mile occupied by RBT	1.5	1.0: C. Stability
Harrington Cr	Unsurveyed, Prvt Land, Probable RBT	3.0	1.0: Obstruction
Marsh Cr.	Occupied RBT	3.0	2.0: Obstruction
Boyd Cr	Occupied RBT	3.0	2.0: Obstruction
Scoonover Cr.	Occupied RBT	3.0	2.0: Obstruction
Dorsey	Occupied RBT	3.0	2.0: Obstruction
Coffin Cr.	Occupied RBT	3.0	2.0: Obstruction
Jack Cr	Occupied RBT, no brook trout surveyed in last 2yrs(used to be abundant)	3.0	2.0: Obstruction
Chicken Cr	Occupied RBT,	3.0	2.0: Obstruction
Mill Cr	Occupied RBT, Brook trout, included 3 forks	3.0	2.0: Obstruction
Niagra Cr	No Surveyed Data	3.0	0.5 Obstruction
Snow Canyon Cr	Occupied RBT, 5 mi occupied	3.0	2.0: Obstruction
Jarritt Canyon	Int/Dry, Unoccupied, Histeric Salmon	2.5	1.5: Obstruction

Burns Cr.(Trib to Jarritt Canyon0	1.5 mile occupied on National Forest, Trout Prsnt	3.0	2.0: Obstruction
Schmidtt Cr.	4 miles occupied	3.0	2.0: Obstruction
McCann Cr	5 mile occupied RBT, low desnity RBT	2.0	2.0: C. Stability H. Flow Obstruction
Taylor Canyon Cr (trib to S.F. Owyhee)	2 miles occupied RBT, BT common	4.0	2.0: Obstruction
Water Pipe Canyon (trib to Taylor Canyon)	2.5 mile occupied RBT	2.0	2.0: Obstruction

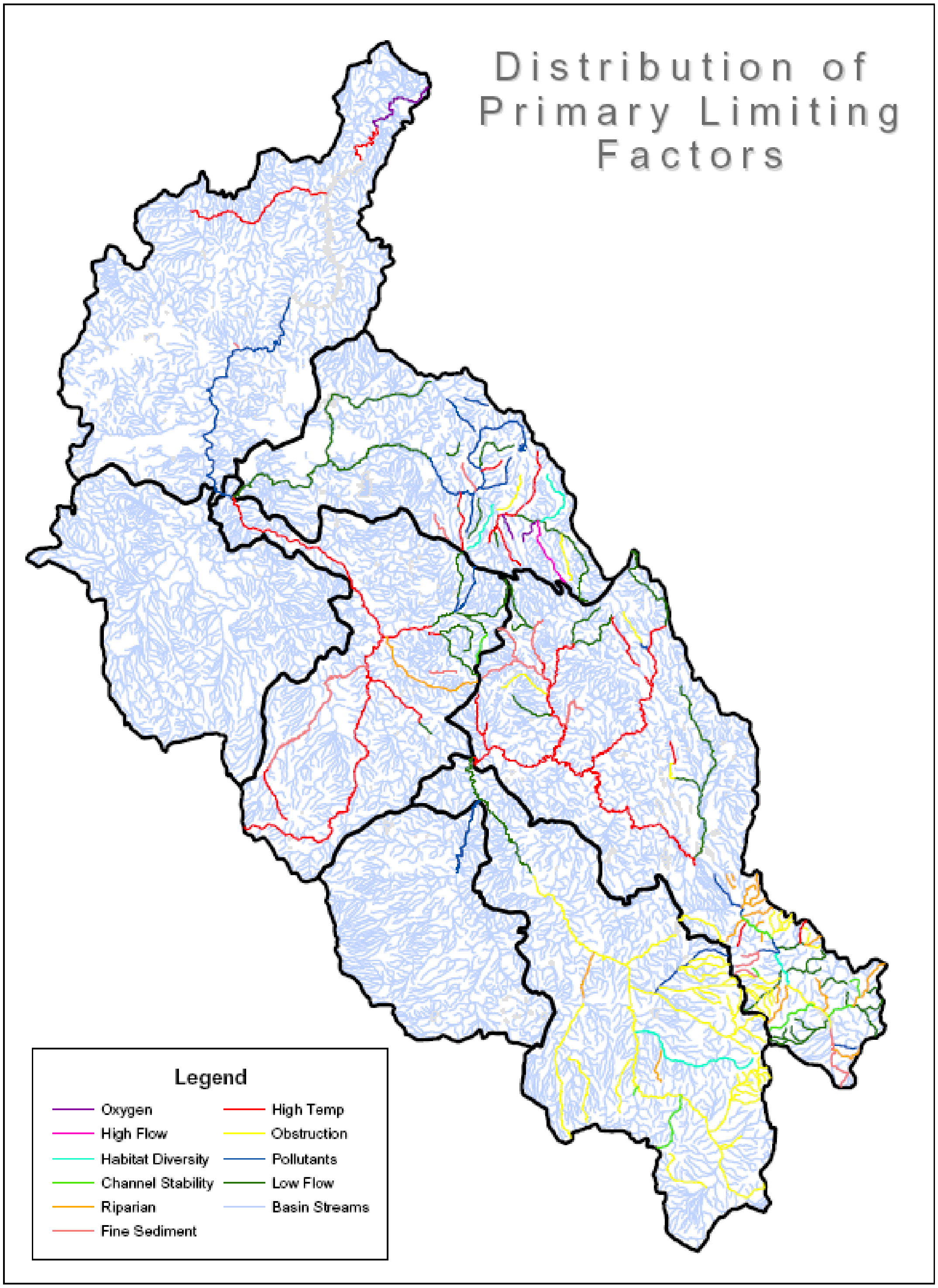


Figure 2.23. Distribution of limiting factors on streams in the Owyhee Subbasin derived from the Qualitative Habitat Analysis.

Cross Reference between the QHA Stream Reach System and HUCs

The cross-references between the QHA stream reach system and 4th, 5th, and 6th field HUCs are presented in Table 2.31 (Oregon), Table 2.32 (Idaho), and Table 2.33 (Nevada) below.

Table 2.31 Cross-reference of specific stream reaches identified in the QHA analysis with 4th, 5th, and 6th field HUC's – for the Oregon Portion of the Owyhee Subbasin.

Reach Name	Description	HUC-5	HUC-6
17050110 – Lower Owyhee			
Owyhee R-1	Mouth to Owyhee Ditch Co Dam (RM14)	1705011001	17050110xxxx
Owyhee R-2	DC Dam to RM28	1705011001	17050110xxxx
Owyhee R-3	Dam to Upstream High Water (RM80)	17050110xx	17050110xxxx
Owyhee R-4[18]	High Water upstream to Jordan Cr	17050110xx	17050110xxxx
Dry Creek	Dry Creek upstream to Crowley Road	17050110xx	17050110xxxx
Rinehart Creek	Mouth to falls	1705011007	17050110070 3
17050108 – Jordan Creek			
Jordan Creek	Mouth to State Line	17050108xx	17050108xxxx
Cow Creek	Mouth to State Line	1705010805	17050108050 6
Owyhee R-5	Confl. Jordan Creek upstream to State line	17050108xx	17050108xxxx
17050107 – Middle Owyhee			
NF Owyhee	Mouth to State line	1705010706	17050107060 1
Middle Fork	Headwaters are in Idaho Segment	1705010708	17050107xxxx
Antelope Creek R-1	Mouth upstream to corrals (~8 mi)	1705010716	17050107160 1
Antelope Creek R-2	Corrals upstream to Star Valley Road (dry segment)	1705010716	17050107xxxx

[18] Most of this Owyhee River reach is in HUC 17050110; however, the upper one mile of this river reach is in HUC 17050107.

Reach Name	Description	HUC-5	HUC-6
Antelope Creek R-3	SV Road upstream to Headwaters	1705010714	17050107xxxx
West Little Owyhee R-1	Mouth upstream to Anderson Crossing	1705010709	17050107090 2
West Little Owyhee R-2	Anderson Crossing to headwaters	1705010712	17050107xxxx

Table 2.32 Cross-reference of specific stream reaches identified in the QHA analysis with 4th, 5th, and 6th field HUC's – for the Idaho Portion of the Owyhee Subbasin.

Reach	Description	HUC 5	HUC 6
4th HUC; 17050108			
Jordan Cr.-1	Jordan Cr. From OR Boundary to BLM boundary section	1705010807	170501080701
Jordan Cr.-2	From end of #2 to Rail Creek	1705010809	170501080904
Jordan Cr.-3	Rail Cr. Confluence to BLM boundary	1705010808	170501080801
Jordan Cr.-4	BLM boundary near Buck Cr. to BLM boundary	1705010808	170501080801
Jordan Cr.-5	BLM boundary section line to BLM boundary upstream of Louse Cr.	1705010808	170501080801
Jordan Cr.-6	BLM boundary upstream of Louse Cr. To BLM boudary section	1705010808	170501080803
Jordan Cr.-7	BLM Boundary to state land section boundary	1705010808	170501080803
Jordan Cr.-8	State linelands boundary to headwaters of Jordan Cr.	1705010808	170501080804
Williams Cr.BLM segments		1705010807	170501080703
Williams Cr.	Including Pole Bridge Cr. And West Cr.	1705010807	170501080703
Duck Cr.	All	1705010808	170501080801
Old Man Cr.	All	1705010809	170501080901

Reach	Description	HUC 5	HUC 6
South Mountain Creek	Lower BLM upper put state includes Howl Cr. Cyote Cr.	1705010809	170501080903
Rail Cr.	All	1705010809	170501080904
Washington Gulch	All	1705010808	170501080801
Flint Cr.1	Lower	1705010808	170501080801
Flint Cr.2	Upper Includes East Cr.	1705010808	170501080801
South Boulder Cr.	From confluence with North Boulder Cr. To confluence with Mill Cr.	1705010812	170501081201
Upper South Boulder Creek	Mill Creek confluence to headwaters	1705010812	170501081201
Indian Cr.	Bogus Cr. (Lower) - confluence with South Fork Boulder to Section 10	1705010812	170501081201
Bogus Cr.	Upper above section 10 and above	1705010812	170501081201
Combination Cr.	Lower reach of stream	1705010810	170501081001
Rose Cr.	Up to state section.	1705010810	170501081001
Josephine	includes Wickiup and Long Valley and Headwater Josephine	1705010811	170501081104
Louisa Cr.	From confluence with Rock Cr.	1705010811	170501081101
Lower Rock Cr.-1	From confluence of North Boulder to Meadow Creek.	1705010810	170501081001
Rock Cr.-2	From Meadow Creek to BLM	1705010811	170501081101
Rock Cr.-3	BLM portion in Section 26	1705010811	170501081103
Rock Cr.-4	From BLM/PVT boundary in Sec. 26 to above Triangle Reservoir.	1705010811	170501081103
Rock Cr. 5	BLM reach above Triangle Reservoir to Sheep Creek/private boundary	1705010811	170501081103
Rock Cr. 6	From Sheep Creek/private boundary to headwaters	1705010811	170501081103
Meadow Cr.	Headwaters to	1705010811	170501081102

Reach	Description	HUC 5	HUC 6
	confluence with Rock Cr.		
Deer Cr.	Confluence with Big Boulder to state section 36	1705010809	170501080902
Owl Cr.	Includes Minear Cr. (Confluence of Lone Tree to headwaters)	1705010807	170501080702
North Boulder-1	From confluence with Big Boulder; BLM reach to Private	1705010810	170501081001
North Boulder-2	From confluence with Mamouth Cr. To headwaters	1705010810	170501081002
Louse Cr.	Includes Cottonwood Cr. From confluence of Jordan Cr. To headwaters	1705010808	170501080802
Upper Trout Cr.	From Split Rock Canyon to headwaters, including Nichols, Wood Canyon creeks	1705010806	170501080601
Split Rock Canyon	Confluence with Trout Creek to headwaters.	1705010806	170501080601
Cow Cr.-2	From confluence with Wildcat Canyon Cr. To headwaters	1705010805	170501080506
Soda Cr.	From confluence of Cow Cr. To headwaters	1705010805	170501080507
Reach	**Description**	**HUC 5**	**HUC 6**
HUC 17050107			
NF Owyhee 1	Lower; From the Oregon State line to the confluence of Juniper Cr.	1705010706	170501070602
NF Owyhee 2	Upper; Headwaters of North Fork , Lower Noon Cr. And Lower Pleasant Valley Cr.	1705010706	170501070605
Upper Pleasant Valley Cr.	From the top of Sec. 7 to headwaters	1705010706	170501070606
Cabin Cr.	From the confluence with Juniper Cr. To the headwaters	1705010706	170501070604
Juniper Cr. 1	From the confluence	1705010706	170501070603

Reach	Description	HUC 5	HUC 6
	with the North Fork Owyhee to lower private boundary		
Juniper Cr. 2	From the start of the private up to the headwaters	1705010706	170501070603
Lone Tree Cr.	From Oregon State line to headwaters	17050107xx	17050107xxxx
Cottonwood Cr.	From the upper private boundary (section 18) to headwaters	1705010706	170501070607
Squaw Cr. 1	From Oregon State line to lower private boundary (section 13)	1705010706	170501070607
Squaw Cr. 2	From the start of private in section 14 to the BLM in the northwest corner of section 31	1705010706	170501070607
Squaw Cr. 3	From private to headwaters	1705010706	170501070607
Pole Cr.	Oregon State line to headwaters	1705010707	170501070701
Middle Fork Owyhee	Oregon State line to headwaters	1705010708	170501070801
Reach	**Description**	**HUC 5**	**HUC 6**
HUC 17050106			
Little Owyhee	From the Nevada State line to the confluence with South Fork Owyhee	1705010601	170501060101
Reach	**Description**	**HUC 5**	**HUC 6**
HUC 17050105			
South Fork Owyhee	From Nevada State line to the confluence with Owyhee River	17050105xx	17050105xxxx
Reach	**Description**	**HUC 5**	**HUC 6**
HUC 17050104			
Blue Cr.-3	Blue Cr. Reservoir to headwaters	1705010413	170501041304
Shoofly Cr.-1	Confluence to BLM boundary	1705010413	170501041301
Shoofly Cr.-2	Private/BLM boundary to Bybee reservoir	1705010413	170501041301

Reach	Description	HUC 5	HUC 6
Shoofly Cr.-3	Bybee reservoir to headwaters	1705010413	170501041302
Owyhee River	DV reservoir border to confluence	17050104xx	17050104xxxx
Owyhee River DVIR portion	Mouth of canyon to NV state line	17050104xx	17050104xxxx
Battle Cr.-1	Confluence to private in sec. 10 (cottonwood draw)	1705010404	1705010404XX
Battle Cr.-2	Section 10 to above state section 36	1705010409	170501040903
Battle Cr.-3	State section 36 to headwaters	1705010409	170501040905
Dry Cr.-1	confluence to reservoir	1705010409	170501040904
Dry Cr.-2	Reservoir to headwaters	1705010409	170501040904
Big Springs Cr.-1	confluence to reservoir	1705010409	170501040902
Big Springs Cr.-3	BLM boundary to private	1705010409	170501040902
Deep Cr.-1	Confluence to private	1705010402	170501040203
Deep Cr.-2	Private to mid section 10	17050104xx	17050104xxxx
Deep Cr.-3	section 10 to Stoneman Cr. Confluence	1705010405	170501040501
Deep Cr.-4	headwaters including:	1705010405	170501040501
Stoneman Cr.	Confluence to headwaters	1705010405	170501040503
Current Cr.	Confluence to headwaters	1705010405	170501040503
Nickel Cr.	Confluence to headwaters including:	1705010405	170501040502
Smith Cr.	Confluence to headwaters including:	1705010405	170501040502
Castle Cr.	Confluence to headwaters including:	1705010403	170501040303
Beaver Cr.	Confluence to headwaters including:	1705010403	170501040302
Red Canyon Cr.	Confluence to headwaters including:	1705010401	17050104xxxx
Petes Cr.	Confluence to headwaters including:	1705010401	170501040103
Dickshooter Cr.	Confluence to headwaters	1705010407	170501040701

Reach	Description	HUC 5	HUC 6
Pole Cr.-1	Confluence to Camas Cr. Confluence including Camel Cr.	17050104xx	17050104xxxx
Pole Cr.-2	Camas confluence to headwaters	1705010406	1705010406xx
Camas Cr.	Confluence to headwaters	1705010406	1705010406004

Table 2.33 Cross-reference of specific stream reaches identified in the QHA analysis with 4th, 5th, and 6th field HUC's – for the Nevada Portion of the Owyhee Subbasin.

Reach	Description	HUC 5	HUC 6
4th HUC; 17050105			
State line to Petan Ranch	Red Band prsnt seasonally (Spring) during good water yrs when sutiable water temps	1705010502	17050105xxxx
Lower boundry of Petan Ranch to Red Cow Cr.	Red Band prsnt seasonally(Spring) during good water yrs when sutiable water temps	1705010504	17050105xxxx
From Red Cow to Hot cr.	RBT Occupied yr round, low density	17050105xx	17050105xxxx
hot creek to McCann	Prvt Land, Brook Trout prsnt in Spring Heads, RBT are seasonal, White Fish yr round	17050105xx	17050105xxxx
Four mile cr from S.F. to Chimney Res.	RBT Down migration during good water yrs, dry 10months of yr, flow controlled by Chimney	1705010521	170501052101
Chimney Cr. Res to T41N R49E sec4	RBT Down migration during good water yrs, dry 10months of yr, flow controlled by Chimney	1705010519	170501051901
T41N R49E sec4 to Head Waters	Occupied by RBT year round, 3miles of reach occupied	1705010519	170501051901
Chimney Cr Res. To Winters Cr.	Int/Dry 10mnths/yr, no RBT	1705010519	170501051901
Winters Cr.	Recently occupied, but	1705010518	170501051802

Reach	Description	HUC 5	HUC 6
	not currently, historic habitat (no record), stocked in 1972 with RBT, ceased in 2000due to fire/livestock grazing		
Sheep Creek-S.F. Owyhee to Sheep Cr. Res		1705010506	170501050601
Sheep Cr. Res to T46n R51E sec 11	Int/Dry, no RBT, spring down migration	1705010506	170501050601
T46n R51e sec 11 to head waters		1705010506	170501050601
Indian Cr. (Trib to S.F. Owyhee)	Occupied RBT through National Forest	1705010507	17050105xxxx
Winters Cr. Trib to Indian Cr	2 miles occupied RBT through National Forest	1705010507	170501050703
Mitchell Cr. Trib to Indian Cr	2 miles occupied RBT through National Forest	1705010507	170501050703
Wall Cr. Trib to Indian Cr	1 Mile occupied RBT through National Forest	1705010507	170501050702
Silver Cr. (Trib to S.F. Owyhee)	2 miles occupied RBT through National Forest	1705010507	170501050704
White Rock Cr.	Unoccupied, probably historic, mining influence	1705010507	170501050704
Cottonwood Canyon Cr.	Unoccupied, probably historic, mining influence	1705010507	170501050704
Breakneck Cr	2 miles occupied RBT	1705010507	170501050704
Bull Run Cr.-S.F. Owyhee to Bull Run Canyon	Diverted for Agriculture use	1705010507	170501050701
Mouth of Bull Run Canyon to Cap Winn Cr.	probably recruitment from upstream tribs	1705010509	170501050904
Frost Cr.	Low number of RBT	1705010509	170501050902
Cap Winn Cr	Occupied RBT,	1705010509	170501050904
Doby George	Occupied RBT,	1705010509	170501050904
Columbia Cr	Occupied RBT, Low number (200's), Brook Trout abundant	1705010509	170501050903
Blue Jacket Cr	Occupied RBT (700), Brook Trout	1705010509	170501050903

Reach	Description	HUC 5	HUC 6
Deep Cr. Trib to S.F. Owyhee		17050105xx	17050105xxxx
S.F Owyhee to Head Waters	Unoccupied, RBT probably present historically	17050105xx	17050105xxxx
Red Cow Cr.	Occupied 1mile by RBT	1705010516	170501051601
Amazon	Ephemeral, no record of RBT, probably historic	1705010511	170501051101
Big Cottonwood Trib	1mile occupied by RBT	1705010515	170501051501
Harrington Cr	Unsurveyed, Prvt Land, Probable RBT	1705010512	170501051201
Marsh Cr.	Occupied RBT	1705010512	170501051201
Boyd Cr	Occupied RBT	1705010512	170501051201
Scoonover Cr.	Occupied RBT	1705010512	170501051201
Dorsey	Occupied RBT	1705010512	170501051201
Coffin Cr.	Occupied RBT	1705010512	170501051201
Jack Cr	Occupied RBT, no brook trout surveyed in last 2yrs(used to be abundant)	1705010512	170501051201
Chicken Cr	Occupied RBT,	1705010510	170501051002
Mill Cr	Occupied RBT, Brook trout, included 3 forks	1705010512	170501051201
Niagra Cr	No Surveyed Data	1705010512	170501051201
Snow Canyon Cr	Occupied RBT, 5 mi occupied	1705010512	170501051201
Jarritt Canyon	Int/Dry, Unoccupied, Historic Salmon	1705010512	170501051201
Burns Cr.(Trib to Jarritt Canyon	1.5 mile occupied on National Forest, Trout Present	1705010512	170501051201
Schmidtt Cr.	4 miles occupied	1705010512	170501051201
McCann Cr	5 mile occupied RBT, low density RBT	1705010514	170501051404
Taylor Canyon Cr (trib to S.F. Owyhee)	2 miles occupied RBT, BT common	1705010514	170501051402
Water Pipe Canyon (trib to Taylor Canyon)	2.5 mile occupied RBT	1705010514	170501051402
HUC 17050104			
E.F. Owyhee ID-NV state line to Paridise Point Diversion	Irrigated hay fields, No RBT habitat	1705010412	170501041201

Reach	Description	HUC 5	HUC 6
Boyle Cr	Starts in NV and enters Owyhee in ID	1705010412	170501041201
S.F of Boyle Cr		1705010412	170501041201
E.F. Owyhee Paridise Point to Duck Valley Indian Res border	DVIR	1705010414	17050104xxxx
Skull Cr		1705010414	170501041406
N.F. of Skull Cr		1705010414	170501041406
E.F. of Skull Cr		1705010414	170501041406
Reed Cr		1705010414	170501041405
Summit Cr		1705010414	170501041405
Fawn Cr	USFS RBT occupied for sure 4.8miles	1705010414	170501041404
Jones Cr		1705010414	170501041405
Granite	probably fishless	1705010414	170501041403
E.F. Owyhee Duck Valley Indian Res border to Patsville (Mill Cr)	U.S.F.S.	1705010414	170501041403
Slaughter House Cr	Occupied RBT 2 miles	1705010414	170501041403
Brown's Gulch (Slaughter house Trib	2.4 miles RBT occupied	1705010414	170501041403
Miller Cr.	3 mile occupied RBT	1705010414	170501041403
West Fr. (of Slaughterhouse Cr)	1.5 miles occupied RBT	1705010414	170501041403
California Cr	Min. occupied RBT by headwater of Cr.	1705010414	170501041407
North Fr (trib of California Cr)	No RBT, lack of flow(Drought yr)	1705010414	170501041407
Dip Cr	1 mile RBT occupied	1705010414	170501041407
Big Springs Cr	Unoccupied (insufficient flow)	1705010414	170501041407
South Fr.	2 mile RBT occupied	1705010414	170501041407
Pixley	1 mile RBT occupied	1705010414	170501041407
E.F. Owyhee Mill Cr.to Badger Cr	U.S.F.S.	17050104xx	17050104xxxx
Lower Mill Cr to S.F Owyhee River	Unoccupied, pollution, mine tailings	1705010414	170501041402
Upper Mill Cr to Rio tinto Mine	occupied RBT whole distance in none drought years	1705010414	170501041402
McCall Cr.	5.5 miles occupied RBT	1705010414	170501041402

Reach	Description	HUC 5	HUC 6
Allegheny	Native Dace only	1705010415	170501041504
Cold Spring (trib to Allegheny)	Native Dace only	1705010415	170501041504
Trail Cr	8.2 occupied RBT, Brook Trout(MGT concern)	1705010415	170501041502
Van Duzer Cr. (Trib to Trail Cr)	5 mile occupied, Brook Trout (MGR concen)	1705010415	170501041503
Lime Cr (trib to Van Duzer)	.3 occupied by RBT, Brook Trout prsnt	1705010415	170501041503
Cobb Cr (trib to Van Duzer)	4.5 RBT occupied	1705010415	170501041503
Deer Cr (trib to Trail Cr.)	min. occupied RBT in a single pool	1705010415	170501041502
Springs Cr.	0.1 mile RBT occupied, Brook trout	17050104xx	17050104xxxx
Wood Gulch	Mine prsnt, 2 mile RBT occupied	1705010415	170501041502
Hutch Cr	1mile RBT occupied, Brook Trout	1705010415	170501041502
Timber Gulch	0.35 RBT occupied, Brook Trout	1705010415	170501041502
Sheep cr	2 mile RBT occupied, Brook Trout	1705010415	170501041502
Road Canyon	1.2 RBT occupied	1705010415	170501041502
Gravel Cr	Lower 0.1 RBT occupied (spawning ground)	1705010415	170501041502
E.F. Owyhee Badger Cr. To Wildhorse Res.	U.S.F.S.	1705010415	170501041501
Badger Cr.	7 miles RBT occupied, some livestock concerns, fair condition, 1600 fish	1705010415	170501041501
Beaver Cr.	All occupied by RBT	1705010415	170501041501
Wildhorse Res		1705010416	170501041601
Hendricks Cr	RBT appearing (questionalble genetics,rainbow?)	1705010416	170501041608
Warm Cr (Trib of Hendricks)	not RBT occupied, warm water temp, soil type/erosion, agriculture	1705010416	170501041608
Penrod	RBT occupied entire	1705010416	170501041602

Reach	Description	HUC 5	HUC 6
	way		
Hay meadow Cr	only native dace present	1705010416	170501041604
Thompson Cr (hay meadow trib)	no fish present in drough yrs	1705010416	170501041604
Martin Cr. (trib to Penrod)	4.5 RBT occupied, Brook Trout	1705010416	170501041602
Gold Cr. (trib to Martin Cr)	1.8 RBT occupied	1705010416	170501041603
Sweet Cr	0.5 RBT occupied	1705010416	170501041603
Rosebud Cr	Native Dace only	1705010416	170501041602
Deep Cr trib to Wildhorse (E.F. Owyhee)	1.5 miles occupied RBT, some on prvt land?	1705010416	170501041607
Clear Cr trib to (Deep Cr)	no fish present in drough yrs	1705010416	170501041607
Riffe Cr (Deep Cr)	3 mile occupied RBT, beaver ponds	1705010416	170501041607
N.F. of Deep Cr	No RBT, lack of flow(Drought yr)	1705010416	170501041607
Middle Fork of Deep Cr	2 mile occupied RBT	1705010416	170501041607
S.F of Deep Cr	3 miles RBT occupied	1705010416	170501041607
E. F. Owyhee Above Wildhorse Res to head waters	Spotted Frog habitat	1705010416	170501041605
Clear Cr trib to Upper E.F Owyhee	Historic potential habitat, poisioning in 1988 to remove chub, killed Trout	1705010416	170501041605
Hanks Cr trib to Upper E.F Owyhee	Dace prsnt, habitat concerns (livestock) no RBT	1705010416	170501041606
E.F. Owyhee ID-NV state line to Paradise Point Diversion	Irrigated hay fields, No RBT habitat	1705010412	170501041201

2.4.2 Terrestrial

This section was not completed due to time constraints.

The Owyhee Subbasin Planning/Technical Team did not complete a quantitative assessment of terrestrial focal species and habitats – this is a deficiency that should be corrected in a subsequent iteration of the Owyhee Subbasin Plan. The Technical Team used the Terrestrial Habitat Problem Statements, Objectives, and Strategies from the draft Bruneau Subbasin Plan (Accessed from the Eco-Vista web site, April 2004) as a "strawman" or model due to time constraits and because the landscape and resource management issues are similar to the Owyhee (Tim Dykstra, Shoshone-Paiute Tribes, Personal Communication). Furthermore, the Bruneau Subbasin Planning Team had spent a great deal of time and inter-agency technical effort in the developing their initial draft, and the Owyhee Subbasin Team did not have the resources to duplicate this level of effort.

2.4.3 Interspecies Relationships

This section was not completed due to time constraints.

Key Environmental Correlates (KEC) and Key Ecological Functions (KEF)

Traditionally defined, the term habitat is that set of environmental conditions, usually depicted as food, water, and cover, used and selected for by a given organism. Despite this broad definition, many land management agencies use the term habitat to denote merely the vegetation conditions and/or structural or seral stages used by a particular species. However, many other environmental attributes or features influence and affect the population viability of wildlife species.

The word Key in Key Environmental Correlate refers to the high degree of influence (either positive or negative) the environmental correlates exert on the realized fitness of a given species. A positive associations supports species viability, abundance, fitness and distribution, while a negative influences may be viewed as environmental stressors.

Both key environmental correlates and ecological functions support as well as influence Ecosystem Services, which are the beneficial outcomes that result from ecosystem functions. Some examples of ecosystem services are support of the food chain, fishing and hunting, clean water, better human health, or scenic views. Ecosystem Services help sustain life and are critical to human welfare. Negative influences to Ecosystem Services, like through KECs or KEFs, often result in a loss of biodiversity processes and functions of natural ecosystems.

Definition of Key Environmental Correlates – Environmental elements that are key or critical factors thought to most influence a species distribution, abundance, fitness and viability. These can be thought of as the fine feature elements that a species principally relies on or are influenced by.

Further defining Key Environmental Correlates – site-specific KECs include natural attributes, both biological and physical (e.g., large trees, woody debris, cliffs, and soil characteristics) as well as anthropogenic features and their effects such as roads, buildings, and pollution. Including these fine-scale attributes of an animal's environment when describing the habitat associations for a particular species expands the concept and definition of habitat, a term widely used only to characterize the vegetative community or structural condition occupied by a species. Failing to assess and inventory KECs within these communities and conditions may lead to errors of commission; species may be presumed to occur when in actuality they do not. KECs that influence a species negatively may preclude occupancy or breeding despite adequate floristic or structural conditions.

Definition of Key Ecological Functions - Principal or key roles performed by each species. Or, the main ways organisms use, influence and alter the environments.

Further Defining Key Ecological Functions -- to ensure sustainable wildlife populations, like conserving threatened or endangered species, cannot stop at addressing only individual species habitat needs. In fact, a primary purpose of the Endangered Species Act is .. . . to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved . . . ..(Sec. 2[b]). As well, natural resource organizations, like the U.S. Forest Service, have moved to an ecosystem-based management approach, to conserve and manage ecosystems means understanding their dynamics and processes, including the ecological functions of species.

It has long been recognized that the ecological roles of vertebrate species influence ecosystems. Examples of some ecological functions of vertebrate species include how: browsing or grazing by ungulates can change plant communities; or carnivore predation can influence populations of ungulate prey species; and pollinators can support plant diversity. Ecological functions of organisms support the trophic structure of ecosystems that is, energy flows, food webs, and nutrient cycling. Hence, more biologically diverse systems support wider arrays of ecological functions.

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Owyhee Subbasin Plan

Chapter 3 Inventory of Existing Activities

<u>Prepared By</u>:

The Shoshone-Paiute Tribes,

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and

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<u>Prepared for:</u>

The Northwest Power and Conservation Council

Final Draft May 28, 2004

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Planning Team – Members who attended Owyhee Subbasin Plan Meetings

- Rex Barrie, S. Board of Control
- Gayle Batt, Idaho Water Users Association
- Leonard Beitz, Businessman and Oregon Resident
- Jay Chamberlin, Manager, Owyhee Irrigation District
- Tom Dayley, Idaho Subbasin Coordinator NWPCC
- Jim Desmond, Owyhee County NRC
- Guy Dodson, Shoshone-Paiute Tribes
- Terry Gibson, Chairman Tribal Council, Shoshone-Paiute Tribes
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- Ross Nishihara, Farmer and Oregon Resident
- Lance Phillips, Malheur Co. SWCD
- John Urquidi, Landowner and Idaho Resident
- Steven Vigg, Consultant

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- Pam Druliner, Bureau of Land Management
- Tim Dykstra, Biologist, Shoshone-Paiute Tribes
- Dave Ferguson, Idaho Soil Conservation Commission
- Jeff Fryer, Oregon Technical Team, Columbia River Inter-Tribal Fish Commission

- Brent Grasty, Bureau of Land Management
- Tracy Hillman, Principal Consultant, BioAnalysts
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- Walt Van Dyke, Oregon Department of Fish & Wildlife
- Jack Wenderoth, Bureau of Land Management
- Randy Wiest, Oregon Department of State Lands
- Bruce Zoellick, Bureau of Land Management

<u>Citizens and Stakeholders who Attended Public Outreach Meetings:</u>

- Lisa Jim, Shoshone-Paiute Tribal Member – Owyhee, Nyssa and Jordan Valley meetings
- Nancy Jackson, Riddle & Petan Rancher – Owyhee, NV meeting
- John Jackson, Petan Ranch – Owyhee, NV meeting
- Peter Jackson, Riddle & Petan Ranch – Owyhee, NV meeting
- Guy Dodson, Shoshone-Paiute Tribal Member & Rancher – Owyhee, Grand View and Jordan Valley meetings
- John Crum, Shoshone-Paiute Tribal Member – Owyhee, NV meeting
- Stephanie Zody, Shoshone – Paiute News – Owyhee, NV meeting
- Jake Sellman, Staff, Shoshone-Paiute Wildlife & Parks – Owyhee, NV meeting
- Tim Dykstra, Staff, Shoshone-Paiute Tribes – Owyhee and Grand View meetings
- Tom Dayley, Northwest Power & Conservation Council – Owyhee, Nyssa and Jordan Valley meetings
- Mattie Allen, Staff, Shoshone-Paiute Tribes Wildlife & Parks – Owyhee, NV meeting Kyle Prior, Shoshone-Paiute Business Council, Tribal Member – Owyhee, NV meeting
- Herman Atkinis, Shoshone-Paiute Administration, Tribal Member – Owyhee, NV meeting

- Jennifer Martin, Owyhee Watershed Council, Ontario, OR – Owyhee, Grand View, Nyssa and Jordan Valley meetings
- Jerry Hoagland – Owyhee Watershed Council and Rancher, Wilson, ID – Owyhee, Grand View, and Jordan Valley meetings
- Steven Vigg, Consultant – Presenter at Owyhee, Grand View, Nyssa and Jordan Valley meetings
- Carl Hill, Owyhee Watershed Council and Farmer, Adrian, OR – Grand View, Nyssa and Jordan Valley meetings
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- John Urquidi, Landowner, Hot Springs, ID – Grand View meeting
- Pam Smolczynski, Idaho DEQ, Boise, ID – Grand View meeting
- Gene Davis, Rancher, Bruneau, ID – Grand View meeting
- Chuck Jones, Rancher, and Simplot Co. Manager, Grand View, ID – Grand View meeting
- Dana Rutan, Rancher (Oreana, ID) –Grand View meeting
- Derron Frederick, Landowner and Rancher (Grand View, ID) – Grand View meeting
- Craig Baker, Landowner and Rancher, Murphy, ID – Grand View meeting
- Chris Collett, Landowner and Rancher, Oreana, ID – Grand View meeting
- Brian Collett, Landowner and Rancher, Oreana, ID – Grand View meeting
- Jeanette Hemenway, – Landowner, Grand View, ID – Grand View meeting
- George Bennett – Landowner, Grand View, ID – Grand View meeting
- Donna Bennett – Landowner, Grand View, ID – Grand View meeting
- Kevin Lawson, Grand View, ID –Grand View meeting
- Jim Jencks, recreationist, Kuna, ID – Grand View meeting
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- Ray Perkins, ODFW Biologist and Presenter, Ontario, OR – Nyssa and Jordan Valley meetings
- Ronald Detweiler, Landowner and Farmer, Nyssa, OR – Nyssa meeting
- George Jones, Landowner and Farmer , Nyssa, OR – Nyssa meeting
- Ed Petersen, NRCS, Ontario, OR – Nyssa meeting
- Kathy Pratt, Malheur Watershed Council, Ontario, OR – Nyssa meeting
- Reid Saito, Onion Growers Association , Nyssa, OR – Nyssa meeting
- Scott Cruickshank, Malheur Growers Association, Ontario, OR – Nyssa meeting
- Lou Wettstein, Malheur County Court Ontario, OR – Nyssa meeting
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- Cameron Skeen, Landowner and Farmer , Nyssa, OR – Nyssa meeting
- Harry Smith, Landowner and Farmer Ontario, OR – Nyssa meeting
- Glade Chadwick, Landowner and Farmer , Nyssa, OR – Nyssa meeting
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- Lynn Jensen, Malheur County Extension Service, Ontario, OR – Nyssa meeting
- Bob Ebbers, Landowner and Farmer , Nyssa, OR – Nyssa meeting
- Jay Chamberlin, Owyhee Irrigation District , Nyssa, OR – Nyssa meeting
- Ryan Martin, Owyhee Watershed Council, Adrian, OR – Nyssa meeting

- Dave Bunker, Landowner and Farmer / Oregon Farm Bureau Federation, Nyssa, OR – Nyssa meeting
- Lawrence Ziemer, Landowner and Farmer , Nyssa, OR – Nyssa meeting
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- Pam White – Owyhee Watershed Council and Landowner, Jordan Valley, OR – Jordan Valley meeting
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- Elias Jaca – Landowner, Murphy, OR – Jordan Valley meeting
- Forest Fretwell – Landowner, Jordan Valley, OR – Jordan Valley meeting
- Jerry Raburn – Landowner, Jordan Valley, OR – Jordan Valley meeting
- Bill Lowry – Landowner, Jordan Valley, OR – Jordan Valley meeting
- Tim Lowry – Landowner, Jordan Valley, OR – Jordan Valley meeting
- Ed Dowell – Owyhee Watershed Council and Landowner, Rome, OR – Jordan Valley meeting
- Robert Corbari – Owyhee Watershed Council and Landowner, Rome, OR – Jordan Valley meeting
- Matthew Bowen – Landowner, Jordan Valley, OR – Jordan Valley meeting
- Martin Andre – Owyhee Watershed Council and Landowner, Arock, OR – Jordan Valley meeting
- Jim Elordi – Landowner, Jordan Valley, OR – Jordan Valley meeting
- Dennis Stanford – Owyhee Watershed Council and Landowner, Jordan Valley, OR – Jordan Valley meeting
- Jayne Collins – Owyhee Watershed Council and Landowner, Jordan Valley, OR – Jordan Valley meeting
- Mike Hanley – Landowner, Jordan Valley, OR – Jordan Valley meeting

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3 Owyhee Subbasin Inventory of Existing Activities

3.1 Existing and Imminent legal protection[1]

3.1.1 Federal Agencies Conducting Fish & Wildlife Restoration Activities

Numerous federal agencies, including the following, conduct activities within the basin that affect fish and wildlife, as well as the Columbia River Basin Indian tribes. Many of these agencies are responsible for managing water resources, the power generated by hydroelectric projects, or land resources, such as forests, grazing lands, and wildlife refuges.

- Bonneville Power Administration (Bonneville) provides power transmission services and markets the electricity generated by the 31 Corps and Reclamation dams comprising the Federal Columbia River Power System (FCRPS). In doing so, it must provide treatment to fish and wildlife equitable to the other purposes for which the FCRPS is operated.
- U.S. Army Corps of Engineers (Corps) designs, builds, and operates civil works projects to provide electric power, navigation, flood control, and environmental protection.
- Bureau of Reclamation (Reclamation) designs, constructs, and operates water projects for multiple purposes, including irrigation, hydropower production, municipal and industrial water supply, flood control, recreation, and fish and wildlife.
- U.S. Forest Service (Forest Service) manages national forests and grasslands under the principles of multiple use and sustained yield, and ensures that lands will be available for future generations.
- Bureau of Land Management (BLM) administers public lands and subsurface mineral resources, and sustains the health, diversity, and productivity of public lands for the use and enjoyment of future generations.
- U.S. Fish and Wildlife Service (FWS) conserves, protects, and enhances fish, wildlife, and plants, and implements the ESA for terrestrial species, migratory birds, certain marine mammals, and certain fish.
- Bureau of Indian Affairs (BIA) encourages and assists American Indians to manage their own affairs under the trust relationship with the federal government.

In addition to the water, power and land resource management agencies, several other federal agencies have regulatory, resource protection, and research responsibilities in the basin.

- NOAA Fisheries (formerly National Marine Fisheries Service, NMFS) conserves, protects, and manages living marine resources so as to ensure their continuation as functioning components of marine ecosystems, and to afford economic

[1] This section is abstracted from GAO (2004).

opportunities. NOAA Fisheries also implements the ESA for marine and anadromous (migratory fish such as salmon and steelhead) species.
- Environmental Protection Agency (EPA) protects human health and safeguards the natural environment by protecting the air, water, and land. It administers the Clean Water Act and Clean Air Act.
- Natural Resources Conservation Service (NRCS) assists farmers, ranchers, and other landowners in developing and carrying out voluntary efforts to protect the nation's natural resources.
- U.S. Geological Survey (USGS) conducts objective scientific studies and provides information to address problems dealing with natural resources, geologic hazards, and the effects of environmental conditions on human and wildlife health.

Along with their primary water, power, resource and other management and regulatory responsibilities, these agencies are responsible under various laws, treaties, executive orders, and court decisions for protecting, mitigating and enhancing fish and wildlife resources in the basin, as well as involving the tribes in the process.

3.1.2 Federal Acts and Laws Guiding Fish & Wildlife Restoration Activities

One of the main drivers of Columbia Basin fish & wildlife activities is the **Pacific Northwest Electric Power Planning and Conservation Act** (Northwest Power Act) – which provided for the establishment of the Northwest Power and Conservation Council (Council). The Northwest Power Act also directs the Council to develop a program to protect, mitigate, and enhance the fish and wildlife of the Columbia River Basin. The Act requires Bonneville's Administrator to use Bonneville's funding authorities to protect, mitigate, and enhance fish and wildlife affected by the development and operation of the FCRPS and to do so in a manner consistent with the Council's program while ensuring the Pacific Northwest an adequate, efficient, economical, and reliable power supply.

Federal environmental and fish and wildlife protection laws create broad responsibilities for federal agencies. The following nationwide laws guide the fish and wildlife activities of federal agencies throughout the United States, in some cases under the oversight and enforcement authority of regulatory agencies such as EPA and NOAA Fisheries.

- **Clean Water Act —** Authorizes EPA to establish effluent limitations and requires permits for the discharge of pollutants from a point source to navigable waters. EPA approves state and tribal limits for the maximum amount of a pollutant that a water body can receive and still meet water quality standards for specified purposes, including fish and wildlife.
- **Endangered Species Act (ESA) —** Provides for the conservation and recovery of species of plants and animals that FWS and NMFS determine to be in danger or soon to become in danger of extinction.
- **National Environmental Policy Act —** Requires federal agencies to examine the impacts of proposed major federal actions significantly affecting the environment. At the basin level, certain federal laws create agency responsibilities that are

specific to the fish and wildlife there. These laws guide the fish and wildlife activities of agencies such as Bonneville, the Corps, and Reclamation that are to be conducted in conjunction with their water and power responsibilities within the basin. Federal agencies identified the following basin-specific laws, among others, as guiding their fish and wildlife activities:

- **Fisheries Restoration and Irrigation Mitigation Act of 2000** — Directs the Secretary of the Interior to establish a program to implement projects, such as installation offish screens and fish passage devices, to mitigate impacts on fisheries associated with irrigation systems in Idaho, Montana, Oregon, and Washington.
- **Mitchell Act** — Directs the Secretary of Commerce to carry on activities for the conservation of fishery resources in the Columbia River Basin.

At the mission level, many agencies that operate within the basin have fish and wildlife responsibilities under laws that are unique to their activities. These laws guide the fish and wildlife activities of agencies such as the Forest Service, BLM, FWS, and BIA that are to be conducted in conjunction with their resource management responsibilities. The following laws were among the numerous mission-specific laws that federal agencies identified as guiding their fish and wildlife activities (GAO 2004):

- National Forest Management Act — Mandates multiple-uses for lands managed by the Forest Service to include outdoor recreation, range, timber, watershed, wildlife and fish, and wilderness purposes.
- Federal Land Policy and Management Act of 1976 — Directs the Secretary of the Interior to develop and maintain land use plans using a systematic interdisciplinary approach to achieve the integrated consideration of physical, biological, and economic factors.
- National Wildlife Refuge System Administration Act of 1966 — Establishes the National Wildlife Refuge System and directs the Secretary of the Interior in the overall management of the refuge system to maintain the biological integrity, diversity and environmental health of the system, and prepare a comprehensive conservation plan for each refuge.

3.1.3 Court Decisions Define and Clarify Federal Agency Fish & Wildlife Responsibilities

Federal responsibilities and activities under laws, treaties and executive orders are continually being defined and clarified through court decisions. These decisions provide guidance regarding the fish and wildlife activities of federal agencies such as Bonneville, the Corps, and NMFS. The following court decisions have guided Federal fish and wildlife activities in the basin (GAO 2004):

- National Wildlife Federation v. National Marine Fisheries Service— Remanded NMFS' 2000 biological opinion for ESA-listed salmon and steelhead in the Columbia and Snake Rivers to NMFS to resolve deficiencies identified by the court.5

- National Wildlife Federation v. United States Army Corps of Engineers—Remanded a decision regarding dam operations in the FCRPS to the Corps to address compliance with its obligations under the Clean Water Act.6

- Northwest Environmental Defense Center v. Bonneville Power Administration—Interpreted Bonneville's responsibility to provide "equitable treatment" for fish and wildlife in conducting its power marketing activities under the Northwest Power Act

3.1.4 Tribal Rights Regarding Fish & Wildlife Restoration – Legally Defined Federal Responsibilities

Federal responsibilities for protecting, mitigating and enhancing fish and wildlife resources in the basin – while involving the tribes in the process – are defined by a multilayered collection of laws, treaties, executive orders, and court decisions. Nationwide, basin-specific, and agency mission-specific laws create responsibilities for federal agencies to mitigate the impacts of their activities on fish, wildlife and their habitat. In addition, various laws, treaties, executive orders, court decisions, and agency policies require agencies to consider the rights of tribes in the basin. Federal responsibilities and activities under these layers of directives have been defined and clarified over the years through numerous court decisions.

The following Six Columbia River Basin Tribes have Treaties with the US Government establishing Reservations and reserving hunting and/or fishing rights:

- Confederated Tribes of the Umatilla Indian Reservation -- Treaty with the Wallawalla, Cayuse, etc. (12 Stat. 945) June 9, 1855
- Confederated Tribes of the Warm Springs Reservation of Oregon -- Treaty with the Tribes of Middle Oregon (12 Stat. 963) June 25,1855
- Confederated Tribes and Bands of the Yakama Reservation, Washington -- Treaty with the Yakama (12 Stat. 951) June 9,1855
- Nez Perce Tribe of Idaho -- Treaty with the Nez Perces (12 Stat. 957) June 11, 1855
- Confederated Salish and Kootenai Tribes of the Flathead Reservation, Montana -- Treaty with the Flatheads, etc. (12 Stat. 975) July 16, 1855
- Shoshone-Bannock Tribes of Idaho -- Treaty with the Eastern Band Shoshoni and Bannock, (15 Stat. 673) July 3,1868

In addition to Treaties, Presidential Executive Orders were used by the U.S. government to reserve lands for six other Columbia River Basin tribes, including the Shoshone-Paiute Tribes of the Duck Valley Indian Reservation:

- Confederated Tribes of the Colville Reservation, Washington -- 1872
- Burns Paiute Tribe of the Burns Paiute Indian Colony of Oregon -- 1872
- Coeur D'Alene Tribe of the Coeur D'Alene Reservation, Idaho -- 1873
- Shoshone-Paiute Tribes of the Duck Valley Reservation, Idaho/Nevada -- 1877

- Spokane Tribe of the Spokane Reservation -- 1881
- Kalispel Indian Community of the Kalispel Reservation, Washington -- 1914

The executive orders are similar to treaties; they describe the lands reserved for habitation by the tribes, but unlike treaties, do not explicitly state each tribe's right to fish and/or hunt. Nevertheless, the federal government has respected non-treaty tribal rights to hunt and fish. Unlike the other twelve Columbia Basin tribes, the Kootenai Tribe of Idaho has neither a treaty nor an executive order establishing reservation lands.

Three other executive orders, as well as a presidential memorandum, were identified by federal agencies as providing guidance in their inter-governmental relationships with tribes while performing their missions (GAO 2004):

- **Executive Order 12866 (September 30,1993), Regulatory Planning and Review —** Establishes a program to reform and make more efficient the regulatory process, including making the process more accessible and open to the public. Provides that wherever feasible, agencies shall seek views of appropriate state, local and tribal officials before imposing regulatory requirements that might significantly or uniquely affect them.

- **Executive Order 12875 (October 26, 1993), Enhancing the Intergovernmental Partnership —** Prohibits executive agencies, to the extent feasible, from promulgating any regulation not required by statute that creates a mandate upon a state, local or tribal government unless funding for the direct costs is provided or the agency consults with the affected government.

- **Executive Order 13175 (November 6, 2000), Consultation and Coordination with Indian Tribal Governments —** Requires executive agencies to respect Indian tribal self governance and sovereignty, honor tribal treaty and other rights, and strive to meet the responsibilities that arise from the unique legal relationship between the federal government and tribal governments. Provides that each agency shall have an accountable process to ensure meaningful and timely tribal input in the development of regulatory policies that have tribal implications.

- **Memorandum for the Heads of Executive Departments and Agencies (April 29, 1994), Government to Government Relations with Native American Tribal Governments —** Requires, among other things, that executive agencies operate within a government to government relationship with federally recognized tribal governments; consult to the greatest extent possible with tribal governments before taking actions that affect tribal governments; and assess the impact of federal government plans, projects, programs and activities on tribal trust resources and ensure that tribal rights and concerns are considered in developing them.

In addition to these executive orders, some federal agencies have internal orders and memorandums to guide their actions with tribes. The Secretarial Order 3206, jointly issued by the Secretary of the Interior and the Secretary of Commerce in 1997, clarifies the responsibilities of the Departments, their agencies, offices and bureaus when actions taken under the authority of the ESA affect or may affect Indian lands, tribal trust resources or the exercise of tribal rights. This order acknowledges the trust responsibility and treaty obligations of the United States toward Indian tribes and tribal members and its government to government relationship in dealing with the tribes.

Accordingly, activities under the ESA should harmonize trust responsibilities, tribal sovereignty, and the agency missions, and strive to ensure that Indian tribes do not bear a disproportionate burden for the conservation of listed species. In its 1996 Tribal Policy, Bonneville outlines the foundation for its trust responsibility as a federal agency and provides a framework for a government to government relationship with the 13 federally recognized Columbia River Basin tribes. In addition, the U.S. Fish & Wildlife Service cited its Native American Policy of 1994, and Environmental Protection Agency cited its Tribal Consultation Framework of 2001, as providing agency guidance for meeting responsibilities to the tribes.

The following mission-specific laws guide the fish and wildlife activities of various Federal agencies in conjunction with their Tribal resource management responsibilities:

- **National Indian Forest Resources Management Act** — Directs the Secretary of the Interior to undertake management activities on Indian forest lands with tribal participation. Treaties and executive orders also establish federal agency responsibilities for fish and wildlife. Federal agencies identified two treaties guiding their fish and wildlife activities in the basin—the Columbia River Treaty, which defines the relationship between the United States and Canada concerning the operation of Columbia River dams and reservoirs, and the Pacific Salmon Treaty, which governs the harvest of certain stocks in the fisheries of Northwest states (including Alaska) and Canada. Federal agencies also identified three executive orders guiding their activities with regard to floodplain management, protection of wetlands, and protection of migratory birds. The most recent of these, Executive Order 13186, January 10, 2001, titled Responsibilities of Federal Agencies To Protect Migratory Birds, directs executive agencies to take certain actions to further implement the Migratory Bird Treaty Act for the conservation of migratory birds and their habitats. Executive Order 11988, May 24,1977, requires certain actions related to floodplain management, and Executive Order 11990 of the same date requires certain actions related to the protection of wetlands. Various Laws, Treaties, and Executive Orders Require Agencies to Consider the Rights of Tribes Laws, treaties and executive orders create federal responsibilities to Indian tribes and guide federal agency activities that affect the tribes of the Columbia River Basin. Federal laws, including the following, create a responsibility for federal agencies to support tribal self-government, facilitate tribal participation in federal activities, and assist in the management of tribal resources.

- **Indian Reorganization Act —** Enacts measures to protect ownership of Indian lands, restore lands to tribal ownership, and grants rights of self-government to Indians.
- **Indian Self Determination and Education Assistance Act —** Enacts measures that promote a policy of Indian self-determination by assuring maximum Indian participation in educational and other federal services to Indian communities, generally provided through Interior and Department of Health and Human Services programs for Indians.
- **Snyder Act —** Authorizes appropriations and expenditures through BIA for the benefit, care and assistance of Indians, such as education, health and other purposes. Treaties between the United States and six basin tribes document the agreements reached between the federal government and the tribes in exchange for ceding most of their ancestral lands. Federal agencies have a trust responsibility to protect tribal rights reserved under these treaties. In general, each treaty describes the boundaries of the tribal lands ceded, the boundaries of lands reserved for habitation by the tribe, payments to be made to the tribe, and certain rights of the tribe under the treaty, including specific hunting and/or fishing rights.

3.2 Existing plans and management programs

Descriptions of plans and programs implemented by federal agencies to manage Columbia River Basin fish and wildlife activities are summarized in Table 3.1 -- including the directives driving the plans and programs and the lead agencies.

Table 3.1. Plans and programs that guide Federal fish and wildlife activities in the Columbia River Basin (GAO 2004).

Plan/program	Lead agency	Description
Northwest Power Act-driven plans and programs:		
Columbia River Basin Fish Bonneville, and Wildlife Program	The Council	Program to protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries. Developed by the Council, funded by Bonneville, and implemented by a number of agencies and other organizations.
Northwest Power and Conservation Council	The Council	Process to incorporate local-level planning for

Plan/program	Lead agency	Description
Subbasin Planning Process		the 50+ subbasins in the Columbia River Basin into the development and implementation of the Columbia River Basin Fish and Wildlife Program.
Northwest Power and Conservation Council Provincial Review	The Council	Program developed by the Council, and operated on a three-year cycle, to improve the technical review and approval of projects funded by the Columbia River Basin Fish and Wildlife Program.
Endangered Species Act-driven plans and programs:		
Biological Opinions for the FCRPS	FWS and NMFS	Plans that set forth reasonable and prudent measures/alternatives for operation by the Corps, Reclamation, and Bonneville of the FCRPS, in order to minimize impacts to fish and wildlife. Created as a result of consultation with FWS and NMFS under Section 7 of ESA.
Biological Opinion Implementation Plans for the FCRPS	Bonneville, the Corps, Reclamation	Frameworks developed by the agencies managing the FCRPS for complying with Biological Opinions for the FCRPS.
Bull Trout Recovery Plan	FWS	Plan designed to organize, coordinate, and prioritize recovery actions for bull trout, and to outline objective measurable criteria that will be used to determine when bull trout no longer need the protection of the ESA.

Plan/program	**Lead agency**	**Description**
recovery plans for salmon (under development)	NMFS	Plans designed to organize, coordinate, and prioritize recovery actions for endangered and threatened salmon and steelhead, and to outline objective measurable criteria that will be used to determine when salmon and steelhead no longer need the protection of the ESA.
Basin-wide Salmon Recovery Strategy (AII-H Paper)	All agencies in the Federal Caucus	A strategy and accompanying suite of actions to be used as a blueprint to guide federal actions towards recovery of threatened and endangered salmon and steelhead in the Columbia River Basin.
Clean Water Act-driven plans and programs:		
Clean Water Act Section 319Grant Program	EPA	Program to provide funding to states and Indian tribes for a wide variety of nonpoint source activities including technical and financial assistance, education, training, technology transfer, demonstration projects, and monitoring.
Clean Water Act General Assistance Grant Program to Tribes	EPA	Program to provide assistance grants to Indian tribal governments and intertribal consortia t o build capacity to administer regulatory and multimedia programs addressing environmental issues on Indian lands.
Clean Water Act Section 104(b)(3) Support to TMDLs	EPA	Program to provide assistance to state water pollution control agencies,

Plan/program	Lead agency	Description
		interstate agencies, and other nonprofit institutions, organizations, and individuals to promote the coordination of environmentally beneficial activities, including storm water control, sludge management, and pretreatment of wastewater.
Clean Water Act Section 106 Grant Program	EPA	Program to provide assistance to Indian tribes in carrying out effective water pollution control programs, including water quality planning and assessments, developing water quality standards and total maximum daily loads, and ambient monitoring.
Clean Water State Revolving Fund	EPA	A loan program to fund water quality protection projects for wastewater treatment, nonpoint source pollution control, and watershed and estuary management.
Lower Columbia Estuary Partnership	EPA	Program under Clean Water Act Section 320 to improve the quality of the Lower Columbia Estuary, and provide the basis for estuarine salmon recovery efforts. Key activities include habitat monitoring, volunteering monitoring, and species recovery.
Court-driven plans and programs:		
US v Oregon Management Plans/Agreements	FWS, NMFS	Plans that address tribal allocation of annual fish harvest, as well as

Plan/program	Lead agency	Description
		hatchery and supplementation measures designed to help rebuild depressed fish stocks.
Mission-driven plans and programs:		
Gas Abatement Project at Chief Joseph Dam	The Corps	Project to install spillway deflectors and implement operational changes at Chief Joseph Dam in order to reduce total dissolved gas levels.
Army Corps Anadromous Fish Evaluation Program	The Corps	Program to develop and evaluate anadromous fish passage facilities Corps at dams on the Columbia and lower Snake Rivers. Includes monitoring, research, and evaluation studies conducted in collaboration with other federal, state, and tribal agencies.
Project Management Plans	The Corps	Internal management plans developed in parallel with any Corps project. Designed to ensure that proper internal procedures are followed to protect and mitigate barriers to fish passage.
District Resource Management Plans	BLM	Internal management plans for all BLM activities. Developed via the National Environmental Policy Act process, they include specific management guidelines for protection of fish and wildlife.
Wild and Scenic River Plans	BLM	Management plans developed to ensure that agency activities protect identified "outstandingly

Plan/program	Lead agency	Description
		remarkable values," including fish and wildlife, recognized in Wild and Scenic River Areas.
Upper Salmon Basin Project	NRCS	Project designed to provide a basis of coordination and cooperation between local, private, state, tribal, and federal fish and land managers, land users, land owners and other affected entities. Goal is to manage the biological, social, and economic resources to protect, restore, and enhance anadromous and resident fish habitat.
General Investigations	Reclamation	Projects funded by special Congressional appropriations, some of which address fish and wildlife enhancement or mitigation. Also typically involve partnerships with other groups, such as states, interest groups, and tribes.
Research and Monitoring Programs	Reclamation	Internal Reclamation programs funded by the Commissioner's office that focus on a range of discretionary activities, including research and monitoring efforts for fish and wildlife.
Resource Management Plans	Reclamation	Management plans required for all reservoirs managed by the agency. Plans address management of recreational activities, as well conservation of fish and wildlife.

Plan/program	**Lead agency**	**Description**
Hungry Horse Mitigation Implementation Plan	Reclamation	Specific project at Hungry Horse Dam to control water withdrawals at the reservoir that were causing harm to fish, and to mitigate for impacts of constructing a water control system.
Lower Snake River Compensation Plan	Bonneville, FWS	Specific project to mitigate impacts to fish and wildlife from construction of last four FCRPS dams on the Lower Snake River. Project preceded mitigation requirements set forth under the Power Act.
Recreational Fishery Resources Conservation Plan	FWS	Internal agency plan to incorporate conservation planning into the management of recreational fisheries.
Land and Resource Management Plans (Forest Plans)	Forest Service	Internal agency plans that incorporate specific conservation measures for fish, wildlife, plants, and other natural resources, into management of National Forests.
Lynx Conservation Strategy and Agreement	Forest Service	Strategy to address the needs of lynx and lynx habitat in the context of forest management, and to foster cooperation and interaction between foresters and wildlife biologists.
PACFISH & INFISH	Forest Service, BLM	Interim standards and guidelines for addressing, and incorporating measures for, the recovery of endangered and threatened fish in the

Plan/program	**Lead agency**	**Description**
		development of Land and Resource Management Plans.
Northwest Forest Plan	Forest Service, BLM	An interagency approach to developing and implementing measures for the long-term health of forests, wildlife, and waterways on federal lands.
Environmental Quality Incentive Program	NRCS	Cost-share program, operated collaboratively with tribes, to benefit fish and wildlife through environmental improvements to irrigation, erosion, water quality, and agriculture.
State-driven plans and programs:		
"Extinction Is Not an Option" Washington Statewide Strategy to Recover Salmon	: State of Washington	Long-term strategy for the recovery of salmon in Washington state Primary goals of the strategy are to restore salmon, steelhead, and trout populations to healthy and harvestable levels and improve the habitats on which fish
Fish and Forest Agreement in Washington	State of Washington	Collaborative agreement between Washington state, tribes, federal agencies, timber interests, and environmental groups to address timber practices so as to minimize impacts to fish populations.
Oregon Plan for Salmons Watersheds	State of Oregon	A statewide approach to natural resource management in Oregon that focuses on restoring Coho salmon through the Coastal Salmon Restoration Initiative and

Plan/program	Lead agency	Description
		improving water quality through the Healthy Streams Partnership.
Tribally-driven plans and programs:		
Wy-Kan-Ush-Mi Wa-Kish- Wit (Spirit of the Salmon")	Nez Perce, Umatilla, Warm Springs, Yakama Tribes	A framework for restoring salmon in the Columbia River that outlines the cultural context for the tribes' salmon restoration efforts, as well as technical and institutional recommendations and watershed restoration activities
Warm Springs National Fish Hatchery Operational and Implementation Plan	Warm Springs Tribe	Plan outlining management measures and operational procedures for the Warm Springs National Fish Hatchery, which is cooperatively managed by FWS and the Warm Springs tribe.

3.2.1 Local Government and Local Non-Governmental Entities in the Owyhee Subbasin

3.2.1.1 Owyhee County, Idaho

http://owyheecounty.net

Located in Idaho's southwestern corner, Owyhee County is bordered by Nevada on the south, Oregon on the west, Canyon, Ada and Elmore counties on the north and Twin Falls County on the east.

- Population: 10,460
- Elevation: 2,200 to 8,438 feet
- Area: 7,639 square miles

3.2.1.2 Elko County, Nevada

http://www.governet.net/NV/CO/ELK/home.cfm

The county, a political subdivision of the State, was organized in the year 1869. The county has been and is now operating under the provisions of the general laws of the State. Elko County is located in northeastern Nevada and is the second largest county in the state (17,135 square miles). It is bordered on the north by Idaho, and on the east by Utah. The City of Elko, the County seat, is 290 miles east of Reno, 241 miles west of Salt Lake City and 246 miles south of Boise. The Land of Elko County consists of mountains interspersed with low, flat valleys. The Humboldt River flows through Elko county, with the Ruby Mountains stretching across the county in a north-south direction. The County's elevation varies between 5,000 and 11,000 feet with the Ruby Dome (elevation 11,300 feet) being the highest point in the county. Approximately 71% of the land in Elko County is federally controlled. Elko County has four incorporated cities: Carlin, Wells, West Wendover, and the City of Elko. Jackpot, a major unincorporated town, has experienced rapid growth in recent years. The City of Elko is the major urban area, with the remainder of the County primarily rural.

3.2.1.3 Malheur County, Oregon

http://www.malheurco.org

Located in Oregon's southeast corner, the county is the state's second largest. It is 94 percent rangeland, two-thirds of which is managed by the Federal Bureau of Land Management. Today, irrigated fields in the county's northeastern corner, known as Western Treasure Valley, are the center of intensive and diversified farming.

3.2.1.4 Owyhee Watershed Council, Ontario, Oregon

Information pertaining to the Owyhee Watershed Council (OWC) can be accessed at the following web site: http://www.owyheewatershed.com .

The OWC Mission statement:
To lead the effort in ensuring sustainable, responsible, and productive stewardship of all land and water resources for the economic and environmental benefit of the Owyhee Watershed.

The Owyhee Watershed Council was formally recognized in June, 2001. The Council is made up of numerous members representing various watershed interests (ranching, farming, local business, scientific community, recreation, etc.) This is in addition to an extensive technical support committee made up of local, state, and federal agency personnel. All members are appointed by the Malheur and Owyhee County Courts.

3.2.1.5 The Owyhee Initiative

The draft Owyhee Initiative proposal is available for review at the following web site link: http://www.owyheeinitiative.org/FAQs/agreement.htm . The following groups participated in the development of the proposed plan:

- The Wilderness Society

- Idaho Conservation League
- Sierra Club
- The Nature Conservancy
- Owyhee County Commissioners
- Owyhee Borderlands Trust
- People For The Owyhees
- Owyhee Cattlemen's Association
- Idaho Outfitters and Guides Association
- Owyhee County Soil Conservation Districts

3.2.2 State Fish Management Plans – Trout

3.2.2.1 Idaho Department of Fish & Game – Trout Management Plan

A primary goal of IDFG trout management is to provide for “quality” and “trophy” trout fisheries (2001-2006 Fish Management Plan; IDFG 2001). Within the context of IDFG’s fish management programs and this fish management plan, these terms are used to refer to specific management programs that utilize special regulations to increase the size of trout. Excerpts of Owyhee Subbasin goals, objectives and strategies from the IDFG trout management plan are summarized in Appendix 4.4.4.

Quality and trophy trout fisheries generally provide increased catch rates as well. Trout may be of wild/natural or hatchery origin. Quality and trophy trout management differ with respect to the size of trout the regulations are designed to provide. They are defined as follows:

Quality Trout Management - A management program using special regulations, that reduces or delays mortality to provide increased size of trout, but where less than 20% of the fish exceed 16 inches. Quality trout management is appropriate for lakes and streams with poorer productivity and growth potential, or on waters with trophy growth potential where the majority of affected anglers desire to retain more harvest opportunity than that provided under trophy management.

Trophy Trout Management - A management program using special regulations that reduces or delays mortality to provide increased catch rates and increased size of trout such that 20% or more of the trout exceed 16 inches. Trophy trout management is appropriate for lakes and streams with good productivity and growth potential where the majority of affected anglers desire to forego all or a major portion of or all harvest opportunity in order to catch large trout.

Special regulations used under quality and trophy trout management programs may include a combination of a 2-fish bag limit and various size limits, or catch-and-release where appropriate. Bait may be applied where necessary to achieve size structure goals. IDFG has quality management programs that may utilize a minimum size limit of 14-inches or 16-inches, depending on productivity and biological characteristics of the fish population. Trophy management programs utilize a minimum size limit (most often 20-

inches), again depending on productivity and biological characteristics of the fish population. For quality and trophy management objectives, slot limits may be used where there is a clear public demand for harvest opportunity or where recruitment is not a limiting factor. The most restrictive regulation, catch-and-release, may be used as part of quality or trophy trout management, depending on the same characteristics.

Quality and trophy management may include seasonal restrictions to reduce mortality on spawners, or on trout as they concentrate to migrate downstream in the fall in response to dropping water temperatures. Seasonal restrictions responding to these circumstances will be employed only after a biological necessity has been established. It may also apply to all trout within a body of water, or may be applied to certain species in order to provide a diversity of opportunity within the same body of water or a geographical area.

As the number of anglers using the water increases and harvest rates impact the size structure of the trout, or as more anglers desire to optimize catch rates and size of fish and de-emphasize harvest, quality and trophy trout management may be applied to additional waters.

The previous 1995-2000 State Fisheries Management Plan (IDFG 1995) noted that a large percentage of Idaho anglers wanted see additional waters managed for larger trout. One statewide goal for the 1995-2000 period was to apply trophy or quality management on approximately 5 to 10 additional streams or stream segments and 10 to 15 additional lakes or reservoirs. During that five-year time period the Commission placed four new lakes and reservoirs (Mormon, Blackstone, Springfield reservoirs and Payette Lake) and more than 20 new streams or stream segments under quality or trophy management regulations.

The following narrative and management objectives – from the IDFG 2001-2006 Fish Management Plan – pertain to trout management in the Owyhee River System.
The Owyhee River and Bruneau River basins lie in southwestern Idaho, southeastern Oregon and northern Nevada. This basin encompasses approximately 11,340 square miles of semi-arid high desert country, of which about 8,000 square miles lies within Idaho. In the higher bench lands of the Bruneau and Owyhee, the rivers and their tributaries flow through deeply incised canyons. Elevations in the Owyhee drainage range from 8,100' in the Owyhee Mountains to 2,400 feet at the Snake River. The Owyhee River has an annual average discharge of 661,500 acre-feet of water at the Oregon/Idaho border. Elevations in the Bruneau drainage range from over 10,000 feet in the Jarbidge Mountains to 2,455 feet at the mouth. The Bruneau River has an annual average discharge of 292,000 acre-feet of water.

Most of the Owyhee River drainage contains populations of redband trout. Due to the unique qualities of this fish and the inaccessibility of the Owyhee drainage, this entire drainage will be managed for racial preservation. Lahontan cutthroat trout have been introduced into several reservoirs near Riddle. Livestock grazing on some tributary streams has impacted fish habitat, and efforts should be made to work with landowners and land management agencies to improve habitat.

<u>IDFG Objectives and Programs for the Owyhee Subbasin</u>

1. Objective: Manage stream and reservoir fisheries to preserve the genetic integrity of native desert redband trout.

- Program: Stock other species of fish only in reservoirs that will not pose a threat to preserving redbands and use only sterile rainbow trout.

- Program: Restock streams with depleted populations where habitat conditions have been restored with redbands by collecting fish or eggs from adjacent areas that contain native redband trout.

2. Objective: Work cooperatively with state and federal land management agencies and grazing permittees to improve riparian and aquatic habitats.

- Program: Establish riparian vegetation objectives in management plans that annually provide 80% of the potential, riparian vegetation mass to be in place prior to high flows occurring.

- Program: Monitor stations on major tributaries of the Owyhee and Bruneau river systems to determine trends in riparian conditions, aquatic habitat, and fish production.

3. Objective: Increase reservoir fishing opportunities.

- Program: Seek opportunities to construct new fishing reservoirs in cooperation with federal, state, and private landowners.

- Program: Seek cooperative agreements with private landowners to gain access to existing reservoirs.

- Program: Restock reservoirs with appropriate stocks of fish when drought conditions cause fish kills or de-watering.

- Program: Renovate reservoirs with rough fish populations that limit the fishery.

3.2.2.2 Nevada Department of Wildlife – Trout Management Plan (Gary Johnson, Elko Office)

The Nevada Department of Wildlife (NDOW) Trout Management Plan is currently under development – as a draft document (Gary Johnson, Personal Correspondence, Elko Office). Extensive fish assessment and habitat survey work has been done by NDOW within the Owyhee Subbasin over the past two decades. These data were utilized, along with expert opinion from Gary Johnson (NDOW) and Pat Coffin (BLM) to help us quantify redband trout habitat ratings for the Nevada portion of the Owyhee Subbasin.

3.2.2.3 Oregon Department of Fish & Wildlife – Trout Management Plan, Redband Trout (Ray Perkins, Vale Office)

Distribution

Inland redband trout are native to the planning area. The populations within the Oregon planning area are grouped with the inland Columbia Basin redband/steelhead group (*Oncorhynchus mykiss gairdneri*) which includes other populations upstream of Hells Canyon Dam. Excerpts of Owyhee Subbasin goals, objectives and strategies from the ODFW trout management plan are summarized in Appendix 4.4.5.

Within the planning area redband are found in the mainstem of the Owyhee River, five tributaries of the Owyhee and in a tributary of Succor Creek – comprising 180 miles of river habitat (Table 3.2). Perkins et al. (unpublished) estimated that about 779 miles of redband trout habitat exists in the Idaho and about 321 miles of redband trout habitat exists in the Nevada portion of the Owyhee system (Table 3.3).

Table 3.2. Inland redband trout populations distribution and genetic status within the planning area in Oregon; and outside the planning area in Idaho and Nevada (From Ray Perkins, unpublished trout management plan, 2004).

STREAM REACH	ESTIMATED MILES OF HABITAT	GENETIC TESTS	RESULTS OF TEST
OREGON			
Dry Creek	5	YES	REDBAND
N. F. Owyhee River	1		
Jordan Creek	5	YES	REDBAND
Antelope Creek	1		
S. F. Carter Cr.	5	YES	REDBAND
W. L. Owyhee R.	5	YES	REDBAND
Owyhee River	159		
TOTAL	**180**		

The populations in Dry Creek and West Little Owyhee River are found in headwater reaches near springs. A few individuals have been found in lower Antelope Creek near ephemeral springs that exist only during average and above average water years. The populations in Jordan Creek and North Fork Owyhee River are located almost entirely in

Idaho. The majority of the habitat and most of the populations of inland redband exist outside the planning area in Idaho and Nevada (Table 3.3).

Table 3.3. Inland redband trout populations present within the Owyhee River basin within Idaho and Nevada (ODFW Trout Management Plan; Ray Perkins 2004).

RIVER REACH	ESTIMATED MILES OF HABITAT	GENETIC TESTS	RESULTS OF TEST
IDAHO			
N. F. Owyhee R.	61		
Jordan Creek		YES	REDBAND
Deep Creek	142		
Battle Creek	103		
Blue Creek	139		
Mainstem E. F. Owyhee	239		
Mainstem S. F. Owyhee	95		
TOTAL	**779**		
NEVADA (East Fork Owyhee River)			
Fawn Creek	5		
Mill Creek	13	YES	REDBAND
Van Duzer Creek	27		
Penrod Creek	15		
Deep Creek	18	YES	REDBAND
Hendricks Creek	3		
Beaver Creek	9		
Badger Creek	7		
California Creek	14		
Slaughterhouse Cr.	19		
Mainstem E. F. Owyhee	46		
TOTAL	**176**		
NEVADA (South Fork Owyhee River)			
Smith Creek	2		
Burns Creek	7		
Snow Canyon Cr.	11		
Jack Creek	32	YES	REDBAND
Bull Run Cr.	17	YES	HYBRIDS
Silver Cr.	10		
Indian Cr.	24	YES	REDBAND
Mainstem S. F. Owyhee	42		
TOTAL	**145**		

Life History

The life history of the inland redband trout within the planning area has not been studied. We assume that their life history is similar to other populations that have been studied, such as work completed in the Blitzen and Malheur river basins (Hosford and Pryble 1985, Hosford and Pryble 1989). Inland redband trout spawn from April through July depending upon water temperature. Spawning success is greatest in streams with clean gravel and cobble substrate. Most fish mature and spawn in their third year with a few in their fourth year. Most die after spawning.

Production

Oregon populations are very small. In tributary streams and confined to stream reaches near perennial springs. The populations in Jordan Creek and North Fork Owyhee River located mostly in Idaho are much larger. The abundance of inland redband trout in the Owyhee River mainstem above the reservoir is unknown.

Samples of redband trout from Dry Creek, West Little Owyhee River, Jordan Creek, and South Fork Carter Creek (Succor Creek) have been analyzed genetically. The results indicated that the populations in these streams show little evidence of hybridization with hatchery rainbow trout.

Growth of redband in the planning area has not been studied, but individuals seldom get over 10 inches in the tributaries. Trout from the mainstem can reach 18 inches.

Fishery

The fishery targeting inland redband trout is small compared to that for hatchery rainbow trout. Some native trout are caught incidental to the harvest of hatchery trout. Size of the catch is usually from 6 to 9 inches, with few individuals over 10 inches.

Management Concerns

A combination of habitat alteration and natural conditions restrict the abundance and distribution of both tributary and mainstem populations of inland redband trout. These conditions also keep the populations in the mainstem very low. Removal of riparian vegetation has allowed water temperatures to increase. The stream banks where the riparian vegetation has been removed are less stable and flush more sediment into streams during high water events. Unscreened diversions allow fish to enter irrigation ditches where they perish.

The confinement of small numbers of individuals in short perennial stream reaches increases the susceptible of these populations to catastrophic events and genetic bottlenecks. Maintaining connectivity of the populations in the planning area with the

populations in Idaho and Nevada is important. It maintains genetic variability and allows populations that are eliminated by catastrophic events to be repopulated.
Introduced hatchery trout that can interbreed with the native redband trout are still being planted in reservoirs in the planning area and upstream in Idaho and Nevada. Effects of stocked hatchery trout into waters with redbands are unknown.

The fishery directed on redband is small and incidental to stocked hatchery rainbow trout and warmwater fish. Stocking hatchery rainbow trout attracts more anglers into remote areas where native fish occur. The impact of an artificially inflated fishery can impact the small native populations.

Critical Uncertainties:

- What effects are the hatchery trout stocked into the planning area having on the native redband trout populations?
- What effects are the nonnative trout stocked into the upper basin in Idaho and Nevada having on the native redband trout in the planning area?
- What are the effects are introduced warmwater game fish having on native redband trout in the planning area?

In desert watersheds the issue of water rights is a major concern. The issue of increasing water storage upstream of Owyhee Reservoir is a concern because construction of additional dams would further segment this species and destroy spawning habitat. The result could mean the isolation and eventual extinction of the small populations in the planning area.

The populations of inland redband trout upstream of Owyhee Dam are acting as a meta-population. A meta-population is a series of populations that exchange individuals over time. If small populations are lost due, the habitat can be re-seeded from other nearby populations. This spreads the risk of extinction over several populations. Maintaining this interconnectivity within the Owyhee Basin is very important to long-term survival and genetic viability of this/these populations.

Management Objectives

Objective 1. Influence land management decisions in ways that benefit fish habitat.

Objective 2. Improve riparian habitat to provide food and cover for fish, maintain late season flows, prevent erosion, and ameliorate temperature extremes.

Objective 3. Improve water quantity and water quality to meet the biological needs of fish by providing adequate instream flows, reducing fish losses at diversions, and reducing nonpoint source pollution.

Ecological Considerations

1. Warmwater vs. coldwater interactions

- Channel catfish and smallmouth bass in the river upstream of the reservoir may be limiting the distribution of redband trout in the main river.
- The warmwater fish populations in the reservoir may be impacting the native amphibian fauna around the reservoir.

2. Fish issues that may conflict with amphibians issues.

- Management for large brown trout in the river downstream of the dam may have impacts on the frog/salamander population within this reach of the river.
- Management of trout in the upper basin stock ponds maybe impacting native populations of amphibians.

3. Introduced populations of fish in the upper river may impact the amphibians native this reach of the river.

- Hatchery rainbow trout stocked into several mainstream stock ponds in the headwaters of Oregon tributaries might be impacting native populations of redband trout.

4. All management activities in the future that concern the reservoir may be driven by the status of the introduced Lahontan tui chub.

3.2.3 State-EPA Water Quality Management

"Designated uses" have been identified for most, but not all, water bodies within Idaho, Oregon, and Nevada portions of the Owyhee Subbasin. For those water bodies not yet designated, the presumed existing uses are cold water aquatic life and primary contact recreation. One important use of waters in the Owyhee subbasin is to provide trout habitat that supports fisheries for both naturally-produced native redband trout and hatchery raised fish. Each "designated use" has narrative and numeric criteria that describe the level of water quality necessary to support that use. When a lake, river or stream fails to meet the water quality criteria that support its "designated use," it is considered to be an impaired water body – and is placed on the Federal Clean Water Act (CWA) 303(d) impaired waters list. Specific actions are required under state and federal law to ensure that the "impaired" water body is restored to a healthy fishable, swimmable condition. A summary of the 303(d) listed impaired waters – for Idaho, Oregon, and Nevada – is presented in § 4.5 "*Consistency with ESA/CWA Requirements*" of the Owyhee Subbasin Management Plan (Chapter 4) and in Appendix 4.3.

Causes of water quality problems are determined when water quality management plans – *Total Maximum Daily Loads* or *TMDLs* – are developed for the watersheds in which the listed segments are located. A TMDL identifies allowable pollutant loads to a waterbody from both *point* (end of pipe) and *non-point sources* (runoff) that will prevent a violation of water quality standards. Within the Owyhee Subbasin, several TMDLs and 305(b) assessments have been developed or are planned by the three states – Idaho, Oregon and Nevada – that have CWA responsibilities (see below).

3.2.3.1 Idaho TMDLs and Water Quality Management in the Owyhee Subbasin

The Idaho Department of Environmental Quality (IDEQ) recently completed its latest Integrated 303(d)/305(b) Report for 2002-03 (IDEQ 2003). (IDEQ) has also completed the following water quality management recovery plans:

- **Upper Owyhee (IDEQ 2003)**
- **North Fork and Middle Fork Owyhee (IDEQ 2003)**
- **South Fork Owyhee (IDEQ 2003)**
- **2002-03 Integrated 303(d)/305(b) Report (IDEQ 2003)**

These plans are available for review at the Idaho Department of Environmental Quality web site.

3.2.3.2 Nevada TMDLs and Water Quality Management in the Owyhee Subbasin

The Nevada Division of Environmental Protection (NDEP) first listed the East Fork Owyhee River (Wildhorse Reservoir to Mill Creek) on the 1996 303(d) list for total phosphorus, total dissolved solids (TDS), total suspended solids (TSS), turbidity and iron. In 1998, the lower reach of the East Fork Owyhee River (Mill Creek to Duck Valley Reservation) was added to the list for the same pollutants. The decision to include these water bodies on the 1996 and 1998 303(d) Lists were based upon data and information collected by NDEP. In 2002, the listing for the upper reach of the East Fork Owyhee River (Wildhorse Reservoir to Mill Creek) was expanded (based upon NDEP data) to include temperature. In 2002, Mill Creek was added to the 303(d) List due to exceedence of the cadmium (total), copper (dissolved and total), dissolved oxygen, iron (total), phosphorus, total dissolved solids, total suspended solids, temperature, turbidity and pH standards. Data collected by NDEP and corroborated by RTWG supported inclusion of these constituents into the 303(d) List for Mill Creek.

In January 2004, a Total Maximum Daily Loads for the East Fork Owyhee River and Mill Creek was completed as a review draft:

- **East Fork Owyhee River and Mill Creek TMDL (NDEP 2004).**

This water quality recovery plan covers the following parameters for the two stream reaches:

East Fork Owyhee River	Mill Creek
⇒ Iron (total)	⇒ Cadmium (total)
⇒ Phosphorus (total)	⇒ Phosphorus (total)
⇒ Total Suspended Solids	⇒ Copper (total; dissolved)
⇒ Turbidity	⇒ Temperature
⇒ Temperature	⇒ Dissolved Oxygen
	⇒ Total Dissolved Solids
	⇒ Iron (total)
	⇒ Total Suspended Solids
	⇒ pH

⇒ Turbidity

This TMDL is available for review at the Nevada Division of Environmental Protection web site.

3.2.3.3 Oregon TMDLs and Water Quality Management in the Owyhee Subbasin

The Oregon Department of Environmental Protection (ODEQ) has completed a state-wide Water Quality Management 305(b) Report (ODEQ 2000). ODEQ has not yet conducted TMDLs for the Oregon portion of the Owyhee Subbasin. The following water quality management plans are scheduled for completion by ODEQ during 2007-2009:

- **Upper Owyhee**
- **Middle Owyhee**
- **Crooked Rattlesnake**
- **Jordan**
- **Lower Owyhee**

3.2.4 Federal Government

3.2.4.1 Bureau of Land Management (BLM) – Resource Southeastern Oregon Management Plan

The Bureau of Land Management Record of Decision (BLM-ROD) approves the BLM's Southeastern Oregon Resource Management Plan (SEORMP). This BLM Resource Management Plan (RMP) will manage the public lands within the Malheur and Jordan Resource Areas of the Vale District during the next 20 years and beyond. Excerpts of Owyhee Subbasin goals, objectives and strategies from the Southeastern Oregon Resource Management Plan are summarized in Appendix 4.4.1. The SEORMP is a general resource management plan for 4.6 million acres of BLM administered public lands primarily in Malheur County with minor acreage in Grant and Harney Counties, Oregon (Table 3.4).

Table 3.4 Area of Federal, State, and private land in each resource area and in the Southeastern Oregon Resource Management Plan (SEORMP.) (source BLM geographic information system (GIS) data base)

Surface Jurisdiction	Malheur RA (acres)	Jordan RA (acres)	Planning Area (acres)
BLM			
Malheur County	1,982,572	2,462,711	4,445,283
Harney County	21,426	124,640	146,066
Grant County	9,299		9,299

Surface Jurisdiction	Malheur RA (acres)	Jordan RA (acres)	Planning Area (acres)
Subtotal	2,013,297	2,587,351	4,600,648
Other Federal Agencies			
Malheur County	51,842	48,487	100,329
Harney County			
Grant County			
Subtotal	51,842	48,487	100,329
State of Oregon			
Malheur County	101,467	176,347	277,814
Harney County	25,344	5,909	31,253
Grant County			
Subtotal	126,811	182,256	309,067
Private			
Malheur County	1,081,194	274,364	1,355,558
Harney County	35,326	39,017	74,343
Grant County	12,411		12,411
Subtotal	1,128,931	313,381	1,442,312
TOTAL	3,320,881	3,131,475	6,452,356

The planning area occupies the northern extent of the Great Basin division of the Intermountain Region. Physiographic provinces include much of the Basin and Range, the Owyhee Uplands, Blue Mountain, and Western Snake. The regional area and general vegetation classification is known as the Intermountain Sagebrush Province/Sagebrush Steppe Ecosystem. The Sagebrush Steppe Ecosystem covers much of eastern Oregon and Washington, southern Idaho, and portions of northern Nevada, California, and Utah. This ecosystem contains a broad diversity of landform and vegetation types, ranging from vast expanses of sagebrush-covered plateaus to rugged mountains blanketed with western juniper woodland and grassland.

The purpose of the SEORMP is to ensure that public land is managed for multiple use and sustained yield in accordance with the "Federal Land Policy and Management Act" (FLPMA) of 1976. A primary goal of this plan is to develop management practices that ensure the long-term sustainability of healthy and productive land, consistent with principles of ecosystem management. The SEORMP establishes guidance for managing a broad spectrum of land uses and allocations including livestock grazing management, wild horse management, land tenure adjustments, off-highway motorized vehicle use, wild, scenic and recreation river designations, mineral management, vegetation management and areas of critical environmental concern (ACECs). The SEORMP contains resource objectives, land use allocations, management actions and direction needed to achieve program goals. The SEORMP consolidated, updates and replaces the existing land management guidance for the Malheur and Jordan Resource Areas.

The plan was prepared under the regulations implementing the Federal Land Policy and Management Act of 1976 (43 CFR 1600). An environmental impact statement was prepared for this plan in compliance with the National Environmental Policy Act (NEPA) of 1969. The plan is nearly identical to the one set forth in the Proposed SEORMP published in November of 2001.

Also, existing activity plans, e.g., livestock allotment management plans and wildlife habitat management plans, will continue to be in effect. They will be evaluated and changed, if needed, to be in conformance with the RMP. This plan established parameters for all resources on BLM-administered land in these two resource areas, with the exception of the wilderness suitability recommendations of existing wilderness study areas (WSA's) in the planning unit. The recommendations for wilderness suitability have been previously analyzed in the 1989 "Oregon Wilderness Final Environmental Impact Statement" and are outside the scope of this planning process.

The following is a summary of the major components of the approved SEORMP:

- Meet or exceed Air Quality Standards.
- Provide opportunities for exploration and development of energy and mineral resources while protecting other sensitive resources.
- Provide for an appropriate management response on all wildfires, while providing for fire fighter and public safety and protecting resource values.
- Recognize and utilize fire as a critical natural process to protect, maintain, and enhance resources.
- Restore, protect, and enhance the diversity and distribution of desirable vegetation communities including perennial native and desirable introduced plant species. Provide for their continued existence and normal function in nutrient, water, and energy cycles.
- Manage big sagebrush cover in seedings and on native rangeland to meet the life history requirements of sagebrush-dependent wildlife.
- Control the introduction and proliferation of noxious weed species and reduce the extent and density of established weed species to within acceptable limits.
- Manage ponderosa pine, Douglas fir, and western larch communities to emphasize forest health.
- Manage western juniper and aspen woodlands to restore and promote productivity and biodiversity.
- Manage public land to maintain, restore, or enhance populations and habitats of special status plant and animal species.
- Manage public lands by ensuring that surface water and ground water influenced by BLM activities comply with or are making progress toward achieving State of

Oregon water quality standards for beneficial uses as established per stream by the Oregon Department of Environmental Quality.

- Manage riparian/wetland areas for the restoration, maintenance, or improvement of riparian vegetation, habitat diversity, and associated watershed function to achieve healthy and productive riparian areas and wetlands.
- Restore, maintain, or improve habitat to provide for diverse and self-sustaining communities of fishes and other aquatic organisms.
- Facilitate the maintenance, restoration, and enhancement of bighorn sheep populations and habitat on public land.
- Manage riparian areas so they provide diverse and healthy habitat conditions for wildlife.
- Manage upland habitats so that the forage, water, cover, security and structure necessary for wildlife are available on public land.
- Maintain and manage wild horse herds in seven established herd management areas (HMA's) of Vale District and Heath Creek-Sheephead HMA of Burns District at appropriate management levels (AML's) to ensure a thriving natural ecological balance between wild horse populations, wildlife, livestock, vegetation resources, and other resource values. Enhance and perpetuate special and unique characteristics that distinguish the respective herds.
- Provide for a sustained level of livestock grazing consistent with other resource objectives and public land use allocations.
- Provide and enhance developed and undeveloped recreation opportunities, while protecting resources, to manage the increasing demand for resource-dependent recreation activities.
- Designate and manage 673,069 acres in five Special Recreation Management Areas (SRMA's), and 3,962,193 acres in two Extensive Special Recreation Management Areas (ERMA's).
- Manage off-highway vehicle (OHV) use to protect resource values, promote public safety, provide OHV use opportunities where appropriate, and minimize conflicts among various users. Designate public lands for OHV use as "Open" on 2,615,066 acres, "Limited" on 2,004,369 acres, and "Closed" on 15,826 acres.
- Manage public land actions and activities in a manner to be consistent with visual resource management (VRM) class objectives. Designate and manage 1,308,297 acres as VRM Class I, 217,226 acres as VRM Class II, 639,657 acres as VRM Class III, and 2,469,509 acres as VRM Class IV.
- Retain and/or designate 26 areas totaling 206,257 acres as Areas of Critical Environmental Concern (ACECs).
- Protect and enhance outstandingly remarkable values (ORV's) of congressionally designated national wild and scenic rivers, and provide interim protection of ORV's of rivers found to be administratively suitable for inclusion in the national wild and scenic river system. Continue to manage the congressionally designated Main Owyhee (120 miles, 35,240 acres), West Little Owyhee (58 miles, 12,520 acres) and North Fork Owyhee (10 miles, 1,247 acres) components of the National Wild and Scenic Rivers System (NWSRS), as prescribed in their 1993 management plan, compliant with the Oregon District Court's decision. Recommend and manage four river segments (42.5 miles) as administratively

suitable for designation as wild and scenic rivers. Release from further wild and scenic river consideration 145.5 miles of eligible study river segments determined to be non-suitable administratively for wild and scenic river designation.
- Continue managing 32 wilderness study areas (WSA's —1,273,015 acres) under BLM's "Interim Management Policy for Land under Wilderness Review" (IMPLWR). Include in adjacent WSA's certain other BLM-administered lands identified in the 1991 "Wilderness Study Report, Oregon" which are determined to have wilderness values and manage them under the IMPLWR.
- Manage caves determined to be significant and caves nominated for significance which require more data to determine significance in compliance with the 1988 "Federal Cave Resources Protection Act" and BLM's "Oregon and Washington Interim Cave Management Policy".
- Manage public land and pursue partnerships to provide social and economic benefits to local residents, businesses, visitors, and future generations.
- Provide for the protection and conservation of cultural and paleontological resources. Increase the public's knowledge of, appreciation for, and sensitivity to cultural and paleontological resources. Consult and coordinate with American Indian groups to ensure their interests are considered and their traditional religious sites, landforms and resources are taken into account.
- Meet public needs for use authorizations such as rights-of way, leases and permits consistent with other resource objectives.
- Acquire and maintain legal public access to public land consistent with other resource objectives.
- Eliminate unauthorized use of public land.
- Lands are identified for retention and acquisition to consolidate public land holdings while retaining and acquiring land with high and public resource values.
- Establish right-of-way corridor routes and corridor avoidance and exclusion areas.

3.2.4.2 Bureau of Land Management (BLM) – Owyhee Resource Area – Resource Management Plan

Purpose and Need

The Owyhee Resource Management Plan (RMP) was prepared to provide the Bureau of Land Management, Lower Snake River District with a comprehensive framework for managing public lands administered by the Owyhee Resource Area. The purpose of the RMP is to ensure public land use is planned for and managed on the basis of multiple-use and sustained yield in accordance with the Federal Land Policy and Management Act of 1976 (FLPMA). Excerpts of Owyhee Subbasin goals, objectives and strategies from the Owyhee Resource Management Plan are summarized in Appendix 4.4.2.

Planning Area

The Owyhee Resource Area, located in southwestern Idaho's Owyhee County, encompasses 1,779,492 acres. This total includes the following:
- 1,320,032 acres administered by BLM, Idaho
- 136,936 acres administered by the State of Idaho
- 319,777 acres of private lands

- 2,747 acres of water, primarily the Snake River

The area is bounded on the west by Oregon, on the south by Nevada, on the north by the Snake River and on the east by Castle Creek, Deep Creek, the Owyhee River, and the Duck Valley Indian Reservation. Most of the public lands are contiguous with only a few scattered or isolated parcels. The resource area contains the northern extent of the Owyhee Mountain Range and lies within what is often referred to as the Columbia Plateau. The Columbia Plateau is an elevated plateau with mountains which are separated by canyons draining to the Pacific Ocean via the Snake and Columbia Rivers. This broad regional landform and vegetative classification is known as the Intermountain Sagebrush Province/ Sagebrush Steppe Ecosystem. The Sagebrush Steppe Ecosystem is widespread over much of southern Idaho, eastern Oregon and Washington, and portions of northern Nevada, California, and Utah. This ecosystem contains a large diversity in landform and vegetation types ranging from vast expanses of flat sagebrush covered plateaus to rugged mountains blanketed with juniper woodlands and grasslands.

Planning Criteria

This step in the planning process provides for the development of planning criteria. Planning criteria influence all aspects of the planning process including inventory and data collection, formulation of alternatives, estimation of effects, and selection of the preferred alternative and RMP. Planning criteria can be in the form of limits or constraints, or they can be statements of goals or standards to be achieved.

Planning Criteria do the following:

- streamline the plan's preparation and put it into focus;
- establish standards, rules, and measures to be used in the process;
- guide development of the RMP to ensure that it is tailored to the issues;
- guide and direct the resolution of issues through the planning process;
- indicate factors and data that must be considered in making decisions.

General Planning Criteria

The principles of multiple use and sustained yield will guide the land use decisions within the Owyhee Resource Area. However, all lands may not be open for all multiple uses. Some uses may be excluded on some lands to protect resource values either by law or regulation or by decision reached through the planning process. Site specific locations for range improvements and other structures will generally not be determined in the RMP. The RMP was prepared using the most current and best available information. Only limited inventories for the purpose of gathering additional data were conducted.

The following general planning criteria apply to the Owyhee RMP.

- Existing laws, regulations, and BLM policies;
- Plans, programs and policies of other federal agencies, state and local governments, and Indian tribes;
- Public input;
- Quantity and quality of noncommodity resource values;

- Future needs and demands for existing or potential resource commodities and values;
- Past and present use of public and adjacent lands;
- Public benefits of providing goods and services relative to costs;
- Environmental impacts;
- Social and economic values;
- Public welfare and safety.

Specific Program Planning Criteria
In addition to the general criteria listed above, the following program-specific criteria will apply to individual program decisions:

Air Quality: Under the Clean Air Act, BLM administered lands were given a Class II air quality classification. This classification allows moderate deterioration associated with moderate, well-controlled industrial and population growth. All lands within the resource area will be managed under Class II standards unless they are reclassified by the State as provided for in the Clean Air Act.

Water Quality: Section 319 of the Clean Water Act obligates federal agencies to be consistent with State Nonpoint Source Management Program Plans and relevant water quality standards. Section 313 requires compliance with State Water Quality Standards. BLM will incorporate applicable best management practices or other conservation measures for specific programs and activities into the RMP. Water quality will be maintained or improved in accordance with State and Federal standards.

Vegetation Management: Vegetation will be managed to achieve desired plant communities (considering the ecological site potential) that provide for:

- Biodiversity; protection and restoration of native species; and non-consumptive uses including plant protection, visual quality and watershed protection.
- The desired plant communities will provide forage for livestock, wildlife, and wild horses.
- Forage will be allocated for domestic livestock grazing on suitable rangeland based on multiple use and sustained yield.
- Plant maintenance, watershed protection and stability, and wildlife habitat needs will be provided for.
- Forage will be allocated to support wildlife at population levels based on multiple use and sustained yield objectives and through consultation with the Idaho Department of Fish and Game.
- Forage will be allocated to wild horses sufficient to support the appropriate management level (AML).
- Water quality will be given priority in all vegetation management decisions.
- Prescribed fire and other treatment methods will be considered as management tools to manipulate vegetation.

Riparian Areas, Floodplains and Wetlands: Riparian areas, floodplains and wetlands will be managed to protect, improve and restore their natural functions to benefit water storage, groundwater recharge, water quality, and fish and wildlife values. All management practices will be designed to maintain or improve the integrity of these high-priority values. The Idaho Standards for Rangeland Health and Guidelines for Livestock Grazing Management will be used to guide management actions.

Forest and Woodland Management: Except where closed by law or regulation, lands containing forest products such as firewood and Christmas trees will be available for harvest, subject to special restrictions to protect other resource values.

Noxious Weed Control: BLM will work with county governments to monitor the locations and spread of noxious weeds. BLM will control the occurrence and spread of noxious weeds on public lands where economically feasible and to the extent funds are available. Noxious weed control will be conducted in accordance with the integrated weed management guidelines and design features identified in the Northwest Area Noxious Weed Control Program EIS of 1985.

Threatened and Endangered Species: Management actions authorized, funded or implemented by BLM will be done so as not to jeopardize the continued existence of Federally listed threatened or endangered plant or animal species or result in the destruction or modification of critical habitat. State sensitive species and species proposed for Federal listing (candidate species) will be given the same consideration as listed species.

Wild Horses: Forage will be provided to support wild horses at levels established in accordance with the Wild and Free-Roaming Horses and Burros Act. Adjustments of the appropriate management level (AML) range will be based on monitoring to ensure a thriving natural ecological balance within the herd management areas (HMAs).

Livestock Management: Livestock utilization of public lands will be managed under the principles of multiple use and sustained yield. Livestock will be managed to improve public land resources, enhance productivity and stabilize the livestock industry dependent upon the public range over the long term. The Idaho Standards for Rangeland Health and Guidelines for Livestock Grazing Management will be used to provide guidance. Forage will be allocated for domestic livestock grazing on suitable rangeland based on multiple use and sustained yield objectives by allotment. Forage determinations made in the RMP will provide guidance for issuance of grazing decisions on individual allotments in accordance with applicable BLM regulations. Decisions will be made on season of use, class of livestock and stocking levels.

Fire Management: Wildfires will be aggressively suppressed in all areas except where specifically identified to allow natural fire processes to occur. Fire suppression will be done using the least amount of surface disturbance. In wilderness study areas and in areas containing significant cultural or paleontological values, surface-disturbing fire suppression equipment will only be used to protect human life or property. Public lands and resources affected by fire will be rehabilitated in accordance with the multiple use objectives identified for the affected area, subject to available funding. The Lower Snake River District Fire Management Plan will provide guidance for fire management activities.

Land Tenure Adjustments: All public lands will be retained in federal ownership unless determined that disposal of a particular parcel will serve the public interest. Lands may be identified for disposal by sale, exchange, or State indemnity selection. Lands identified for acquisition will be based on public benefits, management considerations and public access needs. Specific actions to implement the land tenure decisions made in the RMP will include full public participation.

Rights-of-Way: Public lands will generally be available for transportation and utility rights-of-way except where specifically prohibited by law or regulation (such as wilderness study areas) and in areas specifically identified as avoidance and exclusion areas to protect high resource values.

Energy and Minerals: Except where specifically withdrawn to protect resource values, public lands will be available for energy and mineral exploration and development based upon applicable regulations and Federal and State laws. Mitigation measures will be developed to protect resource values.

Recreation: The public lands will be managed to enhance recreation opportunities and visual resources. All lands will be identified as being within either special recreation management areas (SRMAs) or extensive recreation management areas (ERMAs). Some areas may be subject to special measures to protect resources or reduce conflicts among uses. BLM may develop and maintain various recreation facilities on the public lands including campgrounds, picnic areas and boat launches.

Motorized Vehicle Use: All public lands will be designated as open, limited, or closed to off highway vehicles. Public safety, resource protection, user access needs and conflict resolution will be considered in making these decisions.

National Wild and Scenic Rivers System: All rivers and streams in the Owyhee Resource Area, including those on the Nationwide River Inventory, will be evaluated for potential addition to the National Wild and Scenic Rivers System. The evaluation will be done in accordance with the guidelines published by the Secretaries of Interior and Agriculture on September 7, 1982, and other current applicable guidance.

Wilderness Recommendations: BLM wilderness recommendations developed during previous wilderness evaluation efforts will be carried forward into the RMP. Any additional BLM wilderness “suitable” recommendations developed during the RMP will be in accordance with the criteria and quality standards identified in the BLM Wilderness Study Policy; Policies Criteria and Guidelines for Conducting Wilderness Studies on Public Lands.

Cultural, Geological, Paleontological and Cave Resources: Cultural, geological, paleontological and cave resources will be managed to maintain or enhance significant scientific, educational and recreational values. Cultural sites that meet National Register criteria will be protected and nominated for inclusion on the register.

Areas of Critical Environmental Concern (ACEC): Areas of critical environmental concern (ACECs) are defined by the Federal Land Policy and Management Act (FLPMA) as: "Areas within the public lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards." ACECs may be designated in areas where both criteria of "relevance" and "importance" as defined in the BLM planning regulations are met.

Fish, Wildlife, and Habitat Objectives

Fishery Habitat Objectives:

- FISH 1: Improve or maintain perennial stream/riparian areas to attain satisfactory conditions to support native fish.

- FISH 2: Improve reservoir fisheries, when appropriate, in consultation with State agencies and adjacent landowners.

Wildlife Habitat Objective:

- **WDLF 1:** Maintain or enhance the condition, abundance structural stage and distribution of plant communities and special habitat features required to support a high diversity and desired populations of wildlife.

3.2.4.3 Bureau of Land Management (BLM) – Proposed Elko/Wells Resource Management Plans – Fire Management Amendment and Final Assessment

This plan pertains to the Nevada portion of the Owyhee Subbasin (BLM 2003). Excerpts of Owyhee Subbasin goals, objectives and strategies from the Proposed Elko/Wells Resource Management Plans amendment are summarized in Appendix 4.4.3. Objectives and strategies were developed for protection and enhancement of wildlife in the following habitat types/ species associations:

- Low Sagebrush and Desert Shrub
- Aspen Areas
- Seral Sagebrush Grasslands
- Mountain Mahogany/Juniper
- Mixed Conifer

Objectives and strategies for Low Sagebrush and Desert Shrub:

Objective: **Strategy:**

- To maintain the native community, to provide for livestock and wildlife forage. Some of the areas are important for winter antelope habitat.

- Prevent annual vegetation or non-native plant incursion into this vegetation type resulting from disturbance of the existing community.
- Maintain native vegetation composition.

Objectives and strategies for Aspen Areas:

Objective:

- Maintenance and restoration of the aspen stands.

Strategies:

- Maintain healthy aspen stands with appropriate stand age class diversity.
- Maintain and improve riparian integrity.

Objectives and strategies for Seral Sagebrush Grasslands:

Objective:

- Maintain and improve native vegetation conditions, limit the spread of annual invasive species and noxious weeds, protect critical watersheds, provide wildlife and livestock forage and provide woodland products from higher elevations.

Strategy:

- Maintain and/or improve sagebrush/perennial grass diversity.
- Prevent further encroachment of annual and non-native vegetation in the area.

Objectives and strategies for Mountain Mahogany/Juniper:

Objective:

- Management objectives are for woodland products and big game habitat.

Strategy:

- Maintain woodlands.

Objectives and strategies for Mixed Conifer:

Objective:

- Restore the health of the forest community.

Strategy:

- Healthy mosaic of uneven aged conifer stands with reduced fuel loadings.

3.2.4.4 U.S. Forest Service – Humboldt-Toiyabe Forest Plans

A Forest Plan provides overall management direction that drives activities and sets guidelines for programs and projects. The National Forest Management Act requires Forest Plans to be revised every 10 - 15 years. The Humboldt and Toiyabe Forest Plans were last developed in 1986 – both forest plans are currently being revised. Humboldt and Toiyabe National Forest Plans and revisions can be accessed at the following link: http://www.fs.fed.us/r4/htnf/projects/forestplan/index.shtml .

Currently, the Humboldt-Toiyabe National Forest is updating its 1986 Land Management Plans. Revision efforts will focus on six area which are in need of change (Source the Humboldt-Toiyabe National Forest web site accessed May 2004):

1. **Forest and Rangeland Health**
2. **Fire and Fuel**
3. **Grazing Management**
4. **Recreation Niches**
5. **Off Highway Vehicles**
6. **Landscape Strategy**

1. Forest Plan elements that are in need for change relative to Forest and Rangeland Health include:

- Past management practices, such as fire exclusion and livestock grazing, have moved ecosystems away from their properly functioning conditions. Ecosystems; as defined by their composition, structure, and function; are less resilient and are not sustainable. Examples include the decline of sagebrush communities due to the expansion of cheat grass and encroachment of pinyon-juniper stands, and a decrease in the seral components of forestlands.
- Disturbance processes, such as wildland fire and insects and disease, have changed from historic regimes. Ecosystems are less resilient to the effects of these disturbances.
- Invasive, noxious, and exotic species are increasing. The 1986 Forest Plans do not adequately cover invasive species management.
- There is an increased awareness of the high level of biological diversity that is geographically fragmented across the Forest. The unique qualities of these diverse communities require recognition. Since the Plans were written additional species of concern have been identified in Conservation Agreements.
- Forested lands represent only 8% of the National Forest System land within the Forest, and are critical for watershed integrity. Water quality is important for riparian dependent species and municipal water supplies.
- A new suite of Management Indicator Species (MIS) need to be identified based on habitats, potential impacts of use, and management of National Forest System lands.

2. Forest Plan elements that are in need for change relative to fire and fuel include:

- Since the 1986 Plans were written, much has been learned about the role fire plays as a disturbance process in the ecosystem. Due to fire suppression, the role that fire plays in the ecosystem has been altered.

- There has been an increase in the number of people living adjacent to and within the Forest. This increase in the wildland-urban interface limits fire activity, and creates a need to deal with acceptable fuel treatment options.
- Increasing size, intensity, and severity of wildland fires pose greater threats to firefighter safety, human life, and property. Increasing fuel loads are causing fires to burn outside of their historic regimes, and stand replacement fires are escalating.
- Need to incorporate national and regional fire management strategies, like the National Fire Plan and Healthy Forest initiatives, completed in recent years.

3a. Forest Plan elements that are in need for change relative to Grazing Management with respect to Livestock Use:

- The Humboldt and Toiyabe Plans are not consistent in their goals, objectives, standards, and terminology. For example the Toiyabe Plan set utilization standards relative to condition class of satisfactory or unsatisfactory, while the Humboldt Plan sets maximum utilization standards at or near desired future conditions.
- The current Plans only address utilization, stubble height, and stream bank stability. There is little flexibility to change short and long term management strategies to be responsive to changes in environmental conditions, such as drought, fire, and high forage years.

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3b. Forest Plan elements that are in need for change relative to Grazing Management with respect to wild horses and burros:

- The existing Plans provide little direction regarding wild horse and burro management. For example, many of the wild horse territories do not have or exceed designated management levels.
- Conflicts for forage utilization between livestock, horses, and wildlife are an increasing issue.

4. Forest Plan elements that are in need for change relative to Recreation Niches include:

- Nevada’s increasing population growth, along with the promotion and discovery of Nevada as an outdoor recreation destination, contribute to the accelerating demands on limited recreation facilities, settings, and resources. Changing demographics, including aging populations, nontraditional and urban user groups are rapidly altering recreation products, technologies, and activities. The existing Forest Plans did not anticipate the new and changing demands, use patterns, and resource impacts.
- Increasing demands for recreational opportunities are often most intense in specific areas, especially in urban interface settings. These new pockets of concentrated use have generated resource and social issues not addressed in the current Forest Plans.
- Segments of the public have increased expectations of the Nation’s forests to provide a level of services and facilities. These expectations demonstrate the increased linkage of urban forest zones, urban lifestyles, and quality of life.

- The public expects the Forest to provide high scenic quality as a component of their communities and recreation experiences. The Visual Quality Objectives referenced in the Forest Plans were based more on views from principal travel routes of 20 to 25 years ago, and do not necessarily reflect these current community values and concerns.
- Recreation Opportunity Spectrum (ROS) management objectives and standards need to consider new activities, values, and use patterns. ROS and scenery management objectives need to be consistent with overall desired conditions and management emphases.
- The Forest lacks a strategy to direct and promote rural tourism. Additional pressure is being placed on the development of Forest recreation opportunities and experiences to help support local economies.

5. Forest Plan elements that are in need for change relative to Off Highway Vehicles include:

- Off Highway Vehicle (OHV) popularity and use on National Forest System lands is growing at a phenomenal rate. Many locations throughout the HTNF attract intense OHV recreation, which is escalating the development of pioneered routes. In addition, large motorized events have grown in frequency.
- Motorized use, both summer and winter, is shifting into areas not previously used, and/or areas that are not suitable for these types of activities. User skill, equipment, and values are changing, allowing users to reach and impact new areas. The unrestricted use is causing resource damage and user conflicts.
- Residential growth in the urban interface is closing off traditional use areas, thereby creating conflict between residents and motorized users. This growth has also generated new Forest visitors with easy access to “backyard” National Forest System land.
- Forest Plan direction is outdated and did not anticipate the changes in use intensities, the geographic spread of motorized uses, or the types of equipment. Current travel management direction allows cross-country travel and the associated pioneering of new routes over much of the Forest.
- Areas that do have designated route restrictions have not had those restrictions consistently enforced, which has allowed new routes to proliferate. The designated routes are not necessarily adequate to give users the quality or quantity of experience they seek. Signing, mapping, and pre-trip planning information are generally spotty at best, leaving visitors to decide on their own how and where to travel.

6. Forest Plan elements that are in need for change relative to Landscape Strategy include:

- Current Forest Plan direction sets criteria, but does not set priorities on lands selected for adjustment. The criteria have not been reviewed in the last 20 years.
- In 1989, when the Toiyabe Forest boundary was adjusted, 90% of Reno was incorporated into the administrative boundary. This set the stage for acquisitions within urban landscapes, which have increased management complexities.

Traditional National Forest resource management objectives may not be fulfilled due to these complexities.

- The 1998 Office of Inspector General Report on the Forest Service Lands program in Nevada identified significant problem areas that have changed land adjustment concerns, practices, and procedures.
- Southern Nevada Public Land Management Act provides a significant funding source for land acquisition throughout Nevada. This funding opportunity has fostered many local government acquisition proposals that enhance open space availability around urbanized areas.
- Federal land acquisitions are a sensitive issue for most rural counties in Nevada that have a limited private land base. Some counties already exceed 90 percent federal ownership.

3.2.4.5 U.S. Fish & Wildlife Service – ESA Recovery Plans

The only native salmonid species that is currently known to have self-sustaining populations in the Owyhee Subbasin is the redband trout (*Oncorhynchus mykiss gairdneri*) – this sub-species is currently not listed under the ESA. Bull trout (*Salvelinus confluentus*) – is listed under the ESA as “threatened” – is found in adjacent river systems (such as the Bruneau and Jarbidge); however, self-sustaining populations of this bull trout are not known to exist within the Owyhee Subbasin.

Currently one species of birds and three species of mammals that inhabit the Owyhee Subbasin are listed as threatened or endangered species under the Federal ESA:

- the bald eagle (*Haliaeetus leucocephalus)* – Threatened
- the gray wolf (*Canis lupus)* – Endangered
- the grizzly bear (*Ursus arctos)* – Threatened
- the lynx (*Lynx Canadensis)* – Threatened

Currently, recovery plans are in place for some of these ESA-listed species. The following ESA recovery plans can be accessed at the US Fish & Wildlife Service ESA web site.

- the bald eagle (no recovery plan available on the FWS web site)
- the gray wolf (no recovery plan available on the FWS web site)
- the grizzly bear: http://ecos.fws.gov/docs/recovery_plans/1993/930910.pdf
- the lynx (no recovery plan available on the FWS web site)

In addition, the peregrine falcon (*Falco peregrinus)* was previously listed as a threatened species under the ESA, and has recently been de-listed.

At this time no invertebrates, amphibians or reptiles inhabiting the Owyhee subbasin are listed under the Federal ESA. The Columbia spotted frog, however, is a candidate species that will be evaluated for possible listing. Other candidate specie inhabiting the Owyhee Subbasin is:

- the yellow-billed cuckoo (*Coccyzus americanus*)

Two populations of sage grouse were recently (2003-2004) considered as candidates for listing under the ESA – "western" sage grouse and "eastern" sage grouse. The U.S. Fish and Wildlife Service determined, however, that the petitions to list these subgroups of sage grouse failed to show that "western" or "eastern" sage grouse are genetically distinct – either as a subspecies or a distinct population segment – from each other or from the greater sage-grouse populations. Therefore, USFWS decided that they are not eligible for listing under the ESA. The greater sage grouse, however, is currently under review for possible listing under the ESA.

The USFWS and the Bureau of Land Management (BLM) are the primary federal agencies responsible for the management of species such as sage grouse and pygmy rabbit – that inhabit the sage brush dominated regions of the Columbia Basin. The USFWS has funded ongoing projects to work with federal and state agencies as well as private organizations to conserve the greater sage-grouse and its habitat through voluntary partnerships on both public and private lands. Since 2001, the USFWS has provided Utah with $2.4 million and Washington with $730,000 for the restoration of sagebrush habitat. Through its Landowner Incentive Program, the agency also provided $1.4 million to Montana to improve the management of sagebrush habitat on private lands there. Over the past five years, the Bureau of Land Management has worked with several western states on cooperative sage-grouse conservation projects and has established partnerships with communities throughout the West to conserve and restore sage-grouse habitat.

3.2.4.6 U.S. Environmental Protection Agency – Clean Water Act Recovery Plans

The overall goal of the Clean Water Act is for all waters in the U.S. to be "fishable and swimmable". States are required to develop protective instream standards. Where those standards are not consistently met, a recovery plan must be developed and implemented. These recovery plans are referred to as Total Maximum Daily Loads (TMDL's) and the implementation plans (Water Quality Management Plans) that accompany the TMDL reports. TMDL's and the resulting implementation and improvement of water quality are important mechanisms to support the regional effort to restore healthy populations of salmon, resident fish & wildlife throughout the Columbia Basin (refer to the State TMDLs in the previous section).

The "CWA 303(d) impaired waters list" provides a way for states to identify and prioritize water quality problems. The list also serves as a guide for developing and implementing watershed recovery plans to protect beneficial uses while achieving federal and state water quality standards. Section 305(b) of the federal Clean Water Act (CWA) requires each state to prepare a water quality assessment report every two years. The U.S. Environmental Protection Agency (EPA) compiles the information from the individual state reports and prepares a summary report for Congress on the status of the nation's waters. EPA gives the states guidelines for preparation of 305(b) reports (USEPA 1997).

3.2.5 Shoshone-Paiute Tribe

The Shoshone-Paiute Tribes' have an important co-management role of the in the Owyhee Subbasin of the Middle Snake Province. The **vision** of the Shoshone-Paiute Tribes of Idaho & Nevada is to achieve a healthy Owyhee River system and adjoining watersheds within the Columbia River ecosystem -- which as a functional unit will support viable, genetically diverse and naturally sustainable fish & wildlife communities. Strategic planning and funding of mitigation & enhancement projects is essential to achieve the vision of the Shoshone-Paiute Tribes. In order to achieve the fish & wildlife goals and objectives, the Tribes sees value in working within the Columbia Basin Provincial Review Process and seeking cooperation with tribal, state and federal management entities with jurisdictions adjoining the Duck Valley Indian Reservation. Information compiled and summarized for Subbasin Summaries (Perugini et al. 2002) and Subbasin Plans, as part of the Middle Snake Provincial Review process, will be essential for identification and prioritization of enhancement and mitigation work in the Owyhee and Bruneau/Jarbidge subbasins.

The Shoshone-Paiute Tribes have developed the following goals, objectives and strategies for the fish, wildlife and habitat restoration in the Owyhee and Bruneau Subbasins (Perugini et al. 2002).

Goal: Work cooperatively with federal, state, county and private entities throughout the subbasin to enhance, protect and/or restore fish and wildlife habitat

Objective: Protect, enhance, and/or acquire wildlife mitigation properties in the Middle Snake Province, with emphasis on the Owyhee and Bruneau subbasins.

- Work with local landowners to discus habitat enhancement/protection/ acquisition opportunities.
- Develop method to evaluate habitat enhancement/protection/ acquisition opportunities in the subbasin
- Work collaboratively with interested entities in the subbasins, including, but not limited to: the Nature Conservancy, IDFG, NDOW, local sage grouse working groups, Owyhee Initiative Work Group, BLM, USFS, and NRCS.
- Explore opportunities to develop "grass banks" in Owyhee and Bruneau subbasins

Objective: Coordinate subbasin-wide land acquisitions, conservation easements and riparian habitat improvements.

- Fund and facilitate coordinator position and activities in subbasins where the Shoshone-Paiute Tribes have historical natural resource and cultural interests and rights.
- Facilitate development of cooperative funding and implementation of habitat protection and restoration across state and jurisdictional boundaries

Objective: Protect streams, associated wetlands and riparian areas on Duck Valley Indian Reservation

3.3 Existing restoration and conservation projects

3.3.1 BPA Funded Projects

BPA funded mitigation within the Owyhee Subbasin has occurred primarily through implementation efforts by the Shoshone-Paiute Tribe as off-site protection, mitigation, enhancement and compensation activities called for under Section 4(h) of the Pacific Northwest Electric Power Planning and Conservation Act and the Northwest Power Planning Council Fish and Wildlife Program. These activities provide partial mitigation for the extirpation of anadromous fish resources from usual and accustomed harvest areas and Reservation lands. Additional mitigation is also occurring to address impacts to resident fish and wildlife populations and habitats attributable to development of the Federal Columbia River Power System. This includes the implementation of wildlife mitigation efforts, via the Mid-Snake Interagency Work Group, through off-site mitigation intended to address the wildlife construction and inundation ledger for xx Dam.

These projects are all located within the boundaries of Duck Valley Indian Reservation. Geographic coordinates for DVIR corners are listed below:

LATITUDE	LONGITUDE	DESCRIPTION
-116.391	42.156	NW corner DVIR
-116.391	41.836	SW corner DVIR
-115.984	42.158	NE corner DVIR
-115.985	41.836	SE corner DVIR

3.3.2.1 Wildlife Inventory and Habitat Evaluation of Duck Valley Indian Reservation (200302600)

Project Description:
Conduct wildlife surveys to determine species composition and relative abundance on the Duck Valley Indian Reservation. HEP analyses will be conducted to determine habitat suitability index for target wildlife species.

Target Species:
Columbian spotted frog, sage grouse, white-faced ibis, American white pelican, bald eagle, peregrine falcon, waterfowl, sensitive bat species (including spotted bat), pygmy rabbit.

Type of Project (CBFWA):
wildlife

Objectives:

OBJECTIVE	STRATEGY -- TASK
1. Develop and implement terrestrial habitat and wildlife monitoring plan for the Duck Valley Indian Reservation.	a. Research, Monitoring &Evaluation (RM&E) – contract with a wildlife M&E specialist to develop a terrestrial habitat and wildlife monitoring plan
	a. Research, Monitoring & Evaluation (RM&E) –conduct habitat Analysis of DVIR using Landsat Thematic Mapper satellite image taken of reservation; groundtruthing; and delineation of habitat types and area extent. Incorporate habitat data into monitoring plan in subsequent iteration of plan.
	b. Research, Monitoring &Evaluation (RM&E) – conduct habitat evaluation (HEP methodology).
	c. Research, Monitoring &Evaluation (RM&E) – conduct wildlife monitoring: a.Spotted frog presence/absence surveys; b. Sage grouse lek surveys; c. Waterfowl production surveys; d. Bat surveys; e. Raptor surveys; f. Point counts for avian species; g. Small mammal surveys; h. Amphibian and reptile surveys; i. Big game surveys; j. White-faced ibis surveys; k. Pygmy rabbit survey.

Project 200302600 “Wildlife Inventory and Habitat Evaluation of Duck Valley Indian Reservation” was rated Fund-High Priority by both ISRP and CBFWA, and recommended in the Middle Snake Provincial Review package to NWPCC and subsequently recommended for funding by NWPCC (Mattie Allen, Shoshone-Paiute Tribes). In spite of approval of the project by the regional review process, but it was not funded by BPA in FY2003 or FY20004. Given that the ISRP has recommended this project as fundable, the Shoshone-Paiute Tribes consider the goals, objectives and strategies of this project to be validated and will seek future BPA-funding.

3.3.2.2 Enhance and Protect Habitat and Riparian Areas on the DVIR (199701100)

Project Description:

This project increases critical riparian areas of the Owyhee River and its tributaries as well as preserves the numerous natural springs located on the Duck Valley Indian Reservation. These riparian restoration actions will provide a clean pure source of water for the fish and wildlife.

Target Species:

Redband trout, bull trout other wild resident trout species comprising the native community; anadromous salmonids – either for reintroduction or off site mitigation; all wildlife species.

Type of Project (CBFWA):
Resident

Objectives:

OBJECTIVE	STRATEGY -- TASK
1. Protect specific springs from livestock impacts – based on revision of list of springs in proposal.	a. Cooperative management/Research – identify, prioritize and locate springs in need of protection
	b. Habitat Restoration – implement protective measures of springs (minimum of 6 springs per year)
2. Protect specific streams from livestock impacts –In coordination with Project 2000-079 and field observations.	a. Cooperative management/Research – identify, prioritize and locate streams/stream reaches in need of protection (priority to suspected redband trout streams)
	b. Habitat Restoration – Implement protective measures (fencing riparian areas/fixing road crossings) on streams and/or headwaters (appr. 6-10 miles of fence, troughs, culverts, etc)
3. Conduct fishery and habitat surveys	a. Research, Monitoring & Evaluation (RM&E) – implement PFC assessment
	b. Research, Monitoring & Evaluation (RM&E) – Conduct population estimates, size structure, condition, locations (GPS) in coordination with project 2000-079

Accomplishments:

YEAR	ACCOMPLISHMENT
1997	Began habitat assessments on DVIR
1997	Began planting trees around lakes (1000 4-5' trees)
1997	Initiated erosion control of lakes
1997	Purchase equipment to begin habitat work
1997	Quarterly & Annual report
1998	Began habitat protection of natural springs (i.e. Exclosure fencing, water troughs for stock)
1998	Protected two headwater areas (one fork of the Three Forks, Willis meadows, protecting 2 miles of stream)
1998	Initial data on population location, age structure, size, and habitat condition on 6

YEAR	ACCOMPLISHMENT
	streams and East Fork Owyhee River
1998	Began monitoring tree survival at lakes (Sheep Creek 35% survival, Mt. View 90%)
1998	Began monitoring of exclosures
1998	Began maintenance of exclosures, and springs
1998	Used fishery information to begin work on genetic assessment proposal
1998	Protected six springs (see map in narrative), located and prioritized future work
1999	Continued spring protection
1999	Began stream habitat rehabilitation (planted 50 willow shoots on 3 streams each)
1999	Continued maintenance and monitoring (repair exclosure fence, plumbing of troughs, photos of exclosure for future monitoring)
1999	Began stream habitat protection
1999	Protected 2 headwater areas 1 mile of stream protected (Boyle Creek, Watchabob)
1999	Protected 8 springs
1999	Collected water quality data and began monitoring biological parameters of streams (D.O, Ph, Temp)
2000	Continued Protective measures
2000	Protected 2 headwaters (protecting 1.5 miles of stream Boyle Creek, Willis Meadows)
2000	Protected 7 springs
2000	Continued monitoring of water quality
2000	Continued monitoring and maintenance of exclosures and springs
2000	Began to work with Tribal Environmental Department in monitoring
2000	Began to develop descriptions of streams, length, elevations, etc.
2001	Continued protective measures
2001	Protected 5 springs
2001	Protected 1 headwater area of suspected redband trout stream (Miller Creek, 1.5 miles of stream)
2001	Continued stream surveys, habitat and biological monitoring
2001	Worked with Project # 2000-079 in sharing data and information on trout streams, habitat conditions, biological information
2001	Continued with monitoring maintenance of springs and enclosures
2001	Fixed for road crossings (Skull Creek, Jones Creek 2, Little Sheep Creek) putting the stream back in channel and off road.

3.3.2.3 Southern Idaho Wildlife Mitigation - Shoshone-Paiute Tribes (199505703)

Project Description:

Acquire, enhance and protect wildlife habitat to mitigate for the construction of Anderson Ranch, Deadwood, and Black Canyon hydroelectric facilities.

The Tribes will coordinate with the Albeni Falls Wildlife Mitigation Program (BPA Project 9206100) -- the wildlife mitigation program in place in the northern part of the state. The Tribes will consult and coordinate with this interagency team during M&E development and on HEP activities.

Target Species:
Mule deer, elk, mallard mink, black-capped chickadee, yellow warbler, yellow-rumped warbler, ruffed grouse, blue grouse, spruce grouse, sage grouse, redband trout, bull trout.

Type of Project (CBFWA):

Objectives:

OBJECTIVE	STRATEGY -- TASK
1. Identify parcels for acquisition or conservation easement	a. Research, Monitoring &Evaluation (RM&E) – perform broadscale habitat analysis of province using GIS data from ICDC, NNHP, NRCS, GAP Analysis and regional biologists
	b. RM&E – Consult with state and federal agency biologists, the Nature Conservancy and other entities to identify high priority areas
	c. Land/easement acquisition – negotiate with willing land owners to buy easements and/or fee-titles
2. Identify sites for habitat enhancement activities	a. RM&E – Consult with BLM Resource Area biologists, USFS, IDFG, Nature Conservancy, Northeastern Nevada Stewardship Group, Owyhee Initiative work group, local sage grouse work groups and others to identify habitat enhancement opportunities
	b. Cooperative Co-management -- Identify cost-sharing opportunities, develop enhancement plan, conduct NEPA compliance, and develop necessary MOUs – with cooperating agency(ies)
3. Protect 2500 HUs of wildlife habitat and associated aquatic habitat through fee-title acquisition or conservation easement	a. Land/easement Acquisition – acquire fee title or easement to appropriate parcels of land.
	b. RM&E – Conduct baseline HEP
	c. RM&E – Conduct baseline survey of property (GPS fences, habitat extents, aerial photos, noxious weed survey)
	e. RM&E – Conduct baseline aquatic resources

OBJECTIVE	STRATEGY -- TASK
	evaluation (PFC at minimum).
	f. RM&E – Conduct baseline wildlife surveys Draft property management plan that details O&M and M&E
4. Protect 500 HUs of wildlife habitat and associated aquatic habitat through habitat enhancement activities	a. RM&E – Conduct baseline monitoring activities (HEP); GPS treatment/enhancement areas
	b. Habitat Restoration – control noxious weeds
	c. Habitat Restoration – construct/repair/maintain fencing
	e. Habitat Restoration – conduct stream protection activities (water troughs, etc.)
	f. Habitat Restoration – rehabilitate/restore habitat by planting native seed stock or by transplanting native plants
	g. Habitat Restoration – manipulate vegetation (seeding, prescribed burns, chaining) to achieve enhancement objectives

Accomplishments:

Mitigation will occur in the Middle Snake Province – including the Owyhee Subbasin -- as defined by the NWPCC 2000 Fish and Wildlife Program for the following FCRPS hydroelectric projects:

- Deadwood Dam
- Anderson Ranch Dam
- Black Canyon Dam

YEAR	ACCOMPLISHMENT
2002	Purchase of 5355 acre wildlife mitigation parcel (closing ~ September 2002) in Bruneau subbasin

3.3.2.4 Lake Billy Shaw Operations and Maintenance and Evaluation (199501500)

Project Description:
The purpose of this Operation and Maintenance(O&M) project is to enhance and develop the Billy Shaw Reservoir fishery as a premier trout fishery in the Northwest U.S. Stocking with native fish (or suitable surrogate species); and conduct shoreline enhancement and water quality monitoring to facilitate fishery development.

Target Species:

Native resident fish.

Type of Project (CBFWA):
resident

Objectives and Strategies:

OBJECTIVE	STRATEGY -- TASK
1. Protect shoreline and inlet streams from degradation	a. Habitat restoration – plant native trees/willows and grasses along shoreline and tributaries to Lake Billy Shaw
	b. Control grazing impacts – install 4-7 water troughs/stock ponds to keep stock away from reservoir/fences
2. Disseminate information to public.	a. Education & public outreach – monthly newspaper articles/quarterly to city paper
	b. Education & public outreach – update & maintain signs to alert public to new fishing facility.
3. Work with Owyhee Schools on volunteer projects.	a. Education and public outreach – have students aid in planting trees/willows/grasses.
4. Reports to Bonneville Power Administration	a. Information documentation and transfer – Annual and Quarterly reports to track progress.
5. Stock Lake Billy Shaw with Sterile rainbow trout	a. Fishery Management – manage put-and-take fishery in Lake Billy Shaw – stock fish in reservoir during spring and fall as temperatures and conditions warrant and set fishery seasons.
	b. Monitor & evaluate – collect and summarize data on biological and economic aspects of Lake Billy Shaw fishery.
6. In coordination with scientists and other agencies update and review Operations and Maintenance and Monitoring and Evaluation Plan	a. Monitoring and Evaluation Plan
	b. Operations and Maintenance Plan, including maintenance of fish screens at the dam and water intake structure.

Accomplishments:

YEAR	ACCOMPLISHMENT
1998	Construction complete on Dam and associated structures
1999	Initial filling in spring, water quality and piezometer monitoring begun, Fish

	screen maintenance, reseeding of borrow areas in fall 1999
2000	Continued monitoring of piezometers and water quality, Invertebrate sampling, invertebrate transplants, initial enhancement of shoreline areas (tree planting, willows), water quality data analyzed for fish stocking, exclosure fence around reservoir,
2001	Continued monitoring of piezometers and water quality, willows planted along shoreline, trees planted, contracts developed for initial stocking with sterile rainbow trout, maintenance of screens and structures, further development of M&E plan,
2001	installed solar water pump to provide water for stock, monitoring and maintenance of fences, water pumps and well, photo points established for monitoring of enhancement activities, Initial wildlife surveys begun in reservoir area

Project 199501500 “Lake Billy Shaw Operations and Maintenance and Evaluation (O&M, M&E)” was merged (in 2003) with Project 198815600 “Implement Fishery Stocking Program Consistent With Native Fish Conservation” (Mattie Allen, Shoshone-Paiute Tribes). The new of this project title is: "Duck Valley Reservoirs Fish Stocking and O&M" and retains the old Lake Billy Shaw project number (199501500). The budget is the total of both recommended budgets and retains all the objectives of both projects (see below for the fish stocking objectives and strategies.

3.3.2.5 Implement Fishery Stocking Program Consistent With Native Fish Conservation (198815600)

Project Description:
To enhance fisheries on the DVIR we will stock three reservoirs (closed systems) with rainbow trout. This project will support a sustainable (put-and-take) harvest by Shoshone-Paiute tribal members and non-Indian anglers without impacting native trout.

Target Species:
Rainbow Trout (hatchery), Redband Trout (native)

Type of Project (CBFWA):
Resident

Objectives:

OBJECTIVE	STRATEGY -- TASK
1. Provide subsistence put-and-take trout fisheries for tribal and sport fishery for non-tribal members at various reservoirs on the Duck Valley Indian Reservation.	a. Fishery Management – manage put-and-take fisheries at suitable times & reservoirs (Mountain View Reservoir, Lake Billy Shaw, and Sheep Creek Reservoir) on the Duck Valley Indian Reservation to maximize survival and harvestable production (within one year) and minimize the impact on native resident fish populations.

	b. Monitor and Evaluation (M&E) – monitor seasonal reservoir conditions such as temperature and dissolved oxygen – to schedule trout stocking in order to optimize growth rates, catch rates, and harvest rates of hatchery trout.
	c. Monitor and Evaluation (M&E) – monitor native redband trout populations (presence/absence in reservoirs and influent/effluent streams – to minimize impact by hatchery trout.
	c. Monitor and Evaluation (M&E) – monitor cost & benefits of put-and–take fisheries.

Accomplishments:

YEAR	ACCOMPLISHMENT
1988	Rainbow trout stocking in Mountain View Reservoir, ID and Sheep Creek Reservoir, NV
1989-1998	(same as above)
1999	biological data collected, fishery data collected, rainbow trout stocking in Mt. View and Sheep Creek Reservoirs
2000	biological data collected, fishery data collected, rainbow trout stocking in Mt. View and Sheep Creek Reservoirs
2001	biological data collected, fishery data collected, rainbow trout stocking in Mt. View and Sheep Creek Reservoirs Began looking at feasibility stocking of native fish

3.3.2.6 Assess Resident Fish, E. Fork Owyhee Subbasin (2000079)

Project Description:

This project will eventually provide information on native trout on the DVIR for possible stocking into Lake Billy Shaw.

Target Species:
Redband Trout

Type of Project (CBFWA):
Resident

Objectives:

Project 2000079 Assess Resident Fish, E. Fork Owyhee Subasin is no longer funded; the funding awarded was limited, as it was awarded through a within-year request (Mattie

Allen, Shoshone-Paiute Tribes). The Tribes tried to get more funding in FY2004 to study native trout in the northern portion of the reservation, specifically the Mary's Creek area, as the original study was fine scale and limited to the southeastern portion of the DVIR.

3.3.2.6 Objectives and Strategies for Proposed and Approved but unfunded BPA Projects

The Habitat, Parks, Fish & Wildlife Department of the Shoshone-Paiute Tribes developed a suite of integrated funding proposals for FY2000 (Table 3.5). These proposals were submitted to the BPA funding process in January 1999. The new proposals were not recommended for funding by the Resident Fish Committee of CBFWA; however, the new Owyhee Basin proposals were subsequently recommended for FY2000 funding by the ISRP.

Table 3.5. Proposals recommended for funding by the Northwest Power Planning Council's Independent Scientific Review Panel for funding – but not funded in FY2000.

Project ID	Owyhee Subbasin Proposals -- Project Title	Strategy	Funded since 2000
20040	Develop a Fish & Wildlife Management Plan for the Owyhee Basin, DVIR	Integrated fish, wildlife and habitat planning.	no
20041	Develop a Fish & Wildlife Conservation Law Enforcement Plan, DVIR	Law Enforcement	no
20094	Assess Resident Fish Stocks Of The Owyhee Basin, DVIR	Research, Monitoring & Evaluation (RM&E) of fish populations, including genetic assessment of native trout	partially
20092	Inventory Wildlife Species & Populations Of The Owyhee Basin, DVIR	Research, Monitoring & Evaluation (RM&E) of wildlife populations, including habitat evaluation	yes
20093	Evaluate the Feasibility for Anadromous Fish Reintroduction in the Owyhee	Reintroduction of extirpated anadromous fish species	no

In their October 8, 1999 evaluation of FY2000 projects, the ISRP (99-3) clearly articulated the rationale to fund the five new Shoshone-Paiute Owyhee Basin proposals as a unified program:

> The proposals provide a strong rationale that funding be awarded to initiate the native fish and wildlife program that these 5 proposals present, because of: 1) the absence of any current wildlife or resident fish survey or management programs, 2) the total blockage of the Owyhee by Hell's

> Canyon Dam, and 3) the presence of potentially strong native stocks of redband trout in the Owyhee Subbasin. Further, since the current proposal solicitation and review process is under consideration of change, the important basic sub-basin survey work that is proposed could go undeveloped while the region develops a new proposal solicitation process. Funding for the development of a fish and wildlife inventory and subbasin plan in the Owyhee would further the proposed strategy to emphasize eco-province planning and peer review, which the ISRP supports." The ISRP went on to say: "Collectively, the proposals contain innovative projects of high programmatic value" … and "The work outlined in the 5 DVIR proposals will address the 4 criteria proposed by the Council for highest priority of recommendation …"

The final outcome was a decision by the Northwest Power Planning Council to not fund the Shoshone-Paiute proposals for FY2000. Since that time elements of some of these proposals have been funded; but a comprehensive management plan that encompasses all fish, wildlife and habitat projects is still lacking. The subbasin plans for the Owyhee and Bruneau/Jarbidge will together contribute to the comprehensive management of the DVIR.

Table 3.6. Summary of biological objectives and strategies for ongoing and proposed fish & wildlife projects sponsored by the Shoshone-Paiute Tribes.

PROJECT/OBJECTIVES	STRATEGIES
ONGOING BPA-FUNDED PROJECTS	
PROJECT 200302600 Wildlife Inventory and Habitat Evaluation of Duck Valley Indian Reservation	
1. Develop and implement terrestrial habitat and wildlife monitoring plan for the Duck Valley Indian Reservation.	a. Research, Monitoring &Evaluation (RM&E) – develop a terrestrial habitat and wildlife monitoring plan; conduct habitat Analysis of DVIR using Landsat Thematic Mapper satellite image taken of reservation; groundtruthing; and delineation of habitat types and area extent. Incorporate habitat data into monitoring plan in subsequent iteration of plan; conduct habitat evaluation (HEP methodology), b. Conduct wildlife monitoring: (1). Spotted frog presence/absence surveys; (2). Sage grouse lek surveys; (3). Waterfowl production surveys; (4). Bat surveys; (5) Raptor surveys; (6). Point counts for avian species; (7). Small mammal surveys; (8). Amphibian and reptile surveys; (9). Big game surveys; (10). White-faced ibis surveys; (11). Pygmy rabbit survey.
PROJECT 199701100 Enhance and Protect Habitat and Riparian Areas on the DVIR	
1. Protect specific springs from	a. Cooperative management/Research – identify,

PROJECT/OBJECTIVES	STRATEGIES
livestock impacts – based on revision of list of springs in proposal. 2. Protect specific streams from livestock impacts –In coordination with Project 2000-079 and field observations. 3. Conduct fishery and habitat surveys	prioritize and locate springs in need of protection (priority to suspected redband trout streams), b. Habitat Restoration – implement protective measures of springs (minimum of 6 springs per year); implement protective measures (fencing riparian areas/fixing road crossings) on streams and/or headwaters (appr. 6-10 miles of fence, troughs, culverts, etc). c. Research, Monitoring & Evaluation (RM&E) – implement PFC assessment; conduct population estimates, size structure, condition, locations (GPS) in coordination with Project 2000-079.
PROJECT 199505703 Southern Idaho Wildlife Mitigation - Shoshone-Paiute Tribes	
1. Identify parcels for acquisition or conservation easement 2. Identify sites for habitat enhancement activities 3. Protect 2500 HUs of wildlife habitat and associated aquatic habitat through fee-title acquisition or conservation easement 4. Protect 500 HUs of wildlife habitat and associated aquatic habitat through habitat enhancement activities	a. Research, Monitoring &Evaluation (RM&E) – perform broadscale habitat analysis of province using GIS data from ICDC, NNHP, NRCS, GAP Analysis; conduct baseline HEP treatment/enhancement areas; conduct baseline survey of property (GPS fences, habitat extents, aerial photos, noxious weed survey); conduct baseline aquatic resources evaluation (PFC at minimum); conduct baseline wildlife surveys b. draft property management plan that details O&M and M&E. c. Coordinate enhancement efforts -- consult with state and federal agency biologists, the Nature Conservancy, USFS, IDFG, Nature Conservancy, Northeastern Nevada Stewardship Group, Owyhee Initiative work group, local sage grouse work groups to identify high priority species/areas. d. Land/easement acquisition – negotiate with willing land owners to buy easements and/or fee-titles. e. Cooperative Co-management -- Identify cost-sharing opportunities, develop enhancement plan, conduct NEPA compliance, and develop necessary MOUs – with cooperating agency(ies) f. Land/easement Acquisition – acquire fee title or easement to appropriate parcels of land. g. Habitat Restoration – control noxious weeds;construct/repair/maintain fencing; conduct stream protection activities (water troughs, etc.); rehabilitate/restore habitat by planting native seed stock or by transplanting native plants; manipulate vegetation (seeding, prescribed burns, chaining) to achieve enhancement objectives.
PROJECT 199501500 Lake Billy Shaw Operations and Maintenance and Evaluation (O&M, M&E)	
1. Protect shoreline and inlet	a. Habitat restoration – plant native trees/willows and

PROJECT/OBJECTIVES	STRATEGIES
streams from degradation. 2. Disseminate information to public. 3. Work with Owyhee Schools on volunteer projects. 5. Stock Lake Billy Shaw with Sterile rainbow trout 6. Update and review Operations and Maintenance and Monitoring and Evaluation Plan	grasses along shoreline and tributaries to Lake Billy Shaw b. Control grazing impacts – install water troughs/stock ponds to keep stock away from reservoir/fences c. Education & public outreach – monthly newspaper articles/quarterly to city paper; update & maintain signs to alert public to new fishing facility; have students aid in planting trees/willows/grasses. d. Fishery Management – manage put-and-take fishery in Lake Billy Shaw – stock fish in reservoir during spring and fall as temperatures and conditions warrant and set fishery seasons. e. Monitor & evaluate – collect and summarize data on biological and economic aspects of Lake Billy Shaw fishery.

PROJECT/OBJECTIVES	STRATEGIES
PROJECT 198815600 Implement Fishery Stocking Program Consistent With Native Fish Conservation	
1. Provide subsistence put-and-take trout fisheries for tribal and sport fishery for non-tribal members at various reservoirs on the Duck Valley Indian Reservation.	a. Fishery Management – manage put-and-take fisheries at suitable times & reservoirs (Mountain View Reservoir, Lake Billy Shaw, and Sheep Creek Reservoir) on the Duck Valley Indian Reservation to maximize survival and harvestable production (within one year) and minimize the impact on native resident fish populations. b. Monitor and Evaluation (M&E) – monitor seasonal reservoir conditions such as temperature and dissolved oxygen – to schedule trout stocking in order to optimize growth rates, catch rates, and harvest rates of hatchery trout. c. Monitor and Evaluation (M&E) – monitor native redband trout populations (presence/absence in reservoirs and influent/effluent streams – to minimize impact by hatchery trout. c. Monitor and Evaluation (M&E) – monitor cost & benefits of put-and–take fisheries.
Project 2000079 Assess Resident Fish, E. Fork Owyhee Subasin	
1. Conduct resident fish assessment, including genetic survey of redband trout	a. Research, Monitoring & Evaluation (RM&E) quanytitative assessment of fish population species composition, distribution and abundance. (b) genetic survey of redband trout
PREVIOUSLY PROPOSED AND APPROVED BY NWPCC, BUT UNFUNDED BPA PROJECTS	
Project Proposal 20040 Develop a Fish & Wildlife Management Plan for the Owyhee Basin, DVIR	
Develop a comprehensive Fish & Wildlife Management Plan for the Owyhee Subbasin Basin, DVIR portion.	Integrated fish, wildlife and habitat planning.
Project Proposal 20041 Develop a Fish & Wildlife Conservation Law Enforcement Plan, DVIR	
Develop a fish & wildlife Conservation Law Enforcement Plan for the DVIR	Enhance Law Enforcement to protect fish, wildlife and habitats.
Project Proposal 20094 Assess Resident Fish Stocks Of The Owyhee Basin, DVIR	
Assess the resident fish stocks of the Owyhee Subbasin, DVIR portion.	Research, Monitoring & Evaluation (RM&E) of fish populations, including genetic assessment of native trout.
Project Proposal 20093 Evaluate the Feasibility for Anadromous Fish Reintroduction in the Owyhee	
Conduct a study to evaluate the	Reintroduction of extirpated anadromous fish

PROJECT/OBJECTIVES	STRATEGIES
feasibility for anadromous fish reintroduction in the Owyhee River system.	species.
Project Proposal 200007900 Assess Resident Fish Stocks Of The Owyhee/Bruneau Basin, D.V.I.R.	
Conduct a systematic resident fish species inventory & genetic stock assessment in the Owyhee/Bruneau River Basin, DVIR component.	Research, Monitoring & Evaluation (RM&E) of fish populations,
Project Proposal 32001 Evaluate the Feasibility Artificial Production Facility DVIR	
To provide a sustenance fishery for the Tribal members of the DVIR	Feasibility, Construction, and Operation of an Artificial Production Facility.

3.3.3 BPA Projects For Non-Tribal Entities

The Shoshone-Paiute Tribes have initiated and sponsored most of the BPA-funded projects in the Owyhee Subbasin. Since the beginning of the Council's Fish & Wildlife Program, only one Project has been funded for work in the Owyhee Subbasin by an entity other than the Tribes – i.e., the ongoing Native Salmonid Assessment Project sponsored by IDFG beginning in 1998. This project (BPA # 199900200), however, is not exclusively focused on the Owyhee Subbasin – it covers the Middle and Upper Snake Provinces in Idaho. The objectives of Idaho's salmonid assessment project are to:

- assess the current status of native salmonids in the Middle and Upper Snake Provinces in Idaho (Phase I);
- identify factors limiting populations (Phase II); and
- develop and implement recovery strategies and plans (Phase III).

The amount of Fish & Wildlife habitat in the Oregon portion of the Owyhee is relatively low (quantity and quality) compared to that in Idaho and Nevada. Although Nevada Department of Wildlife (NDOW) manages a very significant proportion of the fish & wildlife resources of the Owyhee Subbasin, no BPA funding has been provided to Nevada to date.

3.3.4 Actual Expenditures for Past Projects and Estimated Budgets (current and outyear) of Ongoing BPA Funded Projects

3.3.4.1 Budgets for Past BPA Funded Projects for the Owyhee Subbasin

The Shoshone-Paiute Tribe has received relatively little mitigation and enhancement funding from BPA to date, i.e., about $4.0 million from 1984 to 2004 (Table 3.4). About half of the total (2.0 million) has been obligated during the most recent five years. From 1984 to 1998 the Duck Valley Resident Fish Project (198815600) was the central fish mitigation activity. The strategy was simple -- purchase rainbow trout from the U.S. Fish & Wildlife Service and stock them into two productive reservoirs (Mountain View and Sheep Creek) to sustain a put-and-take fisheries for tribal members and non-tribal fishers. Beginning in 1995, the strategy of developing productive reservoir fisheries was elaborated on – with the feasibility study of the construction of another dam and reservoir – expressly for native trout fisheries. The Lake Billy Shaw dam and reservoir construction project was completed in 1998(?). The development of the Lake Billy Shaw fishery is ongoing to present.

Projects based on fish & wildlife habitat restoration strategies were initiated in 1996. The need for concurrent research, monitoring and evaluation (RM&E) of DVIR fish populations, wildlife populations and their habitats is now apparent. A RM&E strategy for DVIR was recently funded by BPA as a prerequisite for ongoing funding of habitat restoration projects. Concurrently, we are developing a RM&E plan for the Owyhee Subbasin Plan which is consistent with the DVIR habitat M&E Plan.

Table 3.7. Review of Shoshone-Paiute Tribes' fish & wildlife projects funded by BPA since the inception of the NWPCC Fish & Wildlife Program amendment in 1984 (Source BPA Web site 2004).

FY		Project (click for detail)		BPA authorized		BPA obligated
1988		DUCK VALLEY RESIDENT FISH PROJECT (198815600)		$59,000		$59,000
1989		DUCK VALLEY RESIDENT FISH PROJECT (198815600)		$0		$76,370
1990		DUCK VALLEY RESIDENT FISH PROJECT (198815600)		$0		$50,000
1991		DUCK VALLEY RESIDENT FISH PROJECT (198815600)		$100,000		$85,000
1992		DUCK VALLEY RESIDENT FISH PROJECT (198815600)		$85,000		$85,000
1993		DUCK VALLEY RESIDENT FISH PROJECT (198815600)		$70,515		$129,019
1994		DUCK VALLEY RESIDENT FISH PROJECT (198815600)		$0		$100,000
1995		(PHASE IV) BILLY SHAW RES DEV PHASE 1 (199501500)		$110,000		$224,766
1995		DUCK VALLEY RESIDENT FISH PROJECT (198815600)		$100,000		$0
			1995 Total	**$210,000**		**$224,766**
1996		(PHASE IV) BILLY SHAW RES DEV PHASE 1		$485,000		$0

		(199501500)				
1996		DUCK VALLEY RESIDENT FISH PROJECT (198815600)		$100,000		$100,012
1996 Total				**$585,000**		**$100,012**
1997		(PHASE IV) BILLY SHAW RES DEV PHASE 1 (199501500)		$3,796,015		$0
1997		DUCK VALLEY RESIDENT FISH PROJECT (198815600)		$105,160		$105,160
1997		SHOSHONE-PAIUTE HABITAT ENHANCEMENT (199701100)		$184,663		$608,000
1997 Total				**$4,085,838**		**$713,160**
1998		(PHASE IV) BILLY SHAW RES DEV PHASE 1 (199501500)		$3,764,015		$0
1998		DUCK VALLEY RESIDENT FISH PROJECT (198815600)		$110,000		$53,643
1998		SHOSHONE-PAIUTE HABITAT ENHANCEMENT (199701100)		$240,000		$240,000
1998 Total				**$4,114,015**		**$293,643**
1999		(PHASE IV) BILLY SHAW RES DEV PHASE 1 (199501500)		$887,392		$0
1999		DUCK VALLEY RESIDENT FISH PROJECT (198815600)		$109,997		$0
1999		DUCK VALLEY RESIDENT FISH STOCKING (198815601)		$0		$110,000
1999		LAKE BILLY SHAW O&M (199501506)		$0		$215,000
1999		SHOSHONE-PAIUTE HABITAT ENHANCEMENT (199701100)		$293,000		$222,767
1999 Total				**$1,290,389**		**$547,767**
2000		(PHASE IV) BILLY SHAW RES DEV PHASE 1 (199501500)		$221,550		$0

2000		DUCK VALLEY RESIDENT FISH PROJECT (198815600)		$119,903		$0
2000		DUCK VALLEY RESIDENT FISH STOCKING (198815601)		$0		$119,903
2000		LAKE BILLY SHAW O&M (199501506)		$0		$218,601
2000		SHOSHONE-PAIUTE HABITAT ENHANCEMENT (199701100)		$294,722		$294,722
		2000 Total		**$636,175**		**$633,226**
2001		(PHASE IV) BILLY SHAW RES DEV PHASE 1 (199501500)		$221,550		$0
2001		ASSESS RESIDENT FISH-OWYHEE BASIN-DUCK VALLEY IR (200007900)		$0		$195,299
2001		DUCK VALLEY RESIDENT FISH PROJECT (198815600)		$138,307		$26,631
2001		DUCK VALLEY RESIDENT FISH STOCKING (198815601)		$0		$119,903
2001		LAKE BILLY SHAW O&M (199501506)		$0		$218,601
2001		SHOSHONE-PAIUTE HABITAT ENHANCEMENT (199701100)		$300,000		$294,722
		2001 Total		**$659,857**		**$855,156**
2002		(PHASE IV) BILLY SHAW RES DEV PHASE 1 (199501500)		$229,082		$0
2002		DUCK VALLEY RESIDENT FISH PROJECT (198815600)		$143,009		$0
2002		DUCK VALLEY RESIDENT FISH STOCKING (198815601)		$0		$146,534
2002		SHOSHONE-PAIUTE HABITAT ENHANCEMENT (199701100)		$310,200		$0
		2002 Total		**$682,291**		**$146,534**

Grand Total	**$12,578,080**		**$4,098,653**

During 1999-2000 the Shoshone-Paiute Tribes began to develop a more comprehensive and integrated approach for enhancement and mitigation projects. This integrated approach was supported by the Independent Scientific Review Panel (ISRP); however, funding limitations in year 2000 forestalled its implementation.

Shoshone-Paiute 3-Year Projected Budget 2005-2007

3.3.4.2 Projected Three Year Budgets for Ongoing BPA Funded Projects

Table 3.8. Fiscal year 2004 and outyear (2005-2007) budget projections for Shoshone-Paiute fish & wildlife projects on the Duck Valley Indian Reservation funded by Bonneville Power Administration.

Project Number / Title	Project phase	2004	2005	2006	2007
SPT200302600 Wildlife Inventory and Habitat Evaluation of Duck Valley Indian Reservation	Monitoring and evaluation	$120,010	$ 23,869	--	--
	Total Outyear Budgets	**$120,010**	**$ 23,869**	--	--
SPT199701100 Enhance and Protect Habitat and Riparian Areas on the DVIR	Planning and design	$ 10,000	$ 10,000	$ 10,000	$ 10,000
	Construction/implementation	$140,000	$145,000	$150,000	$155,000
	Operations and maintenance	$100,000	$105,000	$110,000	$120,000
	Monitoring and evaluation	$110,000	$115,000	$120,000	$125,000
	Total Outyear Budgets	**$360,000**	**$375,000**	**$390,000**	**$410,000**
199505703 Southern Idaho Wildlife Mitigation - Shoshone-Paiute Tribes	Planning and design	$171,347	$178,201	$185,329	$192,741
	Construction/implementation	$570,000	$1,704,000	$600,800	$1,709,000
	Operations and maintenance	$ 60,000	$100,000	$104,000	$144,000
	Monitoring and evaluation	$ 30,000	$ 35,000	$ 40,000	$ 45,000
	Total Outyear Budgets	**$831,347**	**$2,017,201**	**$930,129**	**$2,090,741**
199501500 Lake Billy Shaw Operations and Maintenance and Evaluation (O&M, M&E)	Planning and design	$ 55,000	$ 60,000	$ 40,000	$ 40,000
	Construction/implementation	$ 65,000	$ 67,000	$ 70,000	$ 80,000
	Operations and maintenance	$ 74,000	$ 79,000	$ 84,000	$ 89,000
	Monitoring and evaluation	$ 50,000	$ 55,000	$ 60,000	$ 65,000
	Total Outyear Budgets	**$244,000**	**$261,000**	**$254,000**	**$274,000**
198815600 Implement Fishery Stocking Program Consistent With Native Fish Conservation	Construction/implementation	$150,000	$155,000	$160,000	$160,000
	Operations and maintenance	$ 25,000	$ 27,000	$ 29,000	$ 32,000
	Monitoring and evaluation	$ 34,000	$ 36,000	$ 38,000	$ 45,000
	Total Outyear Budgets	**$209,000**	**$218,000**	**$227,000**	**$237,000**
Total – All Projects		**$1,764,357**	**$2,895,070**	**$1,801,129**	**$3,011,741**

Table 3.9. Outyear (2005-2007) budget projections for Shoshone-Paiute fish & wildlife projects on the Duck Valley Indian Reservation funded by Bonneville Power Administration.

PROJECT	3-YEAR TOTAL 2005-2007
200302600 Wildlife Inventory and Habitat Evaluation of Duck Valley Indian Reservation	**$23,869**
199701100 Enhance and Protect Habitat and Riparian Areas on the DVIR	**$1,175,000**
199505703 Southern Idaho Wildlife Mitigation - Shoshone-Paiute Tribes	**$5,038,071**
199501500 Lake Billy Shaw Operations and Maintenance and Evaluation (O&M, M&E)	**$789,000**
198815600 Implement Fishery Stocking Program Consistent With Native Fish Conservation	**$682,000**
TOTAL 3-year budget for five ongoing projects:	**$7,707,940**

Restoration projects funded by BPA are summarized in Table 3.10.

Table 3.10 Inventory of -BPA-funded projects in the Owyhee Subbasin.

Project Title/ Duration	**Management Entity/ Funding Source and ID # (BPA # if applicable)**	**Brief Project Description/ Scale of Project**	**Subwatershed Name/**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
Assess Resident Fish Stocks of the Owyhee/Bruneau Subbasins	DVIR/ **BPA # 200007900**	access the current status of native salmonids in the rivers and tributaries within the boundaries of the Duck Valley Indian Reservation/ **Rivers and tributaries within the boundaries of the Duck Valley Indian Reservation**		salmonid populations and habitat/ **(1) provide baseline information on genetic variation within and among populations of redband trout within the East Fork Owyhee River and Bruneau River drainage; (2) assess the extent of hatchery introduced rainbow trout introgression within these populations**	**Six of the ten streams scheduled for sampling in 2001 were completed and fin clips are currently being analyzed at a regional genetics laboratory**
Habitat enhancement and protection – Shoshone-Paiute Reservation/ **Ongoing**	Shoshone-Paiute Tribes/ **BPA # 9701100**	Habitat enhancement and protection – Shoshone-Paiute Reservation		Habitat enhancement and protection	
Native Salmonid Assessment Project / **1998-**	IDFG/ **BPA # 199900200**	**a**ssess the current status of native salmonids in the Middle and Upper Snake Provinces in Idaho (Phase I), identify factors limiting populations (Phase II), and develop and implement		Salmonid populations and habitat	

Project Title/ Duration	Management Entity/ Funding Source and ID # (BPA # if applicable)	Brief Project Description/ Scale of Project	Subwatershed Name/	Key Ecological Functions Addressed/ Goal of Project	Results of Project: Accomplishments and failures (Include a Quantitative assessment)
		recovery strategies and plans (Phase III)/ **Middle and Upper Snake Provinces in ID**			
Snake River Native Salmonid Assessment/ **1998-2015**	IDFG/ **BPA # 980002**	assess the status of native salmonids in the Middle and Upper Snake Provinces in Idaho (Phase I), identify factors limiting populations of native salmonids (Phase II), and develop and implement recovery strategies and plans (Phase III)/ **Snake River**		Salmonid populations	**in the first 3+ years of the project, fish and habitat surveys have been made at a total of 757 sites on private and public lands across southern Idaho in nearly all other major watersheds, including the Weiser, Owyhee, Payette, Boise, Goose, Raft, Rock,**

3.3.5 Non-BPA Funded Projects

The Owyhee Subbasin Plan includes some recommended strategies for fish and wildlife protection and restoration that are outside BPA's mandate. In order to aid fish and wildlife managers and the public in implementing this plan, we have attached Appendix 3.4 – which lists a wide array of entities that funding for projects related to natural resources restoration, and that may be alternative sources of future financial support for strategies in this plan.

Past restoration projects in the Owyhee Subbasin not funded by BPA are included in the following inventory of projects derived the Owyhee Watershed Council (OWC) and the Malheur County Soil Conservation Service (source: Jennifer Martin, OWC and Ed Petersen, NRCS; Table 3.11).

Table 3.11 Inventory of non-BPA-funded projects in the Owyhee Subbasin (source: Jennifer Martin, OWC and Ed Petersen, NRCS). .

Project Title/ Duration	Management Entity/ Funding Source and ID #	Brief Project Description/ Scale of Project	Subwatershed Name	Key Ecological Functions Addressed/ Goal of Project	Results of Project: Accomplishments and failures (Include a Quantitative assessment)
California Bighorn Sheep	The Nature Conservancy	Protect and maintain California bighorn sheep populations and their habitats		California bighorn sheep populations and habitats/ **Protect and maintain California bighorn sheep populations and their habitats**	
Fenced off Indian Bathtub in Hot Creek Watershed**/ Completed 1990**	USFWS	Fenced off Indian Bathtub in Hot Creek Watershed			
Groundwater, spring discharge and annual well withdrawals monitoring/ **Ongoing since 1993 (excluding 1997)**	USFWS, USGS				

Project Title/ Duration	**Management Entity/ Funding Source and ID #**	**Brief Project Description/ Scale of Project**	**Subwatershed Name**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
Intermittent Streams and Rivers	The Nature Conservancy	Maintain the high quality and diversity of the riparian communities within and along intermittent streams and rivers and prevent the degradation of these systems		Protect riparian communities/ **Maintain the high quality and diversity of the riparian communities within and along intermittent streams and rivers and prevent the degradation of these systems**	
Owyhee County Sage Grouse Working Group		Map locations of all known active and historic sage grouse leks in Owyhee County; Identify and map sage grouse breeding (nesting and early brood) habitat associated with active leks; Identify and map known sage grouse wintering habitat/ **Owyhee County**		Preserve sage grouse populations/ **Preserve and increase sage grouse populations in Owyhee County**	
Project 32012		assessing water quality standards attainment and meeting grazing, fisheries and terrestrial objectives			

Project Title/ Duration	**Management Entity/ Funding Source and ID #**	**Brief Project Description/ Scale of Project**	**Subwatershed Name**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
Rangewide surveys for all geothermal springs/ **Ongoing (every 2-3 years) since 1993**	USFWS, ISU				
Redband and Bull Trout	The Nature Conservancy	Protect and maintain population strongholds of redband trout by focusing on the protection and enhancement of riparian habitat within the stronghold population's watershed		Protect redband and bull trout populations and habitat/ **Protect and maintain population strongholds of redband trout by focusing on the protection and enhancement of riparian habitat within the stronghold population's watershed**	

Project Title/ Duration	**Management Entity/ Funding Source and ID #**	**Brief Project Description/ Scale of Project**	**Subwatershed Name**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
Sage grouse habitat fragmentation study/ **2000-2004**	IDFG and UI	Researchers will monitor sage grouse using radio telemetry to determine sage grouse use of fragmented habitats; examine sagebrush patch size selection, nest site selection, seasonal movements, and seasonal habitat use in fragmented versus continuous habit/ **Jarbidge Resource Area**		Sage grouse populations and habitat	
Sage grouse life history study/ **Data collected in 2000/2001**	IDFG, UI				

Project Title/ Duration	Management Entity/ Funding Source and ID #	Brief Project Description/ Scale of Project	Subwatershed Name	Key Ecological Functions Addressed/ Goal of Project	Results of Project: Accomplishments and failures (Include a Quantitative assessment)
Sage Grouse Predator Project/ **2002-2008**	IDFG	six year study that will monitor six sage grouse populations across the state, one of which is in the Sheep Creek drainage west of the Bruneau River/ **Idaho**		Sage grouse populations and predator effects/ **(1) evaluate the effect of predator control on sage grouse nest success; (2) evaluate the effect of predator control on sage grouse survival; (3) document cause-specific mortality of sage grouse eggs, juveniles and adults; (4) evaluate the effect of preda**	
Sage grouse recovery in Elko County	Eastern Nevada Stewardship Group, Inc. (Northeast Nevada 2001)	Rehabilitate annual grasslands to perennial plant communities capable of supporting diverse land uses; Improve water quality and quantity within managed basin; Manage uplands and riparian vegetation to improve systems at risk and nonfunctioning systems/ **Elko County**		Preserve sage grouse populations/ **To manage watersheds, basins, or subbasins in a manner that restores or enhances (as appropriate) the ecological processes necessary to maintain proper function ecosystems inclusive of sage grouse**	

Project Title/ Duration	**Management Entity/ Funding Source and ID #**	**Brief Project Description/ Scale of Project**	**Subwatershed Name**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
Shoshone-Paiute Tribes Sage Grouse Working Group	tribal members, Wildlife and Parks Department biologists and Tribal Business Council members	**Duck Valley Indian Reservation**		Preserve sage grouse populations/ **To maintain a sustainable sage grouse population on the Duck Valley Indian Reservation, promote healthy ecosystems and preserve traditional and cultural appreciation of the species**	
Shrub Steppe Habitat	The Nature Conservancy	Identify and protect the existing high quality shrub steppe habitat (late seral condition areas), while moving the fair quality shrub steppe (mid seral areas) into late seral conditions		Protect shrub steppe habitat/ **Identify and protect the existing high quality shrub steppe habitat (late seral condition areas), while moving the fair quality shrub steppe (mid seral areas) into late seral conditions**	
Spotted frog surveys/ **ongoing**	USFWS, IDFG, BSU				

Project Title/ Duration	**Management Entity/ Funding Source and ID #**	**Brief Project Description/ Scale of Project**	**Subwatershed Name**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
Springs, Spring Creek Systems, and Wetlands	The Nature Conservancy	Maintain or improve the ecological conditions of all springs, spring creek systems, and wetlands so as to be rated in Proper Functioning Condition		Protect springs, spring creek systems, and wetlands/ **Maintain or improve the ecological conditions of all springs, spring creek systems, and wetlands so as to be rated in Proper Functioning Condition**	
Jordan Valley Range Improvement/ **5 years**	NRCS/ **EQIP**	Fencing, livestock water pipe & troughs, range seeding/ **1 Ranch**	**170501090902**	Improving upland function and riparian condition	
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management, fencing/ **4 Farms**	**170501102502**	Improving water quality	

Project Title/ Duration	**Management Entity/ Funding Source and ID #**	**Brief Project Description/ Scale of Project**	**Subwatershed Name**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management, fencing/ **10 Farms**	**170501102501**	Improving water quality	
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management, fencing/ **2 Farms**	**170501100104**	Improving water quality	
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management, fencing/ **1 Farm**	**170501150303**	Improving water quality	

Project Title/ Duration	**Management Entity/ Funding Source and ID #**	**Brief Project Description/ Scale of Project**	**Subwatershed Name**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management, fencing/ **1 Farm**	**170501030102**	Improving water quality	
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management, fencing/ **1 Farm**	**170501100104**	Improving water quality	
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management, fencing/ **1 Farm**	**170501100101**	Improving water quality	

Project Title/ Duration	**Management Entity/ Funding Source and ID #**	**Brief Project Description/ Scale of Project**	**Subwatershed Name**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management, fencing/ **2 Farm**	**170501170101**	Improving water quality	
Erosion Control Project/ **2 years**	OWC/ **OWEB**	converting from open dirt ditch to pipe/ **1 Ranch**	Jordan	Improve water quality/ **Reduce soil erosion**	
Riparian Protection Project/ **2 years**	OWC/ **OWEB**	Install animal waste management system to prevent animal waste contamination; fencing of riparian area/ **1 Ranch**	Jordan	Improve water quality/ **Elimate any potential animal waste contamination and protect riparian area**	
Rangeland enhancement project/ **2 years**	OWC:BLM/ **OWEB**	**o**ff-site water development and use exclusion from the Owyhee River/ **BLM Allotment**	Lower Owyhee	**I**mprove upland condition and protect riparian areas/ **Improve livestock distribution and minimize livestock impacts on the banks of the Owyhee River**	

Project Title/ Duration	Management Entity/ Funding Source and ID #	Brief Project Description/ Scale of Project	Subwatershed Name	Key Ecological Functions Addressed/ Goal of Project	Results of Project: Accomplishments and failures (Include a Quantitative assessment)
Sagebrush Pasture Solar Project/ **2 years**	OWC:BLM/ **OWEB**	off-site water development / installation of a solar pumping system/ **pasture within a BLM allotment (Nyssa Allotment)**	Lower Owyhee	Improve upland condition and function/ **Improve livestock distribution, enhance wildlife habitat, and improve riparian conditions**	
S. Board Mainline Extension/ **2 years**	OWC/ **OWEB**	conversion of cement ditch irrigation system to sprinkler and/or drip system/ **1 Farm**	Lower Owyhee	Improve water quality/ **Reduce irrigation-induced erosion through improved farm irrigation system**	
Irrigation Improvement Project/ **2 years**	OWC/ **OWEB**	off-site water development and reduction of irrigation-induced erosion/ **portion of 1 Farm**	Lower Owyhee	Improve water quality and protect riparian areas/ **Improve riparian condition and reduce irrigation-induced erosion through improved farm irrigation system**	
Range Seeding Project/ **2 years**	OWC/ **OWEB**	**brush control and range seeding/** portion of 1 ranch (approx. 640 acres)	Lower Owyhee	Improve hydrologic function of uplands/ **Improve grazing management for the benefit of livestock and wildlife**	

Project Title/ Duration	Management Entity/ Funding Source and ID #	Brief Project Description/ Scale of Project	Subwatershed Name	Key Ecological Functions Addressed/ Goal of Project	Results of Project: Accomplishments and failures (Include a Quantitative assessment)
Rangeland enhancement project/ **2 years**	OWC/ **OWEB**	off-site water development / installation of a solar pumping system/ **portion of 1 ranch**	Middle Owyhee	Improve upland condition and function/ **Achieve proper grazing management; provide reliable source of water for livestock/wildlife**	
Rangeland enhancement project/ **2 years**	OWC/ **OWEB**	off-site water development**/ portion of 1 ranch**	Crooked-Rattlesnake	Improve upland condition and function/ **Improve livestock distribution, reduce pressure on riparian areas, achieve proper grazing management**	
Erosion Control Project/ **2 years**	OWC/ **OWEB**	conversion from dirt ditch irrigation system/ poriton of 1 farm	Jordan	Improve water quality/ **Reduce irrigation-induced erosion through improved farm irrigation system**	

Jennifer Martin sent out the project inventory survey questionnaire to a list of contacts developed by the Owyhee Subbasin Planning Team on April 12th 2004. The response to the inventory survey, however, was minimal – only three entities responded to the survey:

- Pam Smolczynski, Idaho DEQ;
- Chuck Slaughter, University of Idaho; and
- Oregon Department of Fish & Wildlife.

Only, ODFW had an additional restoration projects to report (Appendix 3.4). The pertinent information on this project follows:

- **Project Title**: Fish Population monitoring

- **County**: Malheur
- **Stream Names**: Owyhee River, Dry Creek, N. F. Owyhee River, West Little Owyhee River
- **Project Type**: Monitoring
- **Land Owner**: BLM
- **Funding Source**: State of Oregon
- **Start Date & End Date:**1951-present
- **Status:** on-going
- **Limiting Factor/Environmental Process Addressed**:
    - Fish habitat
    - Water quality
    - Water quantity
    - Upland habitat
    - Riparian/wetland habitat
- **Brief Description**: Normal inventory of fish populations

3.3.5.1 Watershed Protecting Transformations in Malheur County Farming Practices 1980-2004[2]

The full text of the research paper provided by Clinton Shock et al. (May 2004) is presented in Appendix 3.5. Malheur County, Oregon includes portions of the Owyhee and Malheur Subbasins, and its primary irrigation water source is the Owyhee River – delivered by the Owyhee Irrigation District.

Notes on the Implementation of New Practices

The primary method of water application for Treasure Valley crops is furrow irrigation. Furrow irrigation is a method that is fairly easy to use, has been used for many years, and has some large advantages associated with it when applied to certain crops. In the past hundred years, large investments have been made in the effort to improve furrow irrigation. The use of field leveling, control structures, and water conveyance techniques, are just a few examples of the progress that has been made and is being made.

Many BMPs have been implemented in the Northern Malheur County GWMA that are protective of groundwater quality. Some of this progress is documented in the Ontario Hydrologic Unit Area (HUA) Final Report 1990 - 1997 (73).

Major changes in agricultural practices have occurred since groundwater contamination was identified in the Malheur River area in the late 1980s. The method of nitrogen application in this area has been changed. Reduced nitrogen loading has been accomplished by changes in the timing and the application of nitrogen as well as the rate of application. Plant tissue and soil sampling have also played a major role in modifying

[2] This section is derived from a research paper written by Clinton C. Shock, Herb Futter, Lynn B. Jensen, Jim Nakano, Vince Gaona, and Ray Dunten (May 2004).

practices for the application of nitrogen and other nutrients, enabling producers to apply only the amount of nutrient needed and only when that nutrient is needed. Changes in irrigation management practices have also occurred that increase the protection of groundwater quality.

Table 3.12 identifies the extent of specific implemented practices between 1990 and 1997 for groundwater protection, surface water protection, erosion protection, irrigation water management, and animal waste management through SWCD and NRCS programs. Other improvements have occurred before and after this time. Activities conducted exclusively through private efforts are not included.

Table 3.12 Extent of implementation of Best Management Practices in Malheur County, Oregon (Source Shock et al. 2004).

Best Management Practice	Extent of Implementation
Conservation Cropping Sequence	27,5764 acres
Grasses & Legumes in Rotation	1,231 acres
Irrigation Water Management	46,891 acres
Pasture / Hay Land Management	676 acres
Pasture / Hay Land Planting	285 acres
Nutrient Management	44,010 acres
Waste Utilization	1,670 acres
Soil Testing	35,595 acres
Fertilizer Application Timing	21,324 acres
Tissue Analysis	19,098 acres
Split Application of Nitrogen	15,125 acres
Banding of Nutrients	7,625 acres
Surge Irrigation	160 acres
Irrigation Scheduling	18,053 acres
Sprinkler Irrigation	6,737 acres
Filter Strip	618 acres
Tail Water Recovery System	16 systems
Irrigation Land Leveling	1,587 acres
Straw Mulching	5,490 acres
Polyacrylamide (PAM)	16,725 acres
Sediment Basins	8 basins
Irrigation Water Conveyance – Ditches	117,646 feet
Irrigation Water Conveyance - Pipe	373,178 feet
Structures for Water Control	330 structures
Weed screens	386 structures
Waste Management System	11 systems
Waste Storage Structure	4 structures
Waste Treatment Lagoon	2 lagoons
Waste Storage Pond	5 ponds

Number of Producers Adopting Farm Plans

Water quality farm plans are viewed as a set of progressive steps utilizing BMPs that lead to implementation of a Resource Management System. Plans are periodically reviewed and updated to include the newest BMPs available. Nearly all water quality plans written in the HUA include irrigation water management, nutrient management, and pesticide management as basic plan recommendations. Additional practices are included on a case-by-case basis and plans are tailored to individual farm requirements.

The number of water quality farm plans completed through the seven-year period of the HUA project and beyond indicates continued interest and involvement by the local growers. The total number of plans completed is as follows:

- 9 plans by 1991,
- 39 plans by 1992,
- 69 plans by 1993,
- 98 plans by 1994,
- 121 plans by 1995,
- 146 plans by 1996, and
- 156 plans by 1997.

The 157 plans completed by 1997 represent approximately 44,000 acres, or about 28% of the total irrigated acres in the GWMA. From 1997 through 2000, 65 new water quality farm plans were completed (averaging 12 to 15 per year) – for a total of 222 plans.

Shortage of Federal Support for Farm Plans

Numerous growers seek cost share support for adoption of farming practices with positive environmental effects. Although approximately 70 and 170 applications were filed in Malheur County during the last two years, less than 10 percent of growers seeking cost share support have garnered support. It is probable that even more producers would apply if the probability of success were greater. Both profitability of agricultural production and scarcity of public resources currently limit the adoption of new farming practices.

3.3.5.2 Goals, Objectives and Strategies of the USDA Natural Resources Conservation Service (NRCS)

Goal: Enhance natural resource productivity to enable a strong agricultural and natural resource sector.

- Maintain, restore, or enhance wetland ecosystems and fish and wildlife habitat.
- Deliver high quality services to the public to enable natural resource stewardship.

3.3.5.3 Goals, Objectives and Strategies of the Nature Conservancy

Goals:

- Shrub-steppe habitat – Identify and protect the existing high quality shrub-steppe habitat (late seral condition areas), while moving the fair quality shrub-steppe (mid seral areas) into late seral conditions.

- Springs, spring creek systems, and wetlands: Maintain or improve the ecological conditions of all springs, spring creek systems, and wetlands so as to be rated in Proper Functioning Condition.
- River terrace communities: Maintain the existing condition and quality of all A and B ranked big basin sagebrush/basin wildrye river terrace communities along the South Fork of the Owyhee, and identify and protect similar river terrace communities throughout the Owyhee Canyonlands.

Strategies:

- Develop community supported plans for conservation of key ecological values that also take into account economic and cultural values.
- Direct resources to highest priority projects within the subbasin as identified using a science-driven ecoregional planning process.
- Emphasize protection of existing high quality habitats for a wide range of species and maintain existing areas of undisturbed shrub-steppe habitat.
- Work with willing landowners and land managers to protect priority conservation lands through acquisitions, conservation easements, land exchanges, and management agreements.

3.3.5.4 Goals, Objectives and Strategies for Sage Grouse Enhancement – Funded by Various Entities

Entity – Owyhee County Sage Grouse Working Group (Selected objectives and strategies)

Goal: Preserve and increase sage grouse populations in Owyhee County.

- Develop maps that identify sage grouse habitat for high priority protection from wildfire.
- Implement sagebrush restoration projects in historic sage grouse habitat.
- Prioritize sites for juniper control activities.

3.4 Gap assessment of existing protections, plans, programs and projects.

The Technical Guide for Subbasin Planners says that the inventory sections of subbasin plans should identify the gaps between actions that have already been taken or are underway and additional actions that are needed. This perspective can help determine whether ongoing activities are appropriate or should be modified and leading to new management activity considerations.

3.4.1 Analysis of Existing and Ongoing Actions Taken

Most of the BPA-funded fish & wildlife restoration projects in the Owyhee Subbasin since early 1980's have been sponsored by the Shoshone-Paiute Tribes and implemented on the Duck Valley Indian Reservation (DVIR). For the past two decades of the Council's Fish & Wildlife Program, no projects in the Owyhee Subbasin have been sponsored and implemented by the state agencies in Oregon or Nevada. Only one (regional) project has been implemented by IDFG in the Owyhee Subbasin, i.e., native fish assessment in the Snake River Basin. Corresponding objectives and strategies from the management plan that address these needs are referenced. The main focus in the Owyhee Subbasin at this time should be on native fish & wildlife assessment, riparian habitat improvement work, and Adaptive Management via monitoring & evaluation.

In the Owyhee Subbasin, outside the DVIR, many habitat restoration projects have already been implemented by non-BPA funding sources. While these projects have been beneficial for fish and wildlife, they have been mostly small projects not directly targeting fish & wildlife objectives and strategies.

3.4.2 Gaps Between Actions Taken and Actions Needed

Tables 3.13 and 3.14 provide a summary of the needs that were identified through the inventory and technical assessments. A large unmet need for basic scientific information needed to manage fish & wildlife populations. Starting in 2004, a comprehensive M&E Plan is being implemented for the riparian restoration projects sponsored by Shoshone-Paiute Tribes on the Duck Valley Indian reservation. A parallel M&E framework plan has been developed for the Owyhee Subbasin Plan. Funding is also needed for restoration efforts to conserve and enhance vulnerable redband trout populations and habitats. There are numerous objectives and strategies in the management plan that address the need for habitat evaluation, protection, and restoration.

Table 3.13. Summary of objectives and strategies from the management plan that address unmet Owyhee Subbasin strategic needs.

Identified Needs	Examples of management plan objectives and strategies that address needs
Habitat Restoration	Potential fish habitat restoration in the Owyhee Subbasin -- prioritize by determining the amount of usable fish habitat available to pure genetic strains of native species.
Reservoir fishery management plans	Develop fish management plans for Owyhee Subbasin reservoirs that emphasize native fish conservation, e.g., Wildhorse, Sheep Creek, Mountain View, and Lake Billy Shaw reservoirs.
Increased enforcement	Mid-Snake Province objective – Provide additional enforcement and education to protect native trout.
Research	Fully quantify losses to native resident fish & wildlife associated with the construction and inundation of the federal Columbia River hydropower system and Bureau of Reclamation Projects. Subbasin Objective: Conduct a loss assessment for native resident fish & wildlife associated with the operation of the Federal Columbia River Hydropower system and Bureau of Reclamation Projects.
Monitoring & Evaluation	The Owyhee Subbasin M&E Plan – described in Chapter 4 §4.6. The M&E Plan for the Duck Valley Indian Reservation is presented in Appendix 4.5.
Implementation of identified projects	Subbasin Objective -- Based on the loss assessment, restore native redband trout populations & resident wildlife to pre-project levels by addressing limiting factors. Subbasin Objective -- Based on the operational and secondary impacts loss assessment, mitigate for operational and secondary impacts to native resident fish & wildlife by an established date.

There is a need for a comprehensive evaluation of fish passage barriers in Owyhee Subbasin, based on the numerous reaches with "obstructions" as limiting factors in the QHA. The Owyhee Subbasin management plan addresses this need in Objective x

Integrated watershed planning and native fish habitat restoration strategic planning has been implemented by one project on the Duck Valley Indian Reservation. This strategic approach has not been implemented on the remaining portions of the Owyhee Subbasin in Nevada, Idaho and Oregon. The subbasin needs to develop a fisheries co-management plans for the Owyhee Reservoir, and other irrigation dams and reservoirs constructed by the Bureau of Reclamation. The Shoshone-Paiute Tribe plans to develop an integrated management approach for Sheep Creek Reservoir, Mountain View Reservoir, and Lake Billy Shaw. The Tribe also needs to coordinate with NDOW regarding the co-management of Wildhorse Reservoir fisheries.

The provincial management plan addresses this need through a proposed strategy that says, "develop technical and policy working groups that meet regularly to identify problems and implement solutions."

Illegal harvest or habitat alteration may be a problem that is causing depressed redband trout populations in some portions of the Owyhee Subbasin – the extent of this potential problem is not known. Two of the current the current BPA-funded projects sponsored by the Shoshone-Paiute Tribe involve education and outreach and none provide enforcement protection. The managers believe that the current fishing regulations are adequate as long as compliance is high. Education and outreach are needed to increase compliance with fishery and habitat regulations.

In the past five years, worthwhile project proposals have been developed by the Shoshone-Paiute Tribes, approved by CBFWA, and recommended by the ISRP— that have not been funded. Tribal fish and wildlife managers in the Owyhee feel that there is a need for continuing funding existing projects and evaluating their effectiveness with a comprehensive M&E Program prior to funding new projects.

The management plan reflects the concern about lack of information in the objectives and strategies. BLM has conducted extensive PFC assessments and redband trout surveys on public lands, however, the QHA analysis indicated a lack of assessment-based information on private lands. The OSP M&E framework adopts a step-wise process where objectives and strategies can be re-evaluated on an iterative basis with respect to identified limiting factors.

As described in the Owyhee Management Plan, the Owyhee Subbasin offers opportunities for native redband trout restoration and mitigation of irrigation dam project impacts. There are also opportunities in the Owyhee Subbasin for mitigating losses caused by the federal hydropower system – within a broader Mid-Snake Province perspective, through enhancement of other resident fish & wildlife species.

3.4.3 Lack of Information and Critical Uncertainties

One of the most serious fish and wildlife management issues in the Owyhee Subbasin is the lack of basic information needed to scientifically manage the fish & wildlife resources. A critical need exists to implement a comprehensive Monitoring & Evaluation Plan for the Owyhee Subbasin (refer to Chapter 4, § 4.6). Additional fish and wildlife assessments are needed; including assessments on private lands if voluntary participation by landowners can be achieved. Once adequate fundamental scientific monitoring information is gathered, projects can be developed with a more valid basis and then implemented with ongoing monitoring of specific project effectiveness. At present, there are disconnects between identification of problems, prioritization of strategies, design and development of projects, implementation, and evaluation of effectiveness; however a comprehensive M&E plan is being developed for Shoshone-Paiute Projects on the Duck

Valley Indian Reservation (refer to Appendix 4.5) – that will be implemented during the spring-summer of 2004.

During the Qualitative Habitat Assessment (QHA), it became apparent that:

(1) little was known about the redband trout habitat in many river reaches due to the nature of the remote country and lack of easy access,
(2) although most of the land area of the Owyhee Subbasin is in public ownership, a significant proportion of the prime stream/riparian habitat is under private ownership and/or control via access, and
(3) much of the stream and riparian habitats with little or no assessment data are on the privately controlled stream reaches.

The confidence ratings (0= speculative; 1.0= expert opinion; 2= well documented) assigned to specific stream reaches in the QHA analysis of current habitat conditions provides a measure of information availability and uncertainty. If a specific stream reach has a confidence score less than 1.0, it indicates that little quantitative data exist and the rating is somewhat speculative (Table 3.14).

Table 3.14. List of stream reaches evaluated in the Qualitative Habitat Assessment with confidence scores less than 1.0 for the current habitat rating – for all portions of the Owyhee Subbasin – Idaho, Nevada, and Oregon.

4th Field HUC/ Reach Name	Description	Confidence Score <1
Idaho Portion of the Owyhee		
HUC 17050108		
Jordan Cr.-1	Jordan Cr. From OR Boundary to BLM boundary section	0.5
Jordan Cr.-3	Rail Cr. Confluence to BLM boundary	0.5
Jordan Cr.-4	BLM boundary near Buck Cr. to BLM boundary	0.5
Jordan Cr.-5	BLM boundary section line to BLM boundary upstream of Louse Cr.	0.5
Jordan Cr.-6	BLM boundary upstream of Louse Cr. To BLM boundary section	0.5
Jordan Cr.-7	BLM Boundary to state land section boundary	0.5
Jordan Cr.-8	State line lands boundary to headwaters of Jordan Cr.	0.5
Williams Cr.	Including Pole Bridge Cr. And West Cr.	0.5
Old Man Cr.	All	0.5
South Mountain Creek	Lower BLM upper put state includes Howl Cr. Coyote Cr.	0.5
Flint Cr.1	Lower	0.5
Upper South Boulder Creek	Mill Creek confluence to headwaters	0.5
Indian Cr.	Bogus Cr. (Lower) - confluence with South Fork Boulder to Section 10	0.5
Rock Cr.-2	From Meadow Creek to BLM	0.5
Rock Cr.-3	BLM portion in Section 26	0.5
Rock Cr.-4	From BLM/PVT boundary in Sec. 26 to above Triangle Reservoir.	0.5
Rock Cr. 6	From Sheep Creek/private boundary to headwaters	0.5
Meadow Cr.	Headwaters to confluence with Rock Cr.	0.5
HUC 17050107		
Juniper Cr. 2	From the start of the private up to the headwaters	0.5
Lone Tree Cr.	From Oregon State line to headwaters	0.5
Squaw Cr. 2	From the start of private in section 14 to the BLM in the northwest corner of section 31	0.5
Squaw Cr. 3	From private to headwaters	0.5

4th Field HUC/ Reach Name	Description	Confidence Score <1
HUC 17050106 – none <1		
HUC 17050105 – none <1		
HUC 17050104		
Shoofly Cr.-3	Bybee Reservoir to headwaters	0
Battle Cr.-2	Section 10 to above state section 36	0
Dry Cr.-1	confluence to reservoir	0
Nevada Portion of the Owyhee		
HUC 17050104		
Boyle Cr	Starts in NV and enters Owyhee in ID	0.5
S.F of Boyle Cr		0.5
Skull Cr		0.5
N.F. of Skull Cr		0.5
E.F. of Skull Cr		0.5
Reed Cr		0.5
Summit Cr		0.5
Jones Cr		0.5
Granite	probably fishless	0.5
HUC 17050105 – none		
Oregon Portion of the Owyhee		
HUC 17050108		
Cow Creek	Mouth to State Line	0.5
HUC 17050107		
Middle Fork	Idaho Segment	0

Many of the specific reaches with low confidence scores are on streams under private control where state and federal fish & wildlife agencies are unable to conduct fish and habitat assessments.

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Owyhee Subbasin Plan

Chapter 4 Owyhee Management Plan

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and

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Prepared for:

The Northwest Power and Conservation Council

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Disclaimer:

Final approval by the Northwest Power and Conservation Council is contingent upon a favorable review by the Independent Scientific Review Panel and meeting requirements for adoption as an amendment to the Council's Fish & Wildlife Program.

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4.1 Vision, Mission and Guiding Principles for the Owyhee Subbasin

4.1.1 Vision

The Owyhee Subbasin planning and technical teams established the following **Vision** for the Owyhee Subbasin Plan:

> **We envision the Owyhee Subbasin being comprised of and supporting naturally-sustainable, diverse fish and wildlife populations and their habitats, that contribute to the social, cultural, and economic well-being of the subbasin and society.**

4.1.2 Mission

The Owyhee Subbasin planning and technical teams established the following **Mission** of the Owyhee Subbasin Plan.

> **The Owyhee Subbasin Plan will serve as the conceptual and strategic basis for future implementation of the Northwest Power and Conservation Council's Columbia Basin Fish and Wildlife Program in the Owyhee Subbasin.**

4.1.3 Guiding Principles

The Owyhee Subbasin planning and technical teams established the following **Guiding Principles** for the development of the Owyhee Subbasin Plan.

1. Respect, recognize, and honor the legal authority, jurisdiction, tribal rights, and rights of all parties;
2. Protect, maintain, enhance, and restore habitats in a way that will sustain and recover aquatic and terrestrial species diversity and abundance with emphasis on the recovery of native, sensitive, and Endangered Species Act listed species;

3. Foster stewardship of natural resources through conservation, protection, enhancement, and restoration recognizing all components of the ecosystem, including the human component;
4. Provide information to residents of the Owyhee subbasin to promote understanding and appreciation of the need to maintain, enhance, and/or restore a healthy and properly functioning ecosystem;
5. Provide opportunities for sustainable, natural resource-based economies to thrive, while accomplishing the fish and wildlife goals in the plan;
6. Promote, enhance, and recognize local participation in natural resource problem solving and subbasin-wide conservation efforts;
7. Coordinate efforts to implement the Pacific Northwest Electric Power Planning and Conservation Act, the Endangered Species Act, the Clean Water Act, tribal rights, and other local, state, federal, and tribal programs, obligations, and authorities;
8. Include monitoring and evaluation in the design of all fish and wildlife projects – to facilitate review and adjustments to the projects – thus incorporating Adaptive Management[1] principles;
9. Enhance native fish and wildlife populations to a healthy and sustainable abundance to support tribal and public harvest goals.

4.2 Human Use of the Environment

4.2.1 Native American Use – Before and During European Settlement

The following summary information has been abstracted from Appendix 1.2 which is incorporated herein in reference.

An important goal of federal Indian policy has been to establish self-sufficient reservation communities. This has been interpreted by the Shoshone-Paiute as well as by various government agents to require development of various enterprises such as irrigated farming and cattle and horse ranching. Despite various projects and efforts by the federal government, there have been frequent failures in Duck Valley Indian Reservation history due to lack of investment and development of the reservations' water resources by the federal government. These failures have made the importance of various traditional food resources critical for survival in the domestic economy of many Shoshone-Paiute families

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[1] The Council's Fish & Wildlife Program (2000) defines "Adaptive Management" as: "A scientific policy that seeks to improve management of biological resources, particularly in areas of scientific uncertainty, by viewing program actions as vehicles for learning. Projects are designed and implemented as experiments so that even if they fail, they provide useful information for future actions. Monitoring and evaluation are emphasized so that the interaction of different elements of the system are better understood."

who live in economic poverty. A principal impact on such families has been the blockading of anadromous fish passage to the Owyhee, Bruneau, as well as the Boise-Payette-Weiser and Middle and Upper Snake River drainages. These losses must be taken into account in any subbasin planning effort, especially in view of the previous failure to compensate or otherwise mitigate damages done to the Shoshone-Paiute by the loss of these important resources.

Research by Dr. Walker has established a baseline for determination of the extent of these losses. For example, Dr. Walker determined that before the blockading of the fish passage the Shoshone-Paiute of the Duck Valley Indian Reservation enjoyed three annual salmon runs of about ten days each. Dr. Walker determined from interviews of elders as well as from recorded interviews of tribal members born in the 19th century that these three annual salmon runs could be expected, in normal years, to last about ten days each. The research also demonstrates that the location of the Duck Valley Indian Reservation was chosen in part because of the abundant fisheries available in the region. For example, in an interview with Federal Agent Levi Gheen, the *Territorial Enterprise* (1-3-1878) quoted saying, "The country abounds in deer, grouse, prairie chickens and other wild game, while the creeks and river[s] literally swarm with excellent fish. All in all Duck Valley is a veritable Indian paradise." Again, it was at this time that Captain Sam first mentioned Duck Valley to Gheen as a "place . . . about seventy or eighty miles northeast of [Elko] where [the Indians] say there is plenty of game and fish and a good farming country as near as they can judge with plenty of timber [and in the mountains] water and grass" (Gheen 1875).

Using information gained from tribal fishermen as well as from comparative catch records from other related tribes (Walker 1967, 1992, 1993b), Dr. Walker estimates catches to have been about 200 fish per day, averaging 15 pounds each (for each of ten separate weirs), yielding a potential average annual catch of 90,000 pounds, or about 6,000 fish. As further verification of these numbers estimates have been derived for other important fisheries (the Boise-Payette-Weiser Valley and the Hagerman-Shoshone Falls sites) which the Shoshone-Paiute shared with other tribes of southern Idaho. It is estimated that this large area contained at least 25 traditional weir sites, and based on tribal accounts each site could produce significant catches for about ten days, three times per year. For 25 weirs the catches are estimated to have been 200 fish per day, per weir, averaging 15 pounds each, yielding an average annual catch of 2,250,000 pounds or about 150,000 fish. Of course, some of these fisheries were destroyed early by mining and agriculture as other were later destroyed by damming of the Columbia, Snake, and many of their tributaries. While these 19th century salmon catch estimates are large when compared to contemporary catches in the Columbia-Snake system, they are supported by the evidence discovered in Dr. Walkers research.

Beginning in the late 19th century, the destruction of these fisheries has been a significant blow for the Shoshone-Paiute. They have suffered not only economic and subsistence shortfalls because of it, but also have experienced declines in the quality of their diet which in various serious health problems such as diabetes that are becoming extremely common. The loss of this significant source of easily obtained protein and related nutrients cannot be disregarded in subbasin planning; neither can the fact that the Shoshone-Paiute have never been compensated for their losses. Despite such losses, Tribal members have continued to fish for both anadromous and non-anadromous species. Often traveling long distances to other Columbia, Salmon and Snake fisheries.

The summer months were a time of inter-tribal gatherings. Tribes met along the Snake River to trade, hunt, fish, and to collect seeds, nuts and berries. Late fall was a time of intensive preparation for winter. Meats and various plant foods were cached for later use and winter residences along the Snake River were readied (Idaho Army National Guard 2000).

Water, plants, fish, and wildlife were central to Shoshone-Paiute culture in the desert region surrounding the Owyhee River System. Water resources provided the hubs of fish, wildlife and plant utilization by the native peoples. The following is a brief summary description of the utilization of lands and natural resources that the ancestors of the Native Americans presently inhabiting the Duck Valley Indian Reservation depended upon for subsistence and perpetuation of their culture (Vigg et al. 2000).

- **Time Period for Utilization of Currently Existing Species**. Plew (1993, p. 45) describes a settlement model that assumes the environment and the utilization of natural resources by Snake River Shoshoni, White Knife Shoshoni and the Northern Paiute of Southwestern Idaho/Northern Nevada remained relatively stable over the past 2,000 years.

- **Water Use & Demographics.** Water is a vital resource for Native Americans subsisting from natural resources. Plew (1993) observed that most of the Indian camps were close to water. This makes sense because the high desert lands surrounding the Owyhee River Basin are arid and native people need water on a daily basis. Animals of all types would come to the waterways in this arid climate, thus facilitating hunting opportunities. Fish was a primary source of protein for aboriginal bands inhabiting the Owyhee Basin, thus streamside camps would certainly be expected. At the same time, camps in the floodway would not necessarily be preserved as well as the upland camps, so reliance on archaeological evidence alone may underestimate the use of fisheries resources.

4.2.1.1 Habitats, Plants, Fish, and Wildlife used by the ancestors of the Shoshone-Paiute peoples

Archaeological and enthographic data summarized by Dr. Mark G. Plew describes a way of life he considers typical of the ancestors of the people currently residing at the Duck Valley Reservation. Plew (1993) describes the aboriginal use of natural resources by the White Knife Shoshoni and the Northern Paiute as follows:
In Nevada, the White Knife Shoshoni wintered on the Humboldt River and its tributaries [and on the South Fork of the Owyhee River in southwestern Idaho]. In the spring,

groups separated and moved to varied locations where roots, seeds, and other plants were collected. Fish, rabbits, deer, antelope and mountain sheep were important to the diet. Collecting and hunting were restricted to areas around campsites. Food caches for winter use were supplemented by rabbit hunting and sporadic fishing. Roots were harvested in the spring, while seeds were gathered in the fall. Rabbit drives were conducted in the fall and involved some communal effort (Harris 1940: 39-49).

Winter camps were located near stored seeds and moved from year to year with different families wintering together. Spring, summer, and fall camps were established for hunting and collecting.

Seasonal movements were related to resource conditions, needs and uses. Plew (1993) suggests that a prehistoric pattern was to move to spring and summer upland areas, and later in the fall, camps would move toward the stream corridors. He states:

Faunal and artifactual associations as well as seasonal availability of resources suggests a spring-summer occupation for many of the upland sites. The spring-summer field camps were placed near major root crops, while fall field camps are found in the constricted and brushy areas of canyons where deer and a range of berries and fruits were available.

. . . The central winter camps and spring-summer-fall field camps are separated by 15-20 miles, a pattern characteristic of the White Knife Shoshoni and the Northern Paiute. The pattern is one of wintering on the East and South Forks of the Owyhee River and its major tributaries during the mid-December to mid-March period with movement to the higher plateau areas in early spring. Because the plateau sections of the uplands contained productive high yield resources such as camas and biscuitroot, supplemented by game and fish, spring through fall was spent moving from one field camp to another to exploit specific resources. In this model, the same field camps were used during different seasons with some sites being returned to on an annual basis and others during alternate years. The territorial range or logistical range for the area is probably 60 square miles. Within the Owyhee Uplands, there may be several such territorial ranges, having more restricted camp ranges. Territorial ranges probably characterize the areal movements of individual bands. This is the pattern generally characteristic of the Snake River Shoshoni, the Northern Paiute, and in particular the White Knife Shoshoni . . .

. . . The Owyhee River, and the deep canyon areas of its major tributaries, were selected for winter encampments for shelter, wood, house construction and fires, and aggregations of wintering animals. At other times of the year, access to and from the canyon was probably an impediment to habitation.

4.2.1.2 Proximity to water and implications for seasonal land use patterns

Seasonal water levels would have affected where it would be comfortable or safe to camp and which foods would be available. For instance, in the spring, some of the meadows would be quite wet. These wet meadows often produced roots commonly used as foods.

The roots would be largest after finishing the year's growth. They would be locatable when the leaves were dying back and easy to dig, as the meadows began to dry out but were not yet completely dry. Timing would be important to obtain this food source. Another example of the importance of water influencing seasonal use of an area would the timing of fish and game movements with season. For instance, large steelhead would be most available in the spring, when water was high enough that the fish would wander into flooded meadows or move into small creeks where they would be easily caught. In this fishery, fish response to water levels would determine where a particular fishing tool would be effective. Deer and antelope migrations would also follow the availability of grasses, forbs and water.

Water also influenced the distribution of the immigration of other people into the ancestral lands of the tribe. It is through these people that much of our written history comes to us. Pavesic (1993b, p 33) considers this early documentation of the use of waterways as a riverine bias in the historical record, because the majority of trappers and travelers were using the river corridors.

However, the focus on rivers in early records might not be a bias, but a real phenomenon in an arid landscape. Trappers were looking for beaver. They traveled river corridors with and without trails. When they had to move faster, they used the trails of the local people, and these were near waterways. The early trappers rarely went two or three days without meeting native people. As previously discussed, the native people needed water in this arid land, and they fished, so certainly they lived and moved along the rivers.

4.2.1.3 Plant Resources

The seeds, roots, and parts of as many as 150 species of plants -- including camas, grass, berries, and willows -- were used for foods, fiber, and medicines. Plant diversity in Duck Valley and the upper Owyhee was remarkable -- according to Peter Skene Ogden's accounts circa 1826. Camas, which typically grows in wet meadows, was one of the essential plant foods for Native Americans in the region. Such habitats and root resources were available in the upper Owyhee River basin. Ogden describes a "fine lake, nine miles long and two in breadth" in Duck Valley, June 1826. Scholars consider this location to be the lakebed on the north side of the Duck Valley Reservation; Rich et al. (1950) reported this area as typically dry. After describing the lake, Ogden goes on to say "Camass root was to be seen in abundance and a considerable quantity" (Rich et al. 1950). The collection of camas by the Shoshone-Paiute also integrates the concept of water abundance and seasonal land use mentioned previously. Close proximity to the camas digging areas would have obvious benefits, but camps placed on slightly higher (dryer) ground would be more comfortable.

The Owyhee River, with its steep walls, lies at elevations between 4,000 and 4,500 feet, some 1,500 feet below elevations in the uplands where high site densities are noted at elevations of 5,600 to 5,800 feet. . . The spring-summer crops of the uplands [such as camas and biscuitroot] are not available along or near the Owyhee River. . . The upland faunal and flora communities . . . provide [abundant] resources which can be easily transported to winter camps and stored. This is in contrast with the Owyhee River which is, during much of the year, quite arid.

The collection of camas also integrates the concept of water abundance and seasonal land use mentioned previously. Close proximity to the camas digging areas would be desirable, but camps placed on slightly higher ground would be more comfortable. Ogden's observations again assist us as we look at the distribution of camps and resources. He observed native camps separate from the root harvest areas. When he first observes the lake (i.e., a very wet area) of abundant camas, he comments that he is puzzled why the local people are not digging the roots; but the next day he observes, "the plains are covered with women digging roots." The place where the people are digging he describes as a drier site ("the plains") than the lake bed he saw the day before. At the same time, he mentions the plants as roots, and not by the name of camas here. Camas are showy when in bloom in wet meadows; as they die back, they are not showy and would not be identifiable at a distance. At the moment when the ground is no longer quite wet but is still easy to dig, the camas would be identifiable at close range and the meadow would look like a plain.

There is evidence that plant diversity in the upper Owyhee was remarkable. Although camas was one of the main plant staples, the seeds, roots, and other parts of many plants were used for foods and fiber. Plant diversity contributed to many kinds of human needs. The upper Owyhee River basin enchanted the well-traveled Ogden. In June of 1826 he was traveling in the Duck Valley area and said, A more beautiful country I have not seen" (Rich et al. 1950). He commented on the rich abundance of flowers and the number that were new to him: "In this day's journey a botanist would have had full employment and probably would have had many additions to his stock" (Rich et al. 1950).

Early descriptions of the range in the upper Owyhee include discussion of native grass and forbs. For example, there was a lot of bunchgrass on the lower part of Sunflower Flat, and there were many sunflowers. The descriptions claim the country was yellow with these sunflowers prior to the turn of the century. It was primarily a grass range. Gold Creek especially was grass-covered. All the smoother ridges were covered with bunchgrass. There was little sage, and the creek bottoms from the present highway to the mountain were continuous narrow meadows.

"Wild berries of all descriptions grow here in abundance" (Scholl 1860). This observation was probably made in the middle to upper portion of the eastern basin. Willows commonly lined the riparian areas. They would have been a source of both wood and fiber. Jordan Creek was described as having "[only] dense willow bushes grow along its banks" (Scholl 1860).

Shock (2002) did not find convincing evidence to support the hypothesis that the harvest of vegetative food resources was a primary factor related to the occurrence of petroglyph sites. The plant food resources which are available in the Owyhee uplands occur in dispersed patches throughout the landscape. The small concentrations are found in areas with slightly higher amounts of moisture, e.g., near springs. This factor would be difficult to determine because of vegetation changes over time. Shock (2002) concluded that plant foods were probably harvested by yearly movement around the landscape to known locations, and the scarcity of resources in any one location might not have allowed for prolonged stops at any of the locations. A frequently used location might be one where both plant and animal food resources were available at the same site.

Use of plant and wildlife resources by the Shoshone-Paiute people, as implied by the archaeological record, can be confirmed and perhaps refined by the more recent historic record.

4.2.1.4 Wildlife Resources

Large mammals, small mammals and birds are frequently used by the Shoshone-Paiute Tribes. Gruell (1998) provides transcripts of oral histories collected from long-time residents several decades prior to publication. These provide a broad general view of wildlife in the upper Bruneau, Owyhee and Humboldt drainages reported here.

Large mammals include bears, bighorn sheep and deer. Bighorn sheep were known to use the Ruby Mountains, the Jarbidge area, and the lower Bruneau River until domestic sheep came into the area (Gruell 1998).

Smaller predatory mammals are also present, as the stories of wolverines and of the abundant red fox populations demonstrate. In the late 1800s, residents say that the white-tailed jack rabbits, common in grasslands, are abundant; at the same time, the comment is made that the black-tailed jack rabbits are rarely seen.

Three kinds of grouse are present in the historic record (Gruell 1998). Sharptail grouse and sage grouse were common and easily harvested. Sharptail grouse used the willow areas; "they weren't all over the country, just in the drainages. You could get a mess of them anytime." In contrast, the sage grouse used the meadows. Local residents recall that, "Sage chickens (sage grouse) were so plentiful in the 1890s … [in meadows at the foot of the Independence Mountains] they clouded the sky… the birds were always thick in the meadows. As I passed by they would raise up like a bunch of blackbirds." Blue grouse were also abundant, particularly around McDonald Creek and Coon Creek, and on the Bruneau. Residents go on to say that "blue grouse would be in the lower country in the summer."

4.2.1.5 Fisheries

Salmonids, catostomids [suckers], and cottids [sculpins] were found in great numbers within the Mid-Snake Province, including the Owyhee system. The remains of fish bones of both anadromous and non-anadromous species have been found at archaeological sites within the province.

4.2.1.5.1 The Snake River Fishery

In the historic record, Shoshone people are frequently reported as fishing in the Snake River corridor. While band identification is not possible in many of these records, it is clear that many Shoshone people harvested, processed, and used salmon as a trading commodity. For example, in 1811, Wilson Price Hunt recorded seeing large quantities of salmon at several places and traded for a variety of items, including salmon, horses, and dogs. He also observed Snake River Shoshone wearing buffalo robes, and upon inquiry, found that they had traded dried salmon to obtain the robes (Pavesic 1993b, p. 4).

4.2.1.5.2 Owyhee River Basin Fisheries - Spring, Summer, Fall Seasons

Shoshone-Paiute people of the Owyhee River basin relied heavily on anadromous and non-anadromous fish. The archaeological record provides evidence of anadromous fish remains as well as those of non-anadromous fish. Plew (1993, p. 65-69) suggests that fishing activities would have been restricted during much of the year to the upper reaches of the primary and secondary tributaries of the Owyhee River. Access to and use of the Owyhee River for salmon fishing would have been considerably more difficult than on the Snake River. The steep rock walls, coupled with the absence of shoals, riffles, etc., which were known fishing localities on the Snake, would have made spring salmon fishing difficult. High water may have precluded spring access, while low fall water levels may have inhibited salmon runs. Nonetheless, non-game fish are abundant in the Owyhee and its tributaries, and the use of suckers and sculpins on the Owyhee River may have been important (Plew 1993, p. 65-69).

Historical evidence indicates that fishing possibilities beyond those described by Plew existed in the Owyhee River basin. Early diaries, oral histories and newspapers suggest that native people used the upper Owyhee River basin for fishing. Such sources also suggest that this fishing occurred in the headwaters over a longer period than Plew (1993) suggests, and that salmon and steelhead were among the primary species sought.

In the combined experience of the Shoshone and Paiute in the Owyhee River basin, a variety of tools were used, including bows and arrows. Rostlund (1952) identifies such fishing devices as spears, fish clubs, weirs, basketry traps, torchlight, and fish poison made of toza root. This diversity of methods to collect fish begins to contribute to the idea that perhaps fishing was more important than Plew describes.

Weirs were identified as landmarks in the Owyhee River basin. Weirs take some effort to construct and can successfully fish the waters of larger rivers; Indian fish weirs were used in the mainstem Snake River. There is evidence that weirs were in use in the Owyhee.

While locations are hard to pinpoint, Ogden mentions the “Indian Fish Weare” in the “Sandwich Island River,” identified by historians as the Owyhee River; there are at least two such entries in his 1820s journals. In one of the diaries, it appears to be in the headwaters of the Owyhee; in another year’s diary it appears to be near the mouth. In each instance, he uses the weir as a landmark.

There is a great deal of evidence that fishing the Snake River was a major activity of many tribes. The multi-tribe/band events in the Snake River area between the mouth of the Owyhee River and the mouth of the Weiser River were well known and well attended. This event typically occurred during late summer to late fall, and fishing was a primary activity. The records confirming the Snake River resource use are more common than other records, as the Snake River plain had many of the major travel routes, and therefore the fisheries there often were observed in this narrow corridor.

4.2.1.6 Aquatic Habitats in the Owyhee River Basin

Abrupt changes in aquatic habitats were noted shortly after mining and associated activities began. As early as 1870 there were complaints about the destruction of the salmon fishery near Mountain City (The Robert McQuivey Collection 1998). In May of 1887, the news reports that the absence of salmon “is attributable to tailings in the river extending down as far as Duck Valley, driving the fish into Indian Creek, where a great many are caught by White Rock people” (The Robert McQuivey Collection, 1998). Placer mining, like the massive placer workings of the Owyhee River near Mountain City was just one of the early impacts on aquatic habitats. Mining used water, and the first diversions were for washing gold and serving mining communities with domestic water. Lode mining brought the use of chemical slurries; often these slurries were an in-stream activity.

The mining also brought the need to feed the miners the foods they were used to. Agricultural activities began as dry-land farming, and the impact was localized to cultivated grounds. Livestock (primarily horses and sheep) were also brought to the area in large numbers, and grazing took place over large tracts. Some intermittency was noted in the late 1800s, but how much of this was natural and how much was exacerbated by mining, irrigation, and other land uses remains unclear.

Patterson et al. (1969) says that until dams were built on the lower reaches of the South Fork Owyhee, all the streams flowing into the Owyhee were spawning grounds for salmon. They go on to say that from Tuscarora, from Mountain City and from the ranches, people gathered along the streams to spear salmon for winter menus. Although there was always trout to catch, in spring, salmon spearing was the favorite sport" (Patterson et al. 1969).

Chapman (1940) observed "The construction of the Owyhee Dam, some 21 miles from the mouth of the river, by the Bureau of Reclamation in 1933 completely and, as far as I can see, irrevocably eliminated [it] as a producer of anadromous fishes.” … He further notes that even if anadromous fish used the lower 20-25 miles of the Owyhee River, "The Owyhee Canal, about 16 miles downstream from the dam where the river leaves the canyon, dries up the river except for two or three weeks in the spring. It would be expected that nearly all downstream migrants resulting from anadromous fish would be killed in this diversion."

Nonetheless, some anadromous fish were reported for several years after the construction of Owyhee Dam. "In spite of the handicaps [river being dried up] a fairly good run of steelhead still enters the river in the spring and at that time the steelhead fishing is good below the dam for a few miles" (Chapman 1940). Large rainbow trout were caught in irrigation canals and the siphon on the Owyhee Ditch into the late 1940s (Lockwood 1950).

By the mid-1950s, Oregon state agencies observed that there was no spawning steelhead or chinook in the Owyhee basin. The last known observation of chinook were some very small fish within the Owyhee River, but within the first mile upstream of the Snake River during 1954 (Fortune and Thompson 1959; Oregon Game Commission 1956).

4.2.1.7 Upland Vegetation Change and Development of the Basin

Climate Changes at he the Turn of the Century[2]

Dramatic climatic changes have occurred in the Owyhee Mountains in the last one hundred to one hundred and fifty years. The date of this climatic transition varies slightly depending on the source, but scientists generally agree that it occurred around the 1860s (Great Basin Riparian Ecosystems 2004). The area began to slowly change over time from a high precipitation tall grass area to a low precipitation desert plant community. When the first settlers began to move into the Owyhee Mountains in the 1860s and 1870s, they recorded grasses to their horse's shoulders. Other settlers' journals recorded looking over a sea of tall grass as far as the eye could see, taller than their wagon wheels.

As you review settlers' accounts around 1900, they began telling of drier and drier conditions occurring in the Owyhee Mountains. Heavy snow years did not happen every year, but only one year out of five. The annual precipitation was diminishing and the tall grasses had all but disappeared. The early settlers used the Owyhees to raise horses and sheep. They sold replacement horses to the Army and raised small bands of sheep for wool and meat. Sheep and horses were the primary livestock raised in the Owyhee until the early 1940s.

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[2] 1. This section was provided by Duane LaFayette based on interviews with Paul Black and other family members (May 2004) and Black family journals. The Black family lives on Shoo Fly Creek near Grand View, Idaho. Journal "The Valley of the Tall Grass" by Adalene Hawes.

According to the Black's family journal and Paul Black born in 1908, the Indian bands would use the Antelope Trail and Desert Trail out of the high country of the Owyhee Mountains and the Lonesome Trail between Shoo Fly Creek and Little Jacks Creek in late spring and early summer each year to make their way to the annual encampment at the mouth of the Bruneau River. They would go to the Bruneau encampment to catch and dry their winter supply of salmon. The Indian Trails were used so heavily for so many years that they were beat deep into the earth and can still be seen to this day. There was an abundance of trout in the streams in the Upper Owyhee during the late 1800s.

According to the Black family, the earthquake of 1916 changed the Upper Owyhee country forever. For months after the earthquake, the springs and streams ran murky water and the stream and spring flows dropped off sharply. Many springs dried up, and water had to be hauled in for livestock in areas that always had water previously. As stream and spring flows continued to decrease in the 1920s, many homesteads had to be abandoned. Meadows in Camas Creek, Battle Creek, Big Springs, and Rock Creek no longer produced enough hay for the winter feeding of horses and the settlers were forced to move. Where there were large trout populations, they disappeared. Paul Black remembered how they would catch gunny sacks full of trout in Battle Creek; and Paul Black attributes that to the loss of water flow after the 1916 earthquake. Today, there are only limited populations of trout caught in short sections of streams that have enough water year around in the Owyhee Subbasin. A lawsuit was filed over water rights after the earthquake as the water supply dwindled (Burkhardt vs. Black-1981).

Current Climate[3]

The climate of the Great Basin is semiarid, characterized by an mean annual temperature of 9°C (48.2°F) and between 100 and 200 mm (3.94-7.88 in.) of precipitation annually (Smith et al. 1997). The majority of this precipitation comes during the winter and spring. The current climatic conditions of Rome, OR on the Owyhee River at 3400 feet (1036 m) of elevation best reflect recent climatic conditions of the Owyhee uplands. Average annual precipitation over the last 50 years is 8.21 inches (20.85 cm). The average daily maximum temperature in the hottest month, which is July, is 92.0°F (33.3°C). The average daily minimum temperature for January, the coldest month of the year, is 18.1°F (-7.7°C). Data from further to the south at weather station McDermitt 26N (located 26 miles to the North of the Oregon/Nevada border along US 95) reflects similar conditions at 4500 feet (1371 m) of elevation. Average annual precipitation is 9.43 inches (23.95 cm). The temperature ranges from an average daily maximum of 91.1°F (32.8°C) in the month of July and the average daily minimum for Jan of 18.9°F (-7.3°C). The averages for this station are for the last 45 years (Western Regional Climate Center).

[3] This section is based in part on climate description by Shock (2002) and Duane LaFayette's narrative on climate change at turn of century (drought conditions) and the effects of earthquakes with respect to changes in course of Owyhee River.

The environment of the Owyhee uplands is comparable to that of the Great Basin (interior drainage). The main difference between the two is hydrological. While the Owyhee uplands have drainage into the Pacific Ocean by way of streams and rivers, the Great Basin has internal drainage. The plant communities which can be found in the two regions are similar in the Owyhee Subbasin and Great Basin (Murphy and Murphy 1986:285). In turn animal communities are similar with the notable exception of different varieties of fish that inhabit the Owyhee River in comparison to inland lakes.

High winds come up in the morning and evening across the plateau regions of the Owyhee uplands. These winds, anabatic and katabatic, are driven by gravity and the heating and cooling associated with morning and evening, respectively (Christopherson 1997). In the evening as layers of the surface cool, the cold surface air is denser and sinks, moving down slope across the mesa. The downward movement is called a katabatic wind. The reverse happens in the morning as the air at lower elevations warms and rises, pushing air the opposite direction across the mesa as an anabatic wind.

Anthropogenic Impacts on Vegetation

Mining altered the landscape in certain areas by moving tons of rock. When the extraction of the ore included chemical processes, fuel was needed, and the wood in the area was harvested and burned by the smelters. Near Tuscarora, Chinese crews made their living grubbing sagebrush and selling it as fuel to other miners. We did not find discussions about the impact of this rapid timber and sagebrush removal.

Later in the 1800s, grazing modified the productivity of the landscape, an impact recorded by the stockmen. At first, livestock grazed on open range year round, though they were moved between summer and winter range locations. Later, raising stock required more expensive techniques. After a period of drought combined with overgrazing in the late 1880s, and a severe winter, the stockmen reduced the number in their herds/bands and began mowing wild hay for winter feeding (Gold Creek example described by Tremewan [1964]). Irrigation of wild grass also began as a technique to increase hay resources. Later, the practice of cultivating alfalfa to feed stock began.

Keen competition for feed and water continued into the early 1900s, at which time the Federal Forest Reserves and their associated regulations began, in part at the request of the stockmen. There had been complaints about the deteriorating condition of the range on the East Fork, South Fork and North Fork of the Owyhee River. The development of a Forest Reserve was attempted in the Jordan Valley at the turn of the century, but it failed and was not implemented.

Sheep mines were in use to reserve water in the upper Owyhee. Sheep mines were lands claimed as placer ground to obtain the right to the water so stockmen could water their animals. The stockmen who controlled the water controlled the range. Stockmen were in favor of the regulations as they paid less for grazing fees on the Forest Reserve lands than they paid for the bogus placer mining leases. The condition of the range was no small problem. Tremewan (1964) provides this paraphrased description: The conditions in the Independence Mountains had gotten so bad that steers taken off the range in the fall had to be fed for several weeks before they could be driven to the railroad. These conditions existed from a combination of their feed, and the practice of stockmen running the herd back and forth trying to beat each other to the best camps. The Forest Reserves eliminated a lot of this tramping back and forth by establishing trails and allotments.

Jerry Hoagland provided the following narrative about the reduction of overgrazing associated with the implementation of the Taylor Grazing Act (1933). A discussion of this issue is contained in the book by Helen Nettleton.

Support for National Forest in 1924 by Western Owyhee County Ranchers:

As early as the 1920's Owyhee County ranchers recognized the need for grazing management to protect and/or restore water, forage, and timber resources in the Owyhees. In their early attempts to control abuses, the rancher supported the creation of a National Forest as discussed in "Sketches of Owyhee County", by Helen Nettleton, 1978.

"Around 1924 the ranchers in western Owyhee County were becoming concerned about the watershed of the mountains. They circulated a petition and had 94 persons sign it that the watershed be protected by establishing a National Forest. The petition read as follows:

> "TO THE SENATORS AND REPRESENTATIVES OF THE STATE OF IDAHO, GREETINGS: We, the undersigned residents, land owners, stockmen and taxpayers of Owyhee County, respectfully present for your consideration, that; the streams that furnish water to irrigate our farms, produce our crops, and furnish our domestic supply have their headwaters in the public land of the Owyhee Mountains.
>
> That these mountain slopes have been denuded of their forests and ground cover by uncontrolled timber cutting, grazing, and burning during the past thirty years, causing the streams to dry up for part of the season so that many of our farm lands have been abandoned for want of water and many of our stock ranges are useless for the same reason for a large part of the year…"

The petition requested that the legislature create the Owyhee National Forest but the proposal was not accepted by the legislators and the problems continued.

The ranchers organized behind the effort that resulted in the passage of the Taylor Grazing Act in 1934 as a continuation of their efforts to control abuses by "tramp" operators on the public range. This effort is detailed in "Owyhee Trails" by Mike Hanley with Ellis Lucia, 1973. As detailed by Hanley and Lucia:

> "For years, great concern had been expressed by ranchers over the future of the range itself, not only in Jordan Valley but in other parts of this I-O-N

> territory, which had been 'over-grazed to such an extent that the open range was almost a desert.' It wasn't merely a problem with sheep, although they were the most noticeable. Cattlemen were also abusers of the range, and so were horse owners who turned their herds onto the public domain. But at least in the beginning, the so-called 'tramp operator' was the principal offender."

As Hanley and Lucia point out in their book, passage of Taylor Grazing gave the power to control the unbridled use of the range and in the first year after passage, over 100,000 sheep were prevented from grazing on Soldier Creek. While these first year number reductions are significant in terms of reduced effect on range resources, it should not be forgotten that the primary purpose of the act was to provide stabilization of the livestock industry by providing for use by only those operators who operated from private "base properties" associated with the adjacent federal range lands. The Act authorized the Secretary to issue grazing permits on a preferential basis with preference to be given to those "land owners engaged in the livestock business, bonafide occupants or settlers, or owners of water or water rights." 43 U.S.C. § 315 (b). The Secretary was authorized to take action to stabilize the livestock industry which was recognized as necessary to the national well being.

In its passage of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1701 et seq., the Congress did not limit, restrict, or amend the purposes and provisions stated in the Taylor Grazing Act. The Congress has continued to support and validate the principles of the Taylor Grazing Act as it has passed other federal land legislation, for example the Public Rangelands Improvement Act of 1978. In accordance with these Federal Acts—The Taylor Grazing Act, The Federal Land Policy and Management Act and The Public Rangelands Improvement Act – the Bureau of Land management is required to preserve the stability of the western livestock industry and to proved for multiple use management including necessary range improvements for the benefit of livestock production, wildlife habitat, watershed protection, and recreation.

Irrigation began early in the Duck Valley area, and white peoples' use of water upstream from the reservation encroached on the water (McKinney 1983). By the 1909-1928 period, the encroachments on the upper Blue Creek had so limited the water available to the Duck Valley people that in 1928 the tribes abandoned their developments on reservation land along that tributary (McKinney 1983).

4.2.1.8 Current Native American Use of Plants, Terrestrial Animals and Fish

The Shoshone-Paiute people of the Duck Valley Reservation continue to use an extensive array of animals, birds, fish, and plants for a wide variety of purposes. The tribe obtains food and medicine for people and domestic animals; clothing; ornaments; fuel; weaving; baskets; tools such as bows and arrows; ceremonial objects and structures; and spiritual purposes (Shoshone-Paiute Department of Habitat, Parks, Fish & Wildlife Files 1998).

Hunting activities continue to collect deer, antelope, bighorn sheep, elk, cougars, foxes, groundhogs (marmots), ground squirrels, porcupines, rabbits and hares, raccoons, minks, weasels, ducks, geese, swans, eagles, hawks, woodpeckers, sagehens, magpies, and doves. The tribe also uses ants, crickets, snakes and other reptiles and amphibians. Fishing activities include the non-anadromous species that are available in the basin such as redband trout, cutthroat trout, rainbow trout and suckers. Anadromous salmon are not available in the basin today, so tribal members generally rely on resident trout populations for fishing opportunities on the reservation. The only alternative for tribal members to fish for salmon at present would be to travel to below the Hells Canyon Dam Complex or into another river basin . Many plants are still collected for food such as wild potato (yampa), wild carrot, balsam root, and wild onion. Other plants typically collected are sage, various berries, willows, all kinds of trees, grasses, and thistles (McKinney 1983, p. 6-7; Shoshone-Paiute Department of Habitat, Parks, Fish & Wildlife confidential files 1998).

Plant and animal resources are integral to every traditional practice, and every traditional practice may have associated songs, stories, prayers, and other forms of language and knowledge. Therefore, these natural resources are essential to the traditional culture (Shoshone-Paiute Department of Habitat, Parks, Fish & Wildlife confidential Files 1998).

4.2.2 Current Social, Economic & Cultural Use

Currently very little infrastructure exists in the Owyhee Subbasin for commerce, with the exception of agriculture. The infrastructure with respect to power generation, municipal and industrial water supply, sewage treatment, production of goods and services, and transportation is at minimal levels within the subbasin.

4.2.2.1 Water Use

Irrigation accounted for the greatest use of surface and ground water throughout the Owyhee Subbasin. Maximum water use for irrigation occurs in the Lower Owyhee, Jordan and South Fork Owyhee HUCs. Surface water is the source of most of the water used in the subbasin.

Development and Benefits from the Owyhee Project[4]

The 1862 discovery of gold brought miners and pioneers to the arid desert lands of southeastern Oregon and southwestern Idaho. Farms developed in nearby river valleys where water was easily obtained. By the early 1900s, private diversions from the

[4] This section is from Bureau of Reclamation public awareness literature.

Owyhee and Snake Rivers irrigated about 6,000 acres used to produce fruit and alfalfa and raise livestock. As more people came to the region, farmers developed land farther from the rivers.

Private organizations became interested in developing a reservoir to provide late-season irrigation water and to irrigate additional lands at higher elevations. But, private interests were unable to raise enough money to build a dam at one of these remote sites or to develop a large-scale irrigation project.

To assist farmers with irrigation development, Congress passed the Reclamation Act of 1902, establishing what is now the Bureau of Reclamation. The Act specified that those who receive irrigation water from Reclamation projects would pay part of the costs for constructing, operation, and maintaining those projects. From 1903 to 1905, Reclamation surveyed Owyhee River basin lands that had potential for irrigation.

Reclamation investigated various reservoir sites and irrigation plans while local farmers worked toward irrigating their land. Many pumped water directly from the river and a high cost of pumping led water users to enter into repayment contracts with Reclamation for the cost of constructing the Owyhee Project.

Image 1. Owyhee Dam and tailrace (source Bureau of Reclamation -- http://www.usbr.gov/dataweb/html/owyhee.html).

Workers started building the project's only storage dam and canal system in 1928. Owyhee Dam (Image 2), standing 417 feet above the riverbed, ranked as the world's highest dam when it was completed in 1932. Engineers used the dam as a proving ground for the design and upcoming construction of the huge Hoover Dam (726 feet high) which, because of its size, would require new construction methods.

Project facilities delivered the first irrigation water in 1935. The canal system reached the entire project area by 1939, bringing more lands into production.

While the Owyhee Irrigation District still operates Owyhee Dam specifically for irrigation, the water is also used by fish and wildlife, recreationists, and three private power-plants. Flood protection became another valuable benefit.

Owyhee Irrigation District manages three private power-plants built on Owyhee Project facilities between 1985 and 1993. These power-plants generate a combined total of 15,000 kilowatts of electricity used by power customers in Idaho and Oregon.

The drainage basin upstream from Owyhee Dam contains more than 11,000 square miles and has an average annual runoff of about 860,000 acre-feet. Up to 100,000 acre-feet of reservoir space in Lake Owyhee is used to reduce downstream flooding along the Owyhee and Snake Rivers.

The project consists of Owyhee Dam, the 53-mile-long Lake Owyhee, pipelines, tunnels, 9 pumping plants, and more than 900 miles of canals and drains. The Owyhee Irrigation District, in cooperation with the South Board of Control, operates and maintains the project facilities. Reclamation cooperatively works with other agencies to improve steamflow and water quality.

Fertile lands, a favorable climate, and a good irrigation water supply produce abundant crops on more that 118,000 acres west of the Snake River in Malheur County, Oregon, and Owyhee County, Idaho. Onions, grains and forage, sugar beets, potatoes, beans, and sweet corn and alfalfa seed are all grown on project lands. This crop production is closely tied to agricultural products, processing, marketing, and transport industries around Ontario, Oregon, and Boise Idaho. Livestock and dairy industries use these crops and contribute millions of dollars to the local economy (Table 4.1).

Table 4.1. Yearly value of the Owyhee Project (Figures from US Department of the Interior Bureau of Reclamation 2003)

Irrigated Crops:	$97.5 million
Livestock Industry:	$58.5 million
Recreation: 45, 000 visits:	$1.3 million
Flood Damage Prevented:	$575,000

Owyhee Irrigation District (OID) Operations[5]

[5] The primary source of this section is the Owyhee Irrigation District Water Management/Conservation Plan (2002).

Owyhee Dam provides up to 715,000 acre-feet (a-f) of irrigation water storage in Lake Owyhee (Owyhee Irrigation District Water Management/Conservation Plan 2002). The main diversion of the Owyhee Project is at Owyhee Dam. The main diversion works at the dam consists of a horseshoe type tunnel 16 feet-7 inches in diameter and 3.5 miles long. The gated tunnel entrance is in Lake Owyhee at Owyhee Dam 80 feet below maximum normal water surface. It supplies water by gravity to the north and south canals, and to the Ox Flat Division via the Malheur River siphon.

- **North Canal** – extends from the diversion works, located 3.5 miles from Owyhee Dam, and northward 61.5 miles to the Snake River near Weiser, Idaho. (capacity 1,190 cubic feet per second). The canal contains several siphons and tunnels. The most noteworthy structure is the Malheur River Siphon (4.3 miles in length), which carries water from the Mitchell Butte Division across the Malheur Valley to the Dead Ox Flat Division (capacity 325 cubic feet per second).
- **South Canal** – extends from the diversion works, located 3.5 miles from Owyhee Dam, through a five-mile tunnel an then southward 37 miles to the Snake River south of Marsing, Idaho (capacity 490 cubic feet per second). This water is managed by the South Board of Control.

In addition to the diversion works at Owyhee Dam, there are four pumping plants that divert water from the Snake River to different areas with the district. The Dead Ox Pumping Plant is located on the Snake River about 5 miles north of Payette, Idaho delivers water to several areas in the Dead Ox Flat Division of the district. The Dead Ox pumping plant has five pump units with a total capacity of 176 cubic feet per second.

The Owyhee Ditch and Ontario-Nyssa Pumping Plants, located on the Snake River about 5 miles south of Nyssa, deliver water to areas within the Mitchell Butte Division of the district. The Owyhee Ditch Pumping Plant has a capacity of 222 cubic feet per second and the Ontario-Nyssa Pumping Plant has a capacity of 130 cubic feet per second.

Power from the Southern Idaho Federal Power System is transmitted over lines of a private power company to various points on the Owyhee Project. A project transmission line extends 19.4 miles from Ontario-Nyssa substation at Dunaway, Oregon, to Owyhee Dam. In the 1980´s, the water users began pursuing development of hydroelectric power generating facilities on the Owyhee Project and obtained Federal Energy Regulatory Commission licenses to construct and operate three power-plants. These included a 5,000 kilowatt power-plant at Owyhee Dam, using power outlet facilities installed during construction, an 8,000 kilowatt power - plant at Tunnel No. 1, the major diversion works for the project, and a 2,000 kilowatt power-plant on the Mitchell Butte Lateral. These power-plants were placed in operation between 1985 and 1993.

Project works, except Owyhee Dam and related works which were retained and operated by the Bureau of Reclamation were transferred to the water users (represented by the North and South Boards of Control) in 1952 for operation and maintenance. Two years later, Owyhee Dam and related works also were transferred to a Joint Committee comprised of representatives of the North and South Boards of Control for operation and maintenance. On July 14, 1989, all irrigation entities of the North Board of Control merged into the Owyhee Irrigation District and the North Board of Control was dissolved. Owyhee Dam is now operated by the Owyhee Irrigation District in cooperation with the South Board of Control.

A flood control criterion has been developed, but it is informal and advisory only. Under these criteria, a minimum of 70,000 acre-feet of space is maintained in Owyhee Reservoir through February and more space is maintained beginning in January if the inflow forecast is large.

The Owyhee Reservoir has 100,000 acre feet of capacity assigned to flood control. The Owyhee Project has provided an accumulated $33,010,000 in flood control benefits from 1950 to 1998.

Owyhee Reservoir is a long, narrow reservoir with about 150 miles of shoreline, located in a canyon of rugged and spectacular beauty. Water quality varies tremendously between high elevation creeks, streams, and springs and the lower Owyhee River. Water diverted from higher elevations within the Owyhee River watershed and stored in Lake Owyhee is normally very high quality. High runoff events in the winter and early spring do cause some sediment to be flushed into the Owyhee River and Lake Owyhee, however, most of the sediment entering Lake Owyhee is settled out before water is diverted into the canal systems. The lake is in a remote area but, because of an excellent warm-water fishery, it experiences heavy recreational use. Lands around the reservoir are mostly public lands under control of the Bureau of Land Management. Boat ramps are provided at four locations, two operated by the Oregon State Parks system, and two operated by Malheur County Waterworks. The lake also provides excellent waterfowl hunting, and the surrounding hills and canyons offer many opportunities for the pursuit of upland game birds. A variety of wildlife may be observed in the reservoir area, including wild horses, bighorn sheep, golden eagles, pelicans, and cormorants.

Much of the water in the Owyhee Project – originating from the Owyhee River – is diverted out of the Owyhee Subbasin for irrigation of crops in the Malheur Subbasin. This fact should be noted for interpretation of the subsequent discussion of crop production in the Owyhee Irrigation District. Detailed water right maps showing the location of irrigated acres, resulting from the Owyhee Project diversions, are available in the Owyhee Irrigation District office and at the Oregon Water Resources Department. These maps provide final proof survey for beneficial use. The final proof survey maps were not included in the Owyhee Irrigation District Water Management/Conservation Plan (2002) due to the number of maps that would be required.

The Owyhee Irrigation District distribution system is summarized in Table 4.2.

Table. 4.2. Owyhee Irrigation District water distribution system facilities.

Delivery System Component	Total Length in Miles
Tunnels-	7.7
Canals-	172
Unlined	147
Bentonite Lined	17
Concrete Lined	8
Laterals	543
Unlined	455
Bentonite Lined	2
Concrete Lined	11
Converted to Piplines	75
Gravity Pipelines-	75
Siphons-	8
Drains-	227

The Owyhee Irrigation District controls release of stored water during the irrigation season from Lake Owyhee. All releases of stored water during the irrigation season from Lake Owyhee are measured. There are no return flows entering Owyhee Irrigation District from any other irrigation district. There are many out flow points from the district. Main drainage canals within the district provide outlets for on-farm surface and subsurface drainage systems. Approximately 30 percent of the water entering main drainage canals is reused within the district for irrigation, improving the overall district water use efficiency. Delivery records include the reuse of the return flows. The mean and range (low-high) volume of water diversions for the Owyhee Irrigation District is summarized below (Table 4.3).

Table 4.3. Seasonal water diversion (source: Owyhee Irrigation District records).

Characteristic (Representative Year)	Total Seasonal Water Diversion (Acre-Feet)	Acreage planted to irrigated crops	Description
Average (1995)	353,426 a-f	--	The 1995 year was selected to represent the average water supply based on Owyhee Irrigation District water use records from 1992 to 2001. Specific irrigated acreage was available for that year.
Low (1992)	213,476 a-f	56,592 acres	There was a severe drought condition during 1992 and the water supply was not available to meet the planned crop irrigation requirement. If an adequate water supply was available to meet the crop irrigation requirement in the drought year of 1992 it would have probably been a high water supply year.
High (1999)	428,886 a-f	62,933 acres	A high water supply year does not mean that water is "wasted" – acreage in production varies each year and factors such as above-normal seasonal crop evapotranspiration may result in increased crop needs.

4.2.2.2 Current land use

Predominant current land uses in the subbasin include ranching, irrigated agriculture and recreation (Table 4.4).

Table 4.4. Habitat types and land uses in the Owyhee subbasin (USGS data; Perugini et al. 2002).

Description	Acres	Kilometers^2	Miles^2	Percent
Open Water	26,300	106	41	0.373
Perennial Ice/Snow	13	0	0	0.000
Low Intensity Residential	176	1	0	0.002
High Intensity Residential	6	0	0	0.000
Commercial/Industrial/Transportation	5,503	22	9	0.078
Bare Rock/Sand/Clay	48,995	198	77	0.696

Description	Acres	Kilometers^2	Miles^2	Percent
Quarries/Strip Mines/Gravel Pits	193	1	0	0.003
Transitional	129	1	0	0.002
Deciduous Forest	12,969	52	20	0.184
Evergreen Forest/Western Juniper	243,839	987	381	3.462
Mixed Forest	306	1	0	0.004
Shrubland	5,806,647	23,499	9,073	82.439
Grasslands/Herbaceous	686,788	2,779	1,073	9.751
Pasture/Hay	188,049	761	294	2.670
Row Crops	3,934	16	6	0.056
Small Grains	14,259	58	22	0.202
Urban/Recreational Grasses	60	0	0	0.001
Woody Wetlands	5,441	22	9	0.077
Totals	7,043,605	28,505	11,006	100.000

4.2.2.2.1 Transportation

While the Owyhee Subbasin does not contain any large urban areas, it does have relatively high road densities in some areas (Figure 4.1; Perugini et al. 2002). However, in the Owyhee Subbasin, road density may not be a good indicator of the intensity of land use because many "roads" are small un-maintained dirt roads and jeep trails that are infrequently used. There are many gravel and dirt roads on BLM lands, private ranches and farmed areas near the river's confluence with the Snake.

State Highway 51 in the northeast/southeast portion of the subbasin and U.S. Highway 95 in Oregon are the two paved highways in the Owyhee Subbasin. Comparable information was not gathered relative to road densities within Malheur County, Oregon and Elko County, Nevada.

New "cross-country" trails have been created in recent years by motorcycles and all-terrain-vehicles across the landscape. Diverse interests within the Owyhee Subbasin are concerned that many of these new cross-country trails serve as "gateway roads" – allowing dirt bikes and off-road vehicles to carve new routes across this remote landscape. These new illegal routes can fragment important wildlife habitat, destroy sensitive plant species and displace sensitive wildlife.

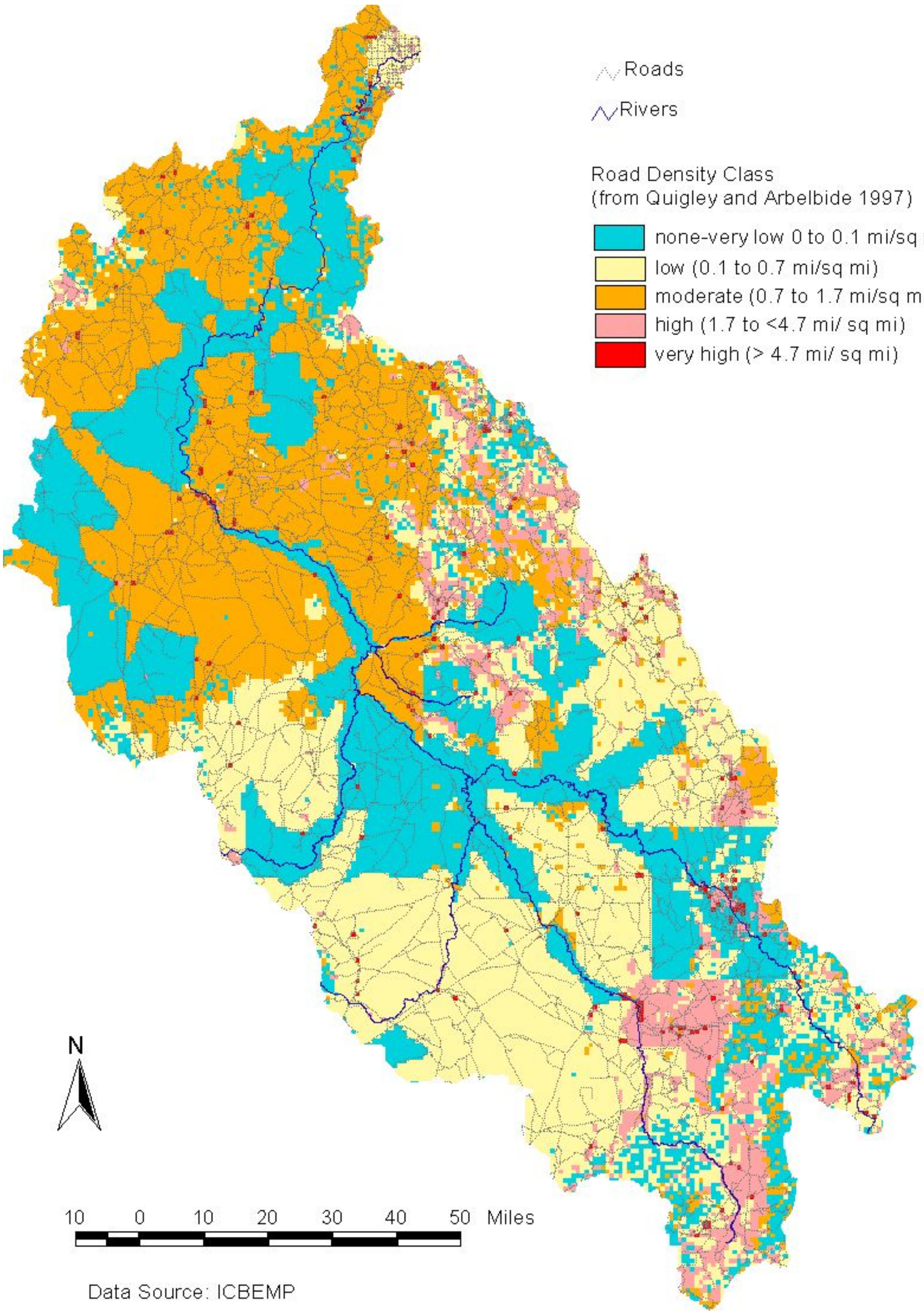


Figure 4.1. Road densities in the Owyhee subbasin (Perugini et al. 2002).

4.2.2.2.2 Mining

The development of the most significant gold mining district in Idaho, the Boise Basin, occurred in 1862. Once gold was discovered along Jordan Creek, mining activities spread throughout the subbasin. Unlike many placer mining districts, millions of dollars were invested in Owyhee underground mines and mills, assuring a long future for mining in the area (Idaho Mining Association 1998). Mining activities were concentrated in the upper watershed and in the Jordan Creek area (Figure 4.2). Silver City is the best-known mining district in the subbasin. This district was a major gold and silver producer, generating more than $60 million in precious metals by 1899 (D.A. Wright; B Tompkins web pages; Perugini et al. 2002).

In addition to gold and silver, a wide variety of products were extracted, including gemstones, metals, minerals, geothermal resources and mercury (Figure 4.2). Current mining activities (producing mines) are concentrated in the lower and central portions of the subbasin. Sand and gravel are the primary products extracted. Gold mining still occurs in the Nevada portion of the subbasin (USDI 1998).

One of the larger inactive mines in the subbasin is located in the historic DeLamar Mining District. The mine is currently in the process of reclamation, and a plan is filed with IDEQ. Since 1976, the mine operated continuously until recently. The last ore was processed in 2002. On average, 35,000 tons of rock was mined daily, and an average of 3,000 tons of ore was milled and treated with cyanide onsite for the recovery of gold and silver (Perugini et al. 2002). Ore from a satellite mine at nearby Florida Mountain was transported to and milled at the DeLamar site (BLM 1999).

Information collected to-date indicates that there are no economically recoverable oil or gas reserves in the subbasin (USDI 1999, USDI 1998). The geothermal potential of the area is considered to be high, but for direct use only, because water temperatures are not high enough for electricity generation (USDI 1999). Mineral materials such as sand, rock, and gravel are present in enormous quantities within the subbasin, with known reservoirs covering 45,000 acres (BLM 1999). The use of these materials is expected to grow in response to the rapidly expanding population of the Boise/Treasure Valley metropolitan area.

Impacts of mining activities on natural resources are variable and depend on mine size and location, mining methods, products being mined, and a number of other factors. Some species (e.g. bats) may benefit from the creation of mines. Typically, both aquatic and terrestrial biota are negatively affected. The most common influences of mining activities on aquatic resources involve the production of acidic wastes, toxic metals, and sediment (Perugini et al. 2002; Nelson et al. 1991).

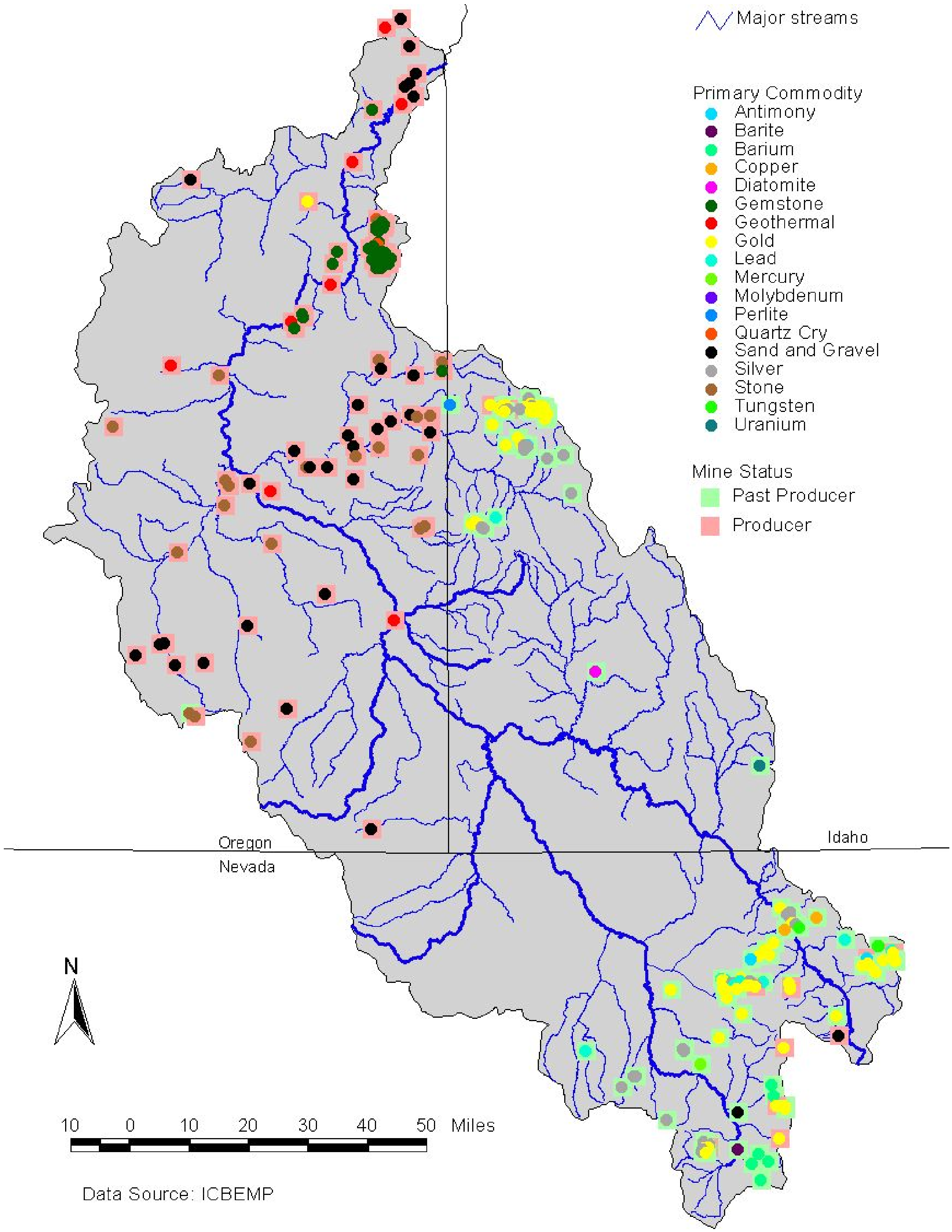


Figure 4.2. Current and historic mines in the Owyhee Subbasin (Perugini et al. 2002).

4.2.2.2.3 Recreation

Recreational opportunities in the Owyhee subbasin include boating, horseback riding, motorized recreation, photography, hunting, fishing, hiking, rock climbing, camping, and all other outdoor recreation. More than 41,000 people use the area annually according to a 1991 study by Boise State University (Perugini et al. 2002). The Duck Valley Indian Reservation also provides excellent recreational opportunities. Trout fishing in three main reservoirs – Lake Billy Shaw, Sheep Creek, and Mountain View – is one of the primary recreational uses (Tim Dykstra, Personnal communication, May 2004). In addition, the Reservation provides other recreational opportunities such as guided pronghorn hunts, birdwatching, and horseback riding.

Rafting on the Owyhee River is becoming increasingly popular. River use has increased ten-fold in the past decade, according to the BLM. Recreation use in the Owyhee Resource Area in Idaho was estimated at 162,682 visits in 1995 (BLM 1999). Recreational use is projected to increase by 70% by 2018 (BLM 1999); however we expect the increase to be much greater.

4.2.2.2.4 Urban and Industrial Development

There is no urban or industrial development in the Owyhee Subbasin.

4.2.2.2.5 Agriculture

Agriculture is confined primarily to the Duck Valley Indian Reservation, the area around the confluence of the Owyhee and Snake Rivers, Jordan Valley and Jordan Creek Basin (Perugini et al. 2002). Irrigated hay farming for cattle feed is the dominant crop. Row crop farming occurs in the northern portion of the subbasin near the confluence with the Snake River (Perkins and Bowers 2000).

Water uses within the Owyhee Irrigation District are 100% for irrigated agriculture (Owyhee Irrigation District Water Management/Conservation Plan 2002). Benefits of fertile lands and favorable climate, combined with a good supply of irrigation water, make possible the production of abundant crops on the Owyhee Project – principally grain, hay, and pasture, sugar beets, potatoes, onions, sweet corn, and alfalfa seed. Livestock and dairy products contribute to the returns from the land.

Acreage of Commonly Grown Crops

Types of crops and acreage for irrigated cropland for a typical crop year are displayed in Table 4.5. The information in this section pertains to Owyhee Irrigation District, which includes statistics for an area that extends beyond the boundaries of the Owyhee Subbasin. For any given year, crops change in many of the specific fields, therefore it is meaningless to display crop information by field for a specific landowner due to the annual change in cropping patter (i.e. rotation). The crops and acreage shown in Table 4.8 are based on the average cropped acres from 1992 to 2001. According to Owyhee Irrigation District crop production and water utilization records, the maximum acreage planted to irrigated crops within the district was 62,933 acres, which occurred in 1999. The minimum acreage planted to crops that were irrigated within the district was 56,592 acres, which occurred in 1992. There were many acres of idle or fallow ground that were not irrigated that year. Currently the maximum acreage that can be planted to crops within the district is 65,606 acres.

Table 4.5. Crops grown in a typical crop year within the Owyhee Irrigation District – showing maximum acreage in production. (Note: the Owyhee Irrigation District includes part of the Owyhee Subbasin and large area outside the Owyhee Subbasin).

Crop	Acres	% of Total Area
Alfalfa hay, Grass/Alfalfa hay, other	12,227	18.64%
Alfalfa seed	4,953	7.55%
Barley	2,349	3.58%
Beans, Dry	2,666	4.06%
Corn, Field	2,048	3.12%
Corn, Silage	2,375	3.62%
Corn, Sweet	1,605	2.45%
Fruit, All	168	0.26%
Misc. other crops	2,592	3.95%
Misc. seed crops	1,236	1.88%
Onions, Dry	4,638	7.07%
Pasture	5,582	8.51%
Peppermint, Spearmint	956	1.46%
Potatoes, early	416	0.63%
Potatoes, late	2,358	3.59%
Sugar Beets	5,676	8.65%
Wheat	8,438	12.86%
Fallow, idle, CRP, etc	5,323	8.11%
Total	**65,606**	**100%**

The crops listed for a typical crop year were used to determine crop evapotransipiration (ET) and irrigation requirement (IR). Field crops represent 48% of the total irrigated crops in Owyhee Irrigation District, i.e. hay, grain, and pasture which can be deficit irrigated with the results being reduced yield, rather than crop failure. Other higher value crops such as seed crops, corn, beans, potatoes, onions and sugar beets, all need a full season water supply to provide a marketable product. When late season water is available, and the soil profile is dry due to crop soil moisture withdrawal, some fields are irrigated to prepare the soil for fall seeding.

Average Crop Water Use

Oregon State University Extension Miscellaneous Publications 8530, Oregon Crop Water Use and Irrigation Requirements, October 1992 was used for the ET (Evapotranspiration) and IR (Irrigation Requirements) analysis in the Owyhee Irrigation District Water Management/Conservation Plan (2002). This publication contains consumptive use data for most of the crops being grown in the district. A 3.0 inch soil moisture carry-over was used for early spring moisture for average and high water supply year.

Some crops within the district, such as field crops of alfalfa/grass hay, grains, pasture, and even sugar beets, can be deficit irrigated with only a reduction in yield, where other crops simply cannot be deficit irrigated. An analysis will be included to display crop water needs for a full season water supply and percentage of deficit, by month. No attempt will be made to isolate deficit water supplies for specific crops. This would take a detailed survey and numerous evaluations of irrigation's actually applied on-farm from June through October, and actual yields from crops grown.

Maximum crop evapotranspiration (ET) and irrigation requirement (IR) typically occurs in July most years when the temperature is the highest, crop growth (foliage) and soil surface evaporation is the greatest and precipitation is the least. Major water use crops in the district are alfalfa-grass hay, pasture, sugar beets and wheat. Irrigation methods used within the Owyhee Irrigation District are summarized in Table 4.6

Table 4.6. Irrigation methods and systems used within the Owyhee Irrigation District.

Method	System	Percent of Total Irrigated Acres	Acres
Surface	Corrugation, Furrow, Border, and Flood	84.5%	50,939
Sprinkler	Periodic Move and Solid Set (side-roll, wheel line, hand move)	15.0%	9,042
Micro	Continuous tube drip line	0.5%	302
Total-		**100%**	**60,283**

Of the sprinkler-irrigated cropland on the district, nearly 100% is pressurized by on-farm pumping (electric and/or diesel) or gravity fed irrigation pipelines. Diesel engines are typically used for temporary solid set sprinkler systems for irrigating potatoes as they are rotated to different fields each year.

As a "water conservation measure" within the district, approximately 30% of surface irrigation tailwater runoff is reused. This water is collected in the district drain system and diverted to users within the district. When drain water is insufficient to meet delivery requirements, district ditch riders add to the flow by turning out additional water from the main canals. Accumulated unused water in the drain system is spilled into the Owyhee, Malheur or Snake Rivers. There are many locations of outflow from the district and none of them are measured.

There is a small amount of shallow subsurface flow that returns to drainage canals and side tributaries of the Malheur and Owyhee Rivers. A scientific investigation has not been done to analyze the source, but it is reasonably speculated this flow is most likely due to deep percolation from upslope surface irrigation and canal seepage. The flow is small, is not measured, and becomes a part of accumulated flows in the drainage system that are used for delivery within Owyhee Irrigation District or outleted into the Malheur, Owyhee and Snake Rivers. No action is planned in the near future to measure or determine the source of these subsurface flows.

Earthen canal and lateral seepage losses are relatively high and throughout the district's conveyance and delivery system. Many techniques for reducing seepage losses have been tried and several are in use. Techniques used include: concrete lining, shotcreting, incorporating betonite clay material and installing pipelines.

Transport losses within the district have been estimated to be as high as 30% in isolated reaches in canals, and 50% in isolated reaches in laterals (Table 4.7). Water lost to seepage enters ground water of which a portion becomes interflow entering the Malheur, Owyhee and Snake River Systems.

Table 4.7. Summary of estimated Owyhee Irrigation District water losses.

	Water Supply Year		
	Average(1995), AF	High(1999), AF	Low(1992), AF
Diversion	353,426	428,886	213,476
Spills	29,643	76,288	26,503
Transport Losses	113,167	116,213	64,490
Water Usage (On-Farm Delivery	210,616	235,713	122,483
Crop Water Use Needs (Irrigation Requirement)	136,986	143,413	136,036
On-Farm Losses	73,630	92,301	N/A

4.2.2.2.6 Bureau of Land Management PFC Assessments and Grazing Assessments/Allotments

Based on the combined assessment of BLM Proper Functioning Condition (PFC) data collected in Nevada, Idaho, and Oregon 46% of the 1,066 miles of stream sampled in the Owyhee Subbasin for are currently rated at Proper functioning condition. Specifically, 10% of the streams surveyed are reported as non-functioning and 44% are reported as functioning at risk (Table 4.8). Not all of the stream reaches within the Owyhee Subbasin have been assessed for PFC by BLM.

Table 4.8. Miles of stream within the Owyhee Subbasin within different categories of Proper Functioning Condition (total miles of stream equals 1,065.7).

Portion of subbasin	Miles of streams				
	Functioning at risk downstream	Functioning at risk upstream	Functioning at risk (no trend)	Non-functioning	Proper functioning
Idaho	8.7	23.2	329.0	78.6	231.4
Oregon	6.2	1.7	65.8	2.8	251.6
Nevada	27.9	7.6	2.8	22.3	6.1
Total	42.8	32.5	397.6	103.7	489.1

Loss of riparian vegetation is one cause of warming of water temperatures and a resultant shift in the fish species composition from coldwater to warmwater species, as indicated by reductions in salmonids and increases in non-game species (BLM 1999). Other important sources of elevated water temperatures is in some reaches there are natural warm springs and high ambient air temperatures.

The majority of the land located in the Owyhee Subbasin, is federally managed by BLM for multiple uses. Some of the uses that BLM manages for include livestock grazing, recreation, wildlife habitat, water quality, and other uses. The BLM produces allotment assessments. The Owyhee Planning and Technical Committees synthesized and reviewed these assessments in the subbasin planning process, but determined that they were not in a useable format for the subbasin plan. The Owyhee Planning and Technical Committees agreed it would be helpful to reformat this information for inclusion and implementation of future drafts of the "Owyhee Subbasin Plan". The committees also anticipate that this information will be used when developing strategies for restoration and protection projects within the Owyhee subbasin. In reviewing this information, the Owyhee Subbasin Planning Team took into account the diverse perspectives from stakeholders within the team, as well as input received at the public outreach meetings.

The Bureau of Land Management (BLM) conducts assessments of rangeland health for individual grazing allotments. In 1997, the BLM in Idaho adopted rangeland health standards. According to Nevada and Oregon assessments of rangeland health, these states also use the BLM rangeland health standards. There are eight standards, not all of which apply to a given parcel of land:

- **Standard 1: Watersheds:** Watersheds provide for the proper infiltration, retention, and release of water appropriate to soil type, vegetation, climate, and landform to provide for proper nutrient cycling, hydrologic cycling and energy flow.
- **Standard 2: Riparian Areas and Wetlands:** Riparian areas are in properly functioning condition appropriate to soil type, climate, geology, and landform to provide for proper nutrient cycling, hydrologic cycling, and energy flow.
- **Standard 3: Stream Channel/Floodplain:** Stream channels and floodplains are properly functioning relative to the geomorphology (e.g. gradient, size, shape, roughness, confinement, and sinuosity) and climate to provide for proper nutrient cycling, hydrologic cycling, and energy flow.
- **Standard 4: Native Plant Communities:** Healthy, productive, and diverse native animal habitat and populations of native plants are maintained or promoted as appropriate to soil type, climate, and land form to provide for proper nutrient cycling, hydrologic cycling, and energy flow.
- **Standard 5: Rangeland Seeding:** Rangelands seeded with mixtures, including predominately non-native plants, are functioning to maintain life form diversity, production, native animal habitat, nutrient cycling, energy flow, and the hydrologic cycle.
- **Standard 6: Exotic Plant Communities:** Exotic plant communities, other than seedings, will meet minimum requirements of soil stability and maintenance of

existing native and seeded plants. These communities will be rehabilitated to perennial communities when feasible cost effective methods are developed.

- **Standard 7: Water Quality:** Surface and ground water on public lands comply with the Idaho Water Quality Standards.
- **Standard 8: Threatened and Endangered Plants and Animals:** Habitats are suiTable 4.to maintain viable populations of threatened and endangered, sensitive, and other special status species.

Standards of rangeland health are expressions of the level of physical and biological condition or degree of function required for healthy, sustainable rangelands. Rangelands should meet applicable standards or be making significant progress. If the standards are met, there should be proper nutrient and hydrologic cycling, and energy flow. Current livestock grazing management is evaluated in these Assessments to determine if it maintains standards or promotes significant progress toward meeting the standards. For each standard, indicators are typical physical and biological factors and processes that can be measured or observed. These Assessments examine the indicators for each standard and use quantitative and qualitative information including inventory data, monitoring data, health assessment information or other observations to evaluate the current status of each indicator for each standard. Conclusions as to whether or not allotments are meeting or making significant progress toward meeting the standards is provided in separate determination documents based on information in the Assessments. Final determinations are based on all available information.

4.3 Approach for the Developing the Management Plan's Objectives & Strategies

The Owyhee Subbasin Planning process has a dual purpose, i.e., the successful completion of this process will result in two integrated outcomes:

1. A professional, comprehensive, and science-based fish and wildlife assessment and restoration plan for the Owyhee Subbasin; and
2. A comprehensive, locally-supported management plan for fish and wildlife resources within the Owyhee Subbasin.

The Owyhee Subbasin Plan (OSP) will serve as the conceptual and strategic basis for future implementation of the Northwest Power and Conservation Council's Columbia Basin Fish and Wildlife Program in the Owyhee Subbasin. Simply stated, the OSP is a Fish & Wildlife Plan for the Owyhee Subbasin. The OSP has the following desired attributes; it is:

- Consistent with all (62) Subbasin Plans being developed in the Columbia Basin.
- Based on scientific F&W assessment integrated with stakeholder input – to produce a locally supported F&W management plan.
- A basis for including Owyhee F&W restoration priorities into an amendment to the Council's Fish & Wildlife Program.
- Focused on actions to mitigate for F&W losses caused by federal dams.

Some local stakeholders have concerns that the Subbasin Planning process will regulate natural resources in the Owyhee Subbasin and thus restrict their local economy. The simple fact is that the Northwest Power and Conservation Council is not a regulatory entity and the provisions of Fish & Wildlife Plan, and the Subbasin Plans it subsumes, are not enforceable. Thus the OSP will not regulate the use of natural resources in the Owyhee Subbasin – it will not regulate or enforce: air quality; water or quantity (storage reservoirs, irrigation or water rights); land management; forestry; or grazing. In short, it will not regulate land owners activities on private lands

Similarly, state and federal agency representatives should not view the Subbasin Plans as a competing or duplicative planning process relative to their management plans for species or land areas under their jurisdiction. The OSP

- is not an ESA recovery plan,
    - it does not displace the authority or responsibilities of USFWS or NMFS;
- is not a Hydro Operations plan,
    - it does not displace the authority or responsibilities of IPC, BOR or FERC;
- is not a Federal Land mgt. plan,
    - It does not displace the authority or responsibilities of BLM or USFS.

4.3.1 The Vision Drives the Strategic Plan for the Owyhee Subbasin Management Plan

The planning elements (i.e., vision, goals, objectives, strategies, action plans) comprise the structure or "framework" built on the foundation of scientific knowledge. Under the unifying Columbia Basin Vision of the Council's Fish & Wildlife Program, the Owyhee subbasin Planning Team has developed a consistent subbasin-specific Vision. The Owyhee Subbasin Plan Vision statement:

"We envision the Owyhee Subbasin being comprised of and supporting naturally-sustainable, diverse fish and wildlife populations and their habitats, that contribute to the social, cultural, and economic well-being of the subbasin and society."

Under the Vision are multiple goals, e.g., for fish, wildlife and their habitats. Likewise, under each goal, there are several measurable Objectives, and under each objective a set of numerous Strategies, etc. – thus the pyramidal shape of the framework illustrated in Figure 4.3.

Figure 4.3. -- Hierarchical strategic planning framework with a scientific foundation -- with Monitoring & Evaluation to provide for Adaptive Management.

During the development of the OSP fish & wildlife management plan it is important to have a common understanding of definitions and linkages of the strategic elements. The strategic planning elements of the Owyhee Subbasin Management Plan are described as follows:

- ⇒ VISION -- Clearly describes the desired future for fish & wildlife within the Owyhee Subbasin
- ⇒ OBJECTIVES – Explicit, quantifiable and achievable F&W targets
- ⇒ STRATEGIES -- Clear problem-solving approaches to restoration and protection

The Management Plan integrates the limiting factors analysis from the Assessment with current status of fish & wildlife restoration from Inventory. The following graphic illustrates how the Assessment & Inventory are integrated with the Management Plan (Figure 4.4).

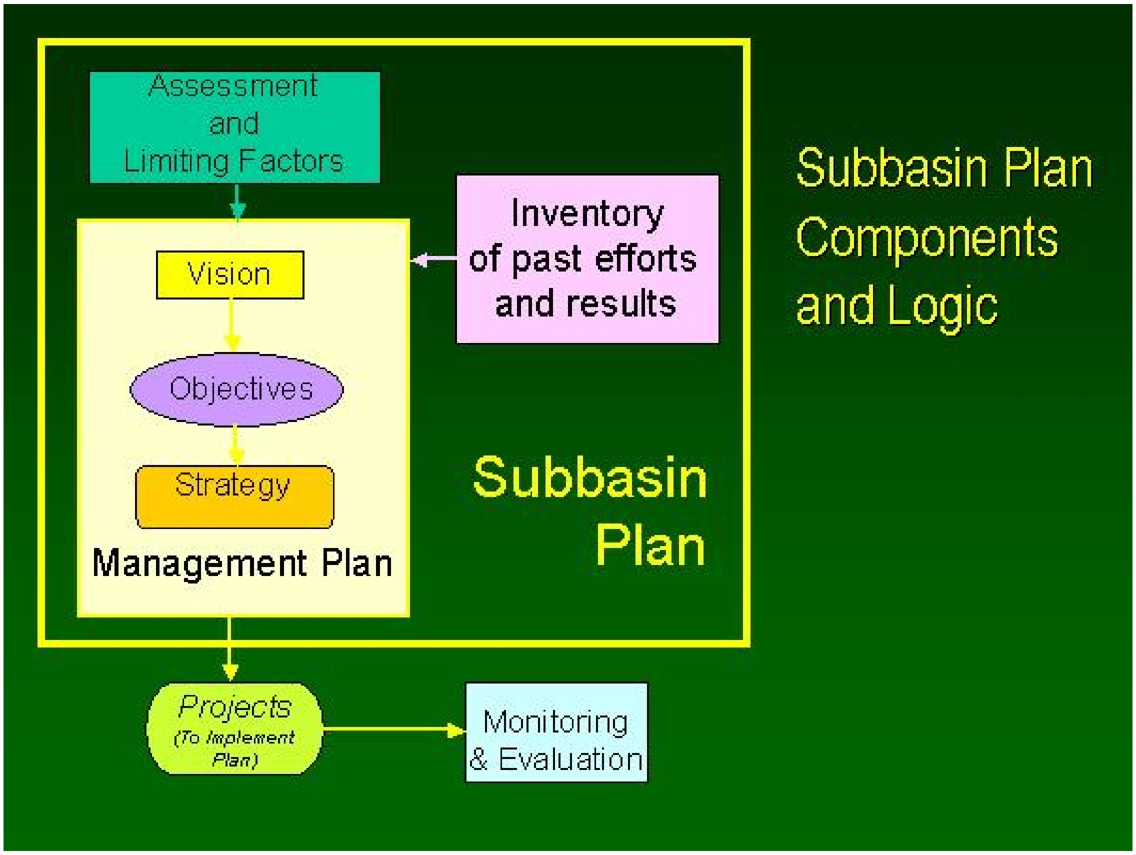


Figure 4.4. Flow chart of the logical connection between the components of the Owyhee Subbasin Plan (source: ISRP (2004) presentation).

4.3.2 Specific Approach for Implementation – Near Term (3-5 years) Objectives and Strategies

For the short-term implementation of this plan, the project sponsor will coordinate with all individuals / entities affected on a project specific basis. The following global near-term strategic initiatives outline the implementation approach for the Owyhee Subbasin Management Plan:

1. **Continue implementation of ongoing project's objectives, strategies, actions.**
2. **Begin implementation of the Owyhee Subbasin M&E Plan.**

These two strategic initiatives are explained in more detail in the following section:

1. **Continue implementation of ongoing projects.**
   1.1. Build on the strength of the objectives, strategies and actions incorporated into successful ongoing projects (2005-2007).
   1.2. Refine or terminate projects shown to be ineffective based on the OSP M&E.
   1.3. Build integral M&E components into revised or new projects that are compatible with the Global OSP M&E Approach.

2. **Begin implementation of the Owyhee Subbasin M&E Plan**
   2.1. The Owyhee Subbasin Plan will recommend funding of the Subbasin M&E Plan in the near future (2005-2007)
   2.2. The M&E Plan will be the basis for Adaptive Management of the OSP Implementation
   2.3. The M&E Plan will be updated and revised as more specifics are developed on the Objectives and Strategies over the long term

4.3.3 Approach for Long Term – the next 10 years (2008-2017)

- Adaptive Management – Evaluate continued funding of ongoing projects based on results quantified via the Owyhee Subbasin M&E Plan – update OSP every 5-years
- Move more & more towards implementing science-based objectives & strategies based on cause-effect Hypothesis testing, measurable performance standards and integration with TMDLs, RMPs & ESA.

The desired future for the implementation of the Owyhee Subbasin Plan is one of cooperation, successful restoration actions, and benefits to all stakeholders. We are working towards a "win-win" solution for Fish & Wildlife Restoration in the Owyhee Subbasin that results in the following outcomes:

- Fish, Wildlife and Habitat are restored to naturally sustainable levels;
- The Rights & Responsibilities of all entities and stakeholders are respected; and,
- Local people and society benefit.

4.3.4 Development of a short-term (3 year) and long-term (10 year) Budget

The short-term (3 year) BPA-funded budget – for fiscal years 2005, 2006, and 2007 – needed to implement the Owyhee Subbasin Plan is presented in Table 4.9.

Table 4.9. Fiscal year 2004 and outyear (2005-2007) budget projections for Owyhee Subbasin fish & wildlife projects funded by Bonneville Power Administration.

Project Number / Title	Project Phase	2004	2005	2006	2007
SPT200302600 Wildlife Inventory and Habitat Evaluation of Duck Valley Indian Reservation	Monitoring and evaluation	$120,010	$ 23,869	--	--
	Total Outyear Budgets	**$120,010**	**$ 23,869**	--	--
SPT199701100 Enhance and Protect Habitat and Riparian Areas on the DVIR	Planning and design	$ 10,000	$ 10,000	$ 10,000	$ 10,000
	Construction/implementation	$140,000	$145,000	$150,000	$155,000
	Operations and maintenance	$100,000	$105,000	$110,000	$120,000
	Monitoring and evaluation	$110,000	$115,000	$120,000	$125,000
	Total Outyear Budgets	**$360,000**	**$375,000**	**$390,000**	**$410,000**
199505703 Southern Idaho Wildlife Mitigation - Shoshone-Paiute Tribes	Planning and design	$171,347	$178,201	$185,329	$192,741
	Construction/implementation	$570,000	$1,704,000	$600,800	$1,709,000
	Operations and maintenance	$ 60,000	$100,000	$104,000	$144,000
	Monitoring and evaluation	$ 30,000	$ 35,000	$ 40,000	$ 45,000
	Total Outyear Budgets	**$831,347**	**$2,017,201**	**$930,129**	**$2,090,741**
199501500 Lake Billy Shaw Operations and Maintenance and Evaluation (O&M, M&E)	Planning and design	$ 55,000	$ 60,000	$ 40,000	$ 40,000
	Construction/implementation	$ 65,000	$ 67,000	$ 70,000	$ 80,000
	Operations and maintenance	$ 74,000	$ 79,000	$ 84,000	$ 89,000
	Monitoring and evaluation	$ 50,000	$ 55,000	$ 60,000	$ 65,000
	Total Outyear Budgets	**$244,000**	**$261,000**	**$254,000**	**$274,000**
198815600 Implement Fishery Stocking Program Consistent With Native Fish Conservation	Construction/implementation	$150,000	$155,000	$160,000	$160,000
	Operations and maintenance	$ 25,000	$ 27,000	$ 29,000	$ 32,000
	Monitoring and evaluation	$ 34,000	$ 36,000	$ 38,000	$ 45,000
	Total Outyear Budgets	**$209,000**	**$218,000**	**$227,000**	**$237,000**
199800200 IDFG Native Trout Assessment	Construction/implementation	$360,000	$375,000	$390,000	$406,000
	Operations and maintenance	**NA**	**NA**	**NA**	**NA**
	Monitoring and evaluation	**NA**	**NA**	**NA**	**NA**
	Total Outyear Budgets	**$360,000**	**$375,000**	**$390,000**	**$406,000**
OSP M&E Plan	**(refer to § 4.6)**		**$800,000**	**$450,000**	**$400,000**
Total – All Projects		**$2,124,357**	**$4,070,070**	**$2,641,129**	**$3,817,741**

The total amount needed to fund short-term (3 year) Owyhee Subbasin Management Plan – for fiscal years 2005, 2006, and 2007 – is $10,528,940. This total three-year cost is broken out, by category, as follows:

- ONGOING SHOSHONE-PAIUTE TRIBES PROJECTS (SUBTOTAL) $7,707,940
- ONGOING IDFG NATIVE TROUT ASSESSMENT 199800200 $1,171,000
- OWYHEE SUBBASIN PLAN M&E (AS PROPOSED IN § 4.6) $1,650,000

TOTAL 3-year budget for seven ongoing & proposed projects: **$10,528,940**

Based on the average annual implementation cost of $3,509,647 (rounded off to $3.5 million), the long-term out year budget to implement the Owyhee Subbasin Plan for the subsequent ten years would be:

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
$3.5 M	$3.6 M	$3.7 M	$3.8 M	$3.9 M	$4.1 M	$4.2 M	$4.3 M	$4.4 M	$4.6 M

These rough annual cost estimates are based on an annual inflationary rate of three percent (3%). Obviously, this long term projection is only approximate and would be revised as the Owyhee Subbasin plan was updated according to the 3-year Provincial Review cycles and 5-year Fish & Wildlife Program amendment cycles – and specific strategies/projects are implemented according to Adaptive Management principles.

4.4 Biological Objectives and Prioritized Strategies

4.4.1 Aquatic Objectives and Strategies

Goals represent broad policy direction; e.g., improve stream habitat conditions and the survival conditions of target fish species. Management objectives should (a) describe the direction and purpose of fish and wildlife recovery efforts, (b) address the question of why restoration programs consist of a given set of strategies and actions, and (c) describe the desired biological state for the subbasin in regard to ecosystem characteristics, defining species and management actions (Science Review Team 1996). Different management objectives and ecological relationships can be accommodated by simply moving up or down levels from the Basin to the subbasin levels. Development of management objectives is an iterative process that cycles between what is desired for watersheds and what is possible given ecological, social and economic constraints. Biological objectives are measurable objectives that are adopted by the Northwest Power and Conservation Council and incorporated into its Fish & Wildlife Program.

Strategies are the methods to achieve goals and objectives. Overall, fisheries management has relatively few major methods available to protect and enhance fish populations or alter fish communities. Fish managers in the upper-Columbia Basin have eight global categories of tools at their disposal (Table 4.10). Not all of these strategies are deemed appropriate for the Owyhee Subbasin. The Council's subbasin planning process is focused mainly on habitat restoration strategies.

Table 4.10. Major tools available to Columbia Basin fish managers -- to achieve goals and objectives (Source MYIP 1196).

Major Tool	Subsets	Use
1. Planning & Modeling	Planning	Program implementation
	Models: individual / population / community / system	Test research hypotheses
2. Research, M&E	Genetic	Species / population diversity
	Biological	Understand processes
	Stock Assessment	Status / population dynamics
	Ecological	Test cause / effect
	Monitoring & Evaluation	Test management actions
3. Habitat / Watershed	Reserves	Conservation
Restoration	Alterations	Restoration / Nat. Production
4. Artificial Production	Wild Brood Stock	Genetic Conservation
	Hatchery stock	Production / harvest
5. Species Alteration (+/-)	Removal	Reduce predation, competition
	Introductions	Restoration, mitigation
	Habitat restoration	Favor native assemblages
6. River System Changes	River / reservoir operations	Normative river
	Dam alterations	Solve specific problems
7. Enforcement	Fisheries regulations	Protect / exploit / alter
	Habitat & environmental laws	Protect
8. Public Awareness	Inform / Involve	Long term societal solutions

In the planning phase, fish & wildlife management objectives are developed from the Council's vision of a healthy Columbia River and basin-wide viable fish & wildlife populations, and the specific Owyhee Subbasin Vision of naturally-sustainable, diverse fish and wildlife populations and their habitats within the subbasin. During the implementation phase, specific measurable biological/ecological objectives and performance standards are formulated. Fisheries management tools are then used to transfer these objectives into actions -- specific strategies that are implemented as restoration projects (Figure 4.4). Statements of Work incorporate specific "Action Plans" that are detailed descriptions of how strategies will be implemented on an operational basis.

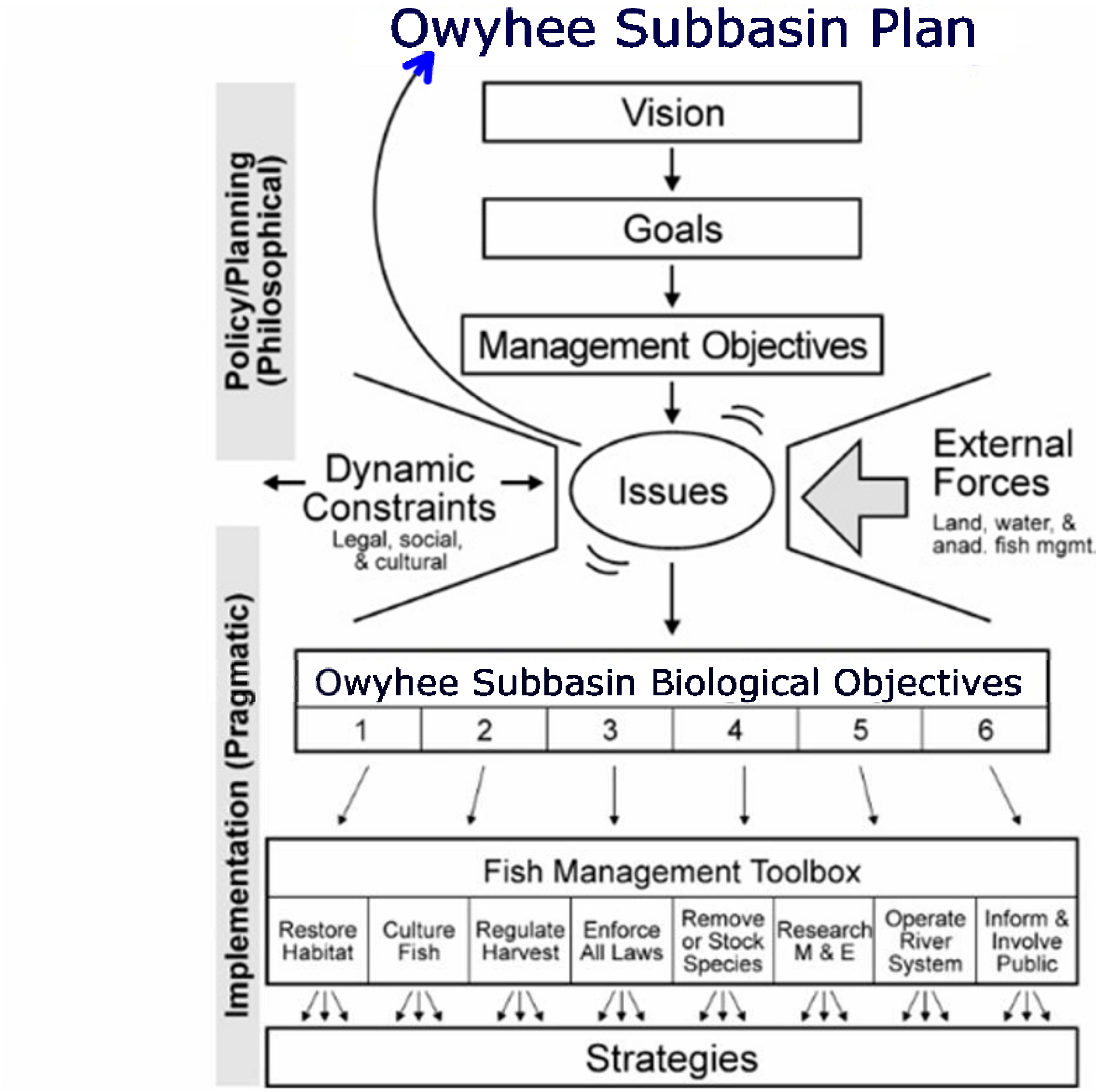


Figure 4.5. A simplified flow diagram of the implementation process showing the development of specific strategies -- from policy & planning through the filter of available management tools.

4.4.1.1 Aquatic – Short-term Objectives and Strategies

The ongoing projects sponsored by the Shoshone-Paiute Tribes form the nucleus of goals, objectives, and strategies for aquatic habitat restoration and enhancement using BPA funds – for the short term (i.e., next three years). This foundation will provide a starting point for the development of a more comprehensive and diverse strategic plan for the Owyhee Subbasin for the long term (i.e., the following decade and beyond).

The ongoing near-term Owyhee Subbasin Plan fish and aquatic habitat restoration objectives and strategies are summarized in Table 4.11.

Table 4.11. Summary of biological objectives and strategies for ongoing and proposed BPA-funded fish and aquatic habitat projects in the Owyhee Subbasin.

PROJECT/OBJECTIVES	STRATEGIES
Enhancement and Protection of Habitat and Riparian Areas	
1. Protect specific springs from livestock impacts – based on revision of list of springs in proposal. 2. Protect specific streams from livestock impacts –In coordination with Project 2000-079 and field observations. 3. Conduct fishery and habitat surveys	a. Cooperative management/Research – identify, prioritize and locate springs in need of protection (priority to suspected redband trout streams), b. Habitat Restoration – implement protective measures of springs (minimum of 6 springs per year); implement protective measures (fencing riparian areas/fixing road crossings) on streams and/or headwaters (appr. 6-10 miles of fence, troughs, culverts, etc). c. Research, Monitoring & Evaluation (RM&E) – implement PFC assessment; conduct population estimates, size structure, condition, locations (GPS) in coordination with Project 2000-079.
DEVELOPMENT AND ENHANCEMENT OF RESERVOIR FISHERIES	
1. Protect shoreline and inlet streams from degradation. 2. Disseminate information to public. 3. Work with Owyhee Schools on volunteer projects. 5. Stock Lake Billy Shaw with Sterile rainbow trout 6. Update and review Operations and Maintenance and Monitoring and Evaluation Plan	a. Habitat restoration – plant native trees/willows and grasses along shoreline and tributaries to Lake Billy Shaw b. Control grazing impacts – install water troughs/stock ponds to keep stock away from reservoir/fences c. Education & public outreach – monthly newspaper articles/quarterly to city paper; update & maintain signs to alert public to new fishing facility; have students aid in planting trees/willows/grasses. d. Fishery Management – manage put-and-take fishery in Lake Billy Shaw – stock fish in reservoir during spring and fall as temperatures and conditions warrant and set fishery seasons. e. Monitor & evaluate – collect and summarize data on biological and economic aspects of Lake Billy Shaw fishery.
Implement Artificial Production and Selective Fish Stocking Consistent With Native Fish Conservation	

PROJECT/OBJECTIVES	**STRATEGIES**
1. Provide subsistence put-and-take trout fisheries for tribal and sport fishery for non-tribal members at various reservoirs on the Duck Valley Indian Reservation.	a. Fishery Management – manage put-and-take fisheries at suitable times & reservoirs (Mountain View Reservoir, Lake Billy Shaw, and Sheep Creek Reservoir) on the Duck Valley Indian Reservation to maximize survival and harvestable production (within one year) and minimize the impact on native resident fish populations. b. Monitor and Evaluation (M&E) – monitor seasonal reservoir conditions such as temperature and dissolved oxygen – to schedule trout stocking in order to optimize growth rates, catch rates, and harvest rates of hatchery trout. c. Monitor and Evaluation (M&E) – monitor native redband trout populations (presence/absence in reservoirs and influent/effluent streams – to minimize impact by hatchery trout. c. Monitor and Evaluation (M&E) – monitor cost & benefits of put-and–take fisheries.
Conduct Assessments of Resident Fish in the Owyhee Subbasin	
1. Conduct resident fish assessment, including genetic survey of redband trout	a. Research, Monitoring & Evaluation (RM&E) quanytitative assessment of fish population species composition, distribution and abundance. (b) genetic survey of redband trout
Conduct a systematic resident fish species inventory & genetic stock assessment in the Owyhee/Bruneau River Basin, DVIR component.	Research, Monitoring & Evaluation (RM&E) of fish populations,
Province-wide Native Salmonid Assessment	Assess the current status of native salmonids in the Middle and Upper Snake Provinces in Idaho (Phase I), identify factors limiting populations (Phase II), and develop and implement recovery strategies and plans (Phase III)/ Middle and Upper Snake Provinces in ID

4.4.1.2 Aquatic – Long-term Strategies for Redband Trout

The Owyhee Subbasin Management Plan will be implemented over the long term 10-15 year planning horizon (e.g., 2008-2017) based on Adaptive management (incorporating new scientific data) and continued input from a cross-section of resource management entities and local stakeholders. One of the recommendations of the OSP Planning/Technical Team is to implement a monitoring and evaluation plan to accompany project implementation plan. The OSP will be revised and refined at various levels on an ongoing and iterative basis according to:

- Results from the project-specific and global OSP M&E Plan implementation (annual);
- The Provincial Review Planning and Regional funding process (3-year cycle); and
- The Council's Subbasin Review and Fish & Wildlife Program Review process (5-year cycle).

Linking Technical Analysis (QHA) with Global Redband Trout Restoration Objectives and Strategies for the Owyhee Subbasin

The following global objectives and strategies were developed by Owyhee Technical team members based the linkage between Qualitative Habitat Assessment and corresponding objectives and strategies from state and federal agency resource management plans. A summary of strategies and objectives contained in state and federal agency resource management plans is presented in Appendix 4.4.

The following global long-term objectives and strategies were compiled from the Technical Team members participating in the Qualitative Habitat Assessment. It is the intent of the Owyhee Subbasin Planning and Technical teams that specific objectives and strategies be implemented on a site-specific basis according to best available scientific information. That is, not all objectives and strategies would be implemented over the whole subbasin, but instead on select basis. The tables in the following section – stratified by State, HUC, and stream reach – provide a "roadmap" of where specific strategies are proposed for implementation. We anticipate that this initial site-specific implementation plan will be modified over time as new information is compiled and the OSP is revised in the iterative Adaptive Management process described above. The Council's Fish & Wildlife Program supports the site specific watershed approach – incorporating Adaptive Management – that results in the selection of technically feasible and cost-effective projects.

Part I Protection Objectives and Strategies

Objective: 1. Improve streamside riparian habitat and bank stability.

Strategies:

1.1. Implement State and BLM riparian, fisheries and water resources Management Actions and Allocations standards and objectives from the plan on watersheds with redband trout habitat.

1.2. Implement State and BLM Standards and Guides, grazing management objectives and guidelines on watersheds with redband trout spawning and rearing habitats.

1.3. Work with private landowners to improve riparian habitat.

1.4. Improve livestock management program to improve riparian habitat on Tribal lands.

1.5. Implement USFS livestock utilization standards from Forest Plan revision on watershed with redband trout priority spawning and rearing habitats.

1.6. Implement grazing management appropriate for riparian pastures.

1.7. Improve riparian areas to increase vegetation shading where feasible.

1.8. Increase riparian vegetation to increase bank stability.

1.9. Increase riparian vegetation to increase channel complexity and channel form.

1.10. Improve riparian vegetation to reduce fine sedimentation.

Objective 2. Control pollution from mining activities.

Strategies:

2.1 Apply Best Management Practices to mine tailings and polluted areas to remediate pollution.

Objective 3. Restore redband trout connectivity.

Strategies:

3.1. Add fish screens to diversion structures to prevent downstream migration of redband trout into diversion ditches.

3.2. Replace impassable culverts with suitable redband trout passage structures.

3.3. Construct and operate a fish ladder over dam.

3.4. Preserve and enhance native Redband trout habitat and connectivity by seeking innovative and voluntary methods to improve stream flows where it is feasible and consistent with State water laws and Tribal sovereignty.

3.5. Provide passage of irrigation structures.

Objective: 4. Improve stream flows to achieve levels needed for redband trout survival and productivity.

Strategy:

4.1. Improve stream flow on public lands by increasing riparian vegetation.
4.2. Improve irrigation efficiency.

Objective: 5. Remove nonnative fish population in order to enhance redband trout survival and productivity. (Restoration only)

Strategy:
5.1. Remove nonnative fish population using most appropriate site-specific methods.

Redband Trout Objective and Strategy Summary for the Idaho Portion of the Owyhee Subbasin

Part I. Objectives and strategies for reaches in the top half of QHA protection scores.

Protection Objective: 1. Improve streamside riparian habitat and bank stability.

- This Objective is recommended for 20 of 22 reaches in HUC 17050108 (ID)
- This Objective is recommended for 9 of 13 reaches in HUC 17050107 (ID)
- This Objective is recommended for 0 of 0 reaches in HUC 17050106 (ID)
- This Objective is recommended for 0 of 0 reaches in HUC 17050105 (ID)
- This Objective is recommended for 20 of 28 reaches in HUC 17050104 (ID)
- This Objective is recommended for 53 of 63 reaches in all HUCs (Idaho portion)

Protection Objective 1 Strategy1:

1.1. Implement State and BLM riparian, fisheries and water resources Management Actions and Allocations standards and objectives from the Owyhee Resource Management Plan and Bruneau Management Framework Plan on watersheds with redband trout habitat.

Strategy 1.1 is recommended for the following reaches, located in HUC 17050108:
- Jordan Cr.-6: BLM boundary upstream of Louse Cr. To BLM boundary section
- Jordan Cr.-8: State line lands boundary to headwaters of Jordan Cr.
- Williams Cr.: BLM segments
- Williams Cr.: Including Pole Bridge Cr. And West Cr.
- South Mountain Creek: Lower BLM upper put state includes Howl Cr. Coyote Cr.
- South Boulder Cr: From confluence with North Boulder Cr. To confluence with Mill Cr.
- Bogus Cr.: Upper above section 10 and above
- Combination Cr: Lower reach of stream: Up to state section.
- Josephine: includes Wickiup and Long Valley and Headwater Josephine
- Lower Rock Cr.-1: From confluence of North Boulder to Meadow Creek.
- Deer Cr.: Confluence with Big Boulder to state section 36

- North Boulder-1: From confluence with Big Boulder; BLM reach to Private
- Upper Trout Cr.: From Split Rock Canyon to headwaters, including Nichols, Wood Canyon creeks
- Cow Cr.-2: From confluence with Wildcat Canyon Cr. To headwaters
- Soda Cr. From confluence of Cow Cr. To headwaters

Strategy 1.1 is recommended for the following reaches, located in HUC 17050107:

- NF Owyhee 1: Lower; From the Oregon State line to the confluence of Juniper Cr.
- NF Owyhee 2: Upper; Headwaters of North Fork , Lower Noon Cr. And Lower Pleasant Valley Cr.
- Upper Pleasant Valley Cr: From the top of Sec. 7 to headwaters.
- Cabin Cr: From the confluence with Juniper Cr. To the headwaters.
- Juniper Cr. 1: From the confluence with the North Fork Owyhee to lower private boundary
- Lone Tree Cr: From Oregon State line to headwaters.
- Cottonwood Cr: From the upper private boundary (section 18) to headwaters.
- Squaw Cr. 1: From Oregon State line to lower private boundary (section 13)
- Squaw Cr. 3: From private to headwaters.
- Pole Cr: Oregon State line to headwaters.

Strategy 1.1 is not recommended for any reaches located in HUC 17050106:

Strategy 1.1 is not recommended for any reaches located in HUC 17050105:

Strategy 1.1 is recommended for the following reaches, located in HUC 17050104:

- Owyhee River: DVIR border to confluence
- Dry Cr.-1: confluence to reservoir
- Dry Cr.-2: Reservoir to headwaters
- Deep Cr.-4: headwaters including
- Stoneman Cr: Confluence to headwaters.
- Nickel Cr: Confluence to headwaters including.
- Smith Cr: Confluence to headwaters including.
- Beaver Cr: Confluence to headwaters including.
- Red Canyon Cr: Confluence to headwaters including.
- Pole Cr.-1: Confluence to Camas Cr. Confluence including Camel Cr.

Objective 1 Strategy 2:

1.2. Implement State and BLM Standards and Guides, grazing management objectives and guidelines on watersheds with redband trout spawning and rearing habitats.

Strategy 1.2 is recommended for the following reaches, located in HUC 17050108:

- Jordan Cr.-6: BLM boundary upstream of Louse Cr. To BLM boundary section
- Jordan Cr.-8: State line lands boundary to headwaters of Jordan Cr.
- Williams Cr.: BLM segments
- Williams Cr.: Including Pole Bridge Cr. And West Cr.
- South Mountain Creek: Lower BLM upper put state includes Howl Cr. Coyote Cr.

- Flint Cr.1: Lower
- Flint Cr.2: Upper Includes East Cr.
- South Boulder Cr: From confluence with North Boulder Cr. To confluence with Mill Cr.
- Bogus Cr.: Upper above section 10 and above
- Combination Cr: Lower reach of stream: Up to state section.
- Rose Cr.
- Josephine: includes Wickiup and Long Valley and Headwater Josephine
- Lower Rock Cr.-1: From confluence of North Boulder to Meadow Creek.
- Rock Cr.-3: BLM portion in Section 26
- Deer Cr.: Confluence with Big Boulder to state section 36
- North Boulder-1: From confluence with Big Boulder; BLM reach to Private
- Louse Cr. Includes Cottonwood Cr. From confluence of Jordan Cr. To headwaters
- Upper Trout Cr.: From Split Rock Canyon to headwaters, including Nichols, Wood Canyon creeks
- Cow Cr.-2: From confluence with Wildcat Canyon Cr. To headwaters
- Soda Cr. From confluence of Cow Cr. To headwaters

Strategy 1.2 is recommended for the following reaches, located in HUC 17050107:

- NF Owyhee 1: Lower; From the Oregon State line to the confluence of Juniper Cr.
- NF Owyhee 2: Upper; Headwaters of North Fork , Lower Noon Cr. And Lower Pleasant Valley Cr.
- Upper Pleasant Valley Cr: From the top of Sec. 7 to headwaters.
- Cabin Cr: From the confluence with Juniper Cr. To the headwaters.
- Juniper Cr. 1: From the confluence with the North Fork Owyhee to lower private boundary
- Lone Tree Cr: From Oregon State line to headwaters.
- Cottonwood Cr: From the upper private boundary (section 18) to headwaters.
- Squaw Cr. 1: From Oregon State line to lower private boundary (section 13)
- Squaw Cr. 3: From private to headwaters.
- Pole Cr: Oregon State line to headwaters.

Strategy 1.2 is not recommended for any reaches located in HUC 17050106:

Strategy 1.2 is not recommended for any reaches located in HUC 17050105:

Strategy 1.2 is recommended for the following reaches, located in HUC 17050104:

- Owyhee River: DVIR border to confluence
- Dry Cr.-1: confluence to reservoir
- Deep Cr.-4: headwaters including
- Nickel Cr: Confluence to headwaters including.
- Smith Cr: Confluence to headwaters including.
- Beaver Cr: Confluence to headwaters including.
- Red Canyon Cr: Confluence to headwaters including.
- Pole Cr.-1: Confluence to Camas Cr. Confluence including Camel Cr.

Objective 1 Strategy 3:

1.3. Work with private landowners to improve riparian habitat.

Strategy 1.3 is recommended for the following reaches, located in HUC 17050108:

- Jordan Cr.-8: State line lands boundary to headwaters of Jordan Cr.
- Williams Cr.: BLM segments
- Williams Cr.: Including Pole Bridge Cr. and West Cr.
- South Mountain Creek:
- Flint Cr.1: Lower
- Flint Cr.2: Upper Includes East Cr.
- Bogus Cr.: Upper above section 10 and above
- Combination Cr: Lower reach of stream: Up to state section.
- Rose Cr.
- Josephine: includes Wickiup and Long Valley and Headwater Josephine
- Lower Rock Cr.-1: From confluence of North Boulder to Meadow Creek.
- Rock Cr.-3: BLM portion in Section 26
- Deer Cr.: Confluence with Big Boulder to state section 36
- North Boulder-1: From confluence with Big Boulder; BLM reach to Private
- Louse Cr. Includes Cottonwood Cr. From confluence of Jordan Cr. To headwaters
- Upper Trout Cr.: From Split Rock Canyon to headwaters, including Nichols, Wood Canyon creeks
- Soda Cr. From confluence of Cow Cr. To headwaters

Strategy 1.3 is recommended for the following reaches, located in HUC 17050107:

- Upper Pleasant Valley Cr: From the top of Sec. 7 to headwaters.
- Cabin Cr: From the confluence with Juniper Cr. To the headwaters.
- Lone Tree Cr: From Oregon State line to headwaters.

Strategy 1.3 is recommended for the following reaches, located in HUC 17050104:

- Deep Cr.-4: headwaters including
- Nickel Cr: Confluence to headwaters including.
- Smith Cr: Confluence to headwaters including.
- Beaver Cr: Confluence to headwaters including.
- Pole Cr.-1: Confluence to Camas Cr. Confluence including Camel Cr.

Objective 1 Strategy 4:

1.4. Improve livestock management program to improve riparian habitat on Tribal lands.

Strategy 1.4 was not recommended for any reaches in Idaho.

Objective 2. Control pollution from mining activities.

- This Objective is recommended for 6 of 22 reaches in HUC 17050108 (ID)
- This Objective is recommended for 0 of 13 reaches in HUC 17050107 (ID)
- This Objective is recommended for 0 of 0 reaches in HUC 17050106 (ID)
- This Objective is recommended for 0 of 0 reaches in HUC 17050105 (ID)

- This Objective is recommended for 0 of 29 reaches in HUC 17050104 (ID)
- This Objective is recommended for 6 of 64 reaches in all HUCs (Idaho portion)

Objective 2 Strategy 1:

2.1 Apply Best Management Practices to mine tailings and polluted areas to remediate pollution.

Strategy 2.1 is recommended for the following reaches in HUC17050108.

- Jordan Cr.-6: BLM boundary upstream of Louse Cr. To BLM boundary section
- Jordan Cr.-8: State line lands boundary to headwaters of Jordan Cr.
- Flint Cr.1: Lower
- Flint Cr.2: Upper Includes East Cr.
- Cow Cr.-2: From confluence with Wildcat Canyon Cr. To headwaters
- Soda Cr. From confluence of Cow Cr. To headwaters

Strategy 2.1 is not recommended for any reaches in HUC17050106.

Strategy 2.1 is recommended for the following reaches in HUC17050104.

- Dry Cr.-1: confluence to reservoir

Objective 3. Restore redband trout connectivity.

- This Objective is recommended for 0 of 22 reaches in HUC 17050108 (ID)
- This Objective is recommended for 0 of 13 reaches in HUC 17050107 (ID)
- This Objective is recommended for 0 of 1 reaches in HUC 17050106 (ID)
- This Objective is recommended for 0 of 1 reaches in HUC 17050105 (ID)
- This Objective is recommended for 1 of 29 reaches in HUC 17050104 (ID)
- This Objective is recommended for 1 of 66 reaches in all HUCs (Idaho portion)

Objective 3 Strategy 1:

3.1. Add fish screens to diversion structures to prevent downstream migration of redband trout into diversion ditches.

Strategy 3.1 is recommended for the following reaches in HUC17050104.

- Shoofly Cr.-2: Private/BLM boundary to Bybee reservoir

Objective 3 Strategy 2:

3.2. Replace impassable culverts with suitable redband trout passage structures.

Strategy 3.2 was not recommended for any reaches in Idaho.

Objective 3 Strategy 3:

3.3. Construct and operate a fish ladder over dam.

Strategy 3.3 is not recommended for any reaches in Idaho.

Objective 3 Strategy 4:

3.4. Preserve and enhance native Redband trout habitat and connectivity by seeking innovative and voluntary methods to improve stream flows where it is feasible and consistent with State water laws and Tribal sovereignty.

Strategy 3.4 is not recommended for any reaches in Idaho.

Objective: 4. Improve stream flows to achieve levels needed for redband trout survival and productivity.

- This Objective is recommended for 1 of 22 reaches in HUC 17050108 (ID)
- This Objective is recommended for 4 of 13 reaches in HUC 17050107 (ID)
- This Objective is recommended for 0 of 0 reaches in HUC 17050106 (ID)
- This Objective is recommended for 0 of 0 reaches in HUC 17050105 (ID)
- This Objective is recommended for 5 of 29 reaches in HUC 17050104 (ID)
- This Objective is recommended for 10 of 65 reaches in all HUCs (Idaho portion)

Objective 4 Strategy 1:

4.1. Improve stream flow on public lands by increasing riparian vegetation.

Strategy 4.1 is recommended for the following reaches, located in HUC 17050108:
- Louse Cr. Includes Cottonwood Cr. From confluence of Jordan Cr. To headwaters

Strategy 4.1 is recommended for the following reaches, located in HUC 17050107:
- NF Owyhee 1: Lower; From the Oregon State line to the confluence of Juniper Cr.
- NF Owyhee 2: Upper; Headwaters of North Fork , Lower Noon Cr. And Lower Pleasant Valley Cr.
- Cottonwood Cr: From the upper private boundary (section 18) to headwaters.
- Squaw Cr. 3: From private to headwaters.

Strategy 4.1 is not recommended for any reaches located in HUC 17050106:

Strategy 4.1 is not recommended for any reaches located in HUC 17050105:

Strategy 4.1 is recommended for the following reaches, located in HUC 17050104:
- Stoneman Cr: Confluence to headwaters.

- Beaver Cr: Confluence to headwaters including.
- Camas Cr: Confluence to headwaters.
- Shoofly Cr.-2: Private/BLM boundary to Bybee reservoir
- Dry Cr.-2: Reservoir to headwaters

<u>Restoration only</u>:

Objective: 5. Remove nonnative fish population in order to enhance redband trout survival and productivity.

- This Objective is not recommended for any of the reaches in all HUCs (Idaho portion)

Objective 5 Strategy 1:

5.1. Remove nonnative fish population using most appropriate site-specific methods.

Strategy 5.1 was not recommended for any reaches in Idaho.

Table 4.12 Summary of Protection objectives and strategies by HUC and reach for the Idaho Portion of the Owyhee.

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
HUC 17050108						
Jordan Cr.-6: BLM boundary upstream of Louse Cr. To BLM boundary section	**1.1 1.2**	**2.1**				1.0: Pollutants
Jordan Cr.-8: State line lands boundary to headwaters of Jordan Cr.	**1.1 1.2 1.3**	**2.1**				1.0: Pollutants
Williams Cr.: BLM segments	**1.1 1.2 1.3**					2.0: C. Stability H. Diversity ~~L. Flow~~ L. Temp. H. Temp.

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
Williams Cr.: Including Pole Bridge Cr. And West Cr.	1.1 1.2 1.3					2.0 H. Diversity L. Temp. H. Temp.
South Mountain Creek: Lower BLM upper put state includes Howl Cr. Cyote Cr.	1.1 1.2 1.3					1.0: H. Diversity
Flint Cr.1: Lower	1.2 1.3	2.1				1.5: F. Sediment Pollutants
Flint Cr.2: Upper Includes East Cr.	1.2 1.3	2.1				1.5: F. Sediment Pollutants
South Boulder Cr: From confluence with North Boulder Cr. To confluence with Mill Cr.	1.1 1.2					1.5: H. Temp.
Bogus Cr.: Upper above section 10 and above	1.1 1.2 1.3					2.5: Riparian C. Stability H. Diversity F. Sediment H. Temp.
Combination Cr: Lower reach of stream: Up to state section.	1.1 1.2 1.3					1.5: Riparian Oxygen
Rose Cr.	1.2 1.3					2.0: Oxygen
Josephine: includes Wickiup and Long Valley and Headwater Josephine	1.1 1.2 1.3					1.5: H. Flow
Lower Rock Cr.-1: From confluence of North Boulder to Meadow Creek.	1.1 1.2 1.3*					1.5: H. Flow L. Flow
Rock Cr.-3: BLM portion in Section 26	1.2 1.3					1.5: H. Flow L. Flow
Deer Cr.: Confluence with Big Boulder to state section 36	1.1 1.2 1.3					2.0: F. Sediment

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
Owl Cr: Includes Minear Cr. (Confluence of Lone Tree to headwaters)						2.0: H. Diversity F. Sediment
North Boulder-1: From confluence with Big Boulder; BLM reach to Private	1.1 1.2 1.3					2.0: H. Temp.
North Boulder-2: From confluence with Mamouth Cr. To headwaters						2.0: H. Temp.
Louse Cr. Includes Cottonwood Cr. From confluence of Jordan Cr. To headwaters	1.2 1.3			4.1*		1.0: H. Diversity L. Flow
Upper Trout Cr.: From Split Rock Canyon to headwaters, including Nichols, Wood Canyon creeks	1.2 1.3					1.5: L. Flow
Cow Cr.-2: From confluence with Wildcat Canyon Cr. To headwaters	1.1 1.2	2.1				2.0: Riparian C. Stability H. Diversity F. Sediment H. Temp. Pollutants
Soda Cr. From confluence of Cow Cr. To headwaters	1.2 1.3	2.1				2.0: H. Diversity F. Sediment Oxygen H. Temp. Pollutants
HUC 17050107						
NF Owyhee 1: Lower; From the Oregon State line to the confluence of Juniper Cr.	1.1 1.2			4.1		2.0: L. Flow H. Temp.
NF Owyhee 2: Upper; Headwaters of North Fork , Lower Noon Cr. And Lower Pleasant Valley Cr.	1.1 1.2			4.1		2.5: L. Flow H. Temp.
Upper Pleasant Valley	1.1					1.0:

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
Cr: From the top of Sec. 7 to headwaters.	**1.2** **1.3**					C. Stability
Cabin Cr: From the confluence with Juniper Cr. To the headwaters.	**1.1** **1.2** **1.3**					2.0: Riparian C. Stability F. Sediment H. Temp. ~~Pollutants~~
Juniper Cr. 1: From the confluence with the North Fork Owyhee to lower private boundary	**1.1** **1.2**					2.0: H. Temp. ~~Pollutants~~
Juniper Cr. 2: From the start of the private up to the headwaters						1.0: L. Flow
Lone Tree Cr: From Oregon State line to headwaters.	**1.1** **1.2** **1.3**					1.5: H. Diversity
Cottonwood Cr: From the upper private boundary (section 18) to headwaters.	**1.1** **1.2**			**4.1**		1.5: L. Flow
Squaw Cr. 1: From Oregon State line to lower private boundary (section 13)	**1.1** **1.2**					2.0: H. Temp.
Squaw Cr. 2: From the start of private in section 14 to the BLM in the northwest corner of section 31.						2.0: L. Flow H. Temp.
Squaw Cr. 3: From private to headwaters.	**1.1** **1.2**			**4.1**		2.0: Riparian C. Stability H. Diversity F. Sediment L. Flow H. Temp.
Pole Cr: Oregon State line to headwaters.	**1.1** **1.2**					2.5: F. Sediment
HUC 17050106						
No quartile #1 and #2 scores for protection objective and strategies in this HUC.						
HUC 17050105						

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
No quartile #1 and #2 scores for protection objective and strategies in this HUC.						
HUC 17050104						
Shoofly Cr.-1: Confluence to BLM boundary						1.0: Riparian H. Diversity L. Flow
Shoofly Cr.-2: Private/BLM boundary to Bybee reservoir				**4.1**		1.0: H. Flow L. Flow Obstruction
Owyhee River: DVIR border to confluence	**1.1** **1.2**					2.0: H. Temp.
Owyhee River DVIR portion: Mouth of canyon to NV state line						1.0: Riparian C. Stability H. Diversity L. Flow H. Temp.
Battle Cr.-3: State section 36 to headwaters.						1.0: H. Diversity L. Flow
Dry Cr.-1: confluence to reservoir	**1.1** **1.2**	**2.1**				2.0: Riparian C. Stability H. Diversity F. Sediment H. Flow L. Flow Oxygen L. Temp. H. Temp. Pollutants
Dry Cr.-2: Reservoir to headwaters	**1.1**		**3.1**	**4.1**		1.0: Riparian C. Stability H. Diversity L. Flow H. Temp. Obstruction
Deep Cr.-4: headwaters including	**1.1** **1.2** **1.3**					1.0: Riparian C. Stability F. Sediment

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
Stoneman Cr: Confluence to headwaters.	1.1			4.1		1.0: C. Stability L. Flow
Nickel Cr: Confluence to headwaters including.	1.1 1.2 1.3					1.0: F. Sediment
Smith Cr: Confluence to headwaters including.	1.1 1.2 1.3					1.0: F. Sediment
Beaver Cr: Confluence to headwaters including.	1.2 1.3			4.1		2.0: Riparian F. Sediment L. Flow
Red Canyon Cr: Confluence to headwaters including.	1.1 1.2					1.0: H. Temp.
Pole Cr.-1: Confluence to Camas Cr. Confluence including Camel Cr.	1.1 1.2 1.3					1.0: H. Temp.

Part II Idaho Restoration Objectives and Strategies

Objective: 1. Improve streamside riparian habitat and bank stability.

- This Objective is recommended for 6 of 17 reaches in HUC 17050108 (ID)
- This Objective is recommended for 2 of 3 reaches in HUC 17050107 (ID)
- This Objective is recommended for 1 of 1 reaches in HUC 17050106 (ID)
- This Objective is recommended for 1 of 1 reaches in HUC 17050105 (ID)
- This Objective is recommended for 14 of 21 reaches in HUC 17050104 (ID)
- This Objective is recommended for 24 of 43 reaches in all HUCs (Idaho portion)

Strategies:

1.1. Implement State and BLM riparian, fisheries and water resources Management Actions and Allocations standards and objectives from the Owyhee Resource Management Plan and Bruneau Management Framework Plan on watersheds with redband trout habitat.

Strategy 1.1 is recommended for the following reaches in HUC17050108

- Williams Cr.: BLM segments
- Duck Cr.: All

- South Mountain Creek: Lower BLM upper put state includes Howl Cr. and Coyote Cr
- Rail Cr. : All
- Combination Cr.: Lower reach of stream
- Meadow Cr.: Headwaters to confluence with Rock Cr.

Strategy 1.1 is recommended for the following reaches in HUC17050107
- Upper Pleasant Valley Cr.: From the top of Sec. 7 to headwaters
- Middle Fork Owyhee : Oregon State line to headwaters

Strategy 1.1 is recommended for the following reaches in HUC17050106
- Little Owyhee: From the Nevada State line to the confluence with South Fork Owyhee

Strategy 1.1 is recommended for the following reaches in HUC17050105
- South Fork Owyhee

Strategy 1.1 is recommended for the following reaches in HUC17050104
- Dry Cr.-1: confluence to reservoir
- Dry Cr.-2: Reservoir to headwaters
- Big Springs Cr.-1: confluence to reservoir
- Big Springs Cr.-3: BLM boundary to private
- Deep Cr.-1: Confluence to private
- Deep Cr.-2: Private to mid section 10
- Deep Cr.-3: section 10 to Stoneman Cr. Confluence
- Deep Cr.-4: headwaters including:
- Stoneman Cr.: Confluence to headwaters
- Current Cr.: Confluence to headwaters
- Smith Cr.: Confluence to headwaters including
- Castle Cr.: Confluence to headwaters including
- Red Canyon Cr.: Confluence to headwaters including
- Petes Cr.: Confluence to headwaters including

1.2. Implement State and BLM Standards and Guides, grazing management objectives and guidelines on watersheds with redband trout spawning and rearing habitats.

Strategy 1.2 is recommended for the following reaches in HUC17050108
- Williams Cr.: BLM segments
- Duck Cr.: All
- South Mountain Creek: Lower BLM upper put state includes Howl Cr. and Coyote Cr
- Rail Cr. : All
- Combination Cr.: Lower reach of stream
- Meadow Cr.: Headwaters to confluence with Rock Cr.

- Louse Cr.: Includes Cottonwood Cr. From confluence of Jordan Cr. To headwaters

Strategy 1.2 is recommended for the following reaches in HUC17050107

- Upper Pleasant Valley Cr.: From the top of Sec. 7 to headwaters
- Middle Fork Owyhee : Oregon State line to headwater

Strategy 1.2 is recommended for the following reaches in HUC17050106

- Little Owyhee: From the Nevada State line to the confluence with South Fork Owyhee

Strategy 1.2 is recommended for the following reaches in HUC17050105

- South Fork Owyhee

Strategy 1.2 is recommended for the following reaches in HUC17050104

- Dry Cr.-1: confluence to reservoir
- Dry Cr.-2: Reservoir to headwaters
- Big Springs Cr.-1: confluence to reservoir
- Big Springs Cr.-3: BLM boundary to private
- Deep Cr.-1: Confluence to private
- Deep Cr.-2: Private to mid section 10
- Deep Cr.-3: section 10 to Stoneman Cr. Confluence
- Deep Cr.-4: headwaters including:
- Current Cr.: Confluence to headwaters
- Smith Cr.: Confluence to headwaters including
- Castle Cr.: Confluence to headwaters including
- Red Canyon Cr.: Confluence to headwaters including
- Petes Cr.: Confluence to headwaters including

1.3. Work with private landowners to improve riparian habitat.

Strategy 1.3 is recommended for the following reaches in HUC17050108

- Williams Cr.: BLM segments
- Duck Cr.: All
- South Mountain Creek: Lower BLM upper put state includes Howl Cr. and Coyote Cr
- Rail Cr. : All
- Combination Cr.: Lower reach of stream
- Meadow Cr.: Headwaters to confluence with Rock Cr.
- Louse Cr.: Includes Cottonwood Cr. From confluence of Jordan Cr. To headwaters

Strategy 1.3 is recommended for the following reaches in HUC17050107
- Upper Pleasant Valley Cr.: From the top of Sec. 7 to headwaters

Strategy 1.3 is recommended for the following reaches in HUC17050104
- Big Springs Cr.-3: BLM boundary to private
- Deep Cr.-1: Confluence to private
- Deep Cr.-2: Private to mid section 10
- Deep Cr.-3: section 10 to Stoneman Cr. Confluence
- Deep Cr.-4: headwaters including:
- Current Cr.: Confluence to headwaters
- Smith Cr.: Confluence to headwaters including
- Castle Cr.: Confluence to headwaters including
- Red Canyon Cr.: Confluence to headwaters including
- Petes Cr.: Confluence to headwaters including

1.4. Improve livestock management program to improve riparian habitat on Tribal lands.

Strategy 1.4 was not recommended for any reaches.

Objective 2. Control pollution from mining activities.

- This Objective is recommended for 2 of 17 reaches in HUC 17050108 (ID)
- This Objective is recommended for 1 of 3 reaches in HUC 17050107 (ID)
- This Objective is recommended for 1 of 1 reaches in HUC 17050106 (ID)
- This Objective is recommended for 0 of 1 reaches in HUC 17050105 (ID)
- This Objective is recommended for 1 of 21 reaches in HUC 17050104 (ID)
- This Objective is recommended for 5 of 43 reaches in all HUCs (Idaho portion)

Strategies:

2.1 Apply Best Management Practices to mine tailings and polluted areas to remediate pollution.

Strategy 2.1 is recommended for the following reaches in HUC17050108:
- Jordan Cr.-2: From end of #2 to Rail Creek
- Jordan Cr.-4: BLM boundary near Buck Cr. to BLM boundary

Strategy 2.1 is recommended for the following reaches in HUC17050106:
- Little Owyhee: From the Nevada State line to the confluence with South Fork Owyhee

Strategy 2.1 is recommended for the following reaches in HUC17050104:
- Dry Cr.-1: confluence to reservoir

Objective 3. Restore redband trout connectivity.

- This Objective is recommended for 1 of 17 reaches in HUC 17050108 (ID)
- This Objective is recommended for 0 of 3 reaches in HUC 17050107 (ID)
- This Objective is recommended for 0 of 1 reaches in HUC 17050106 (ID)
- This Objective is recommended for 0 of 1 reaches in HUC 17050105 (ID)
- This Objective is recommended for 4 of 21 reaches in HUC 17050104 (ID)
- This Objective is recommended for 5 of 43 reaches in all HUCs (Idaho portion)

Strategies:

3.1. Add fish screens to diversion structures to prevent downstream migration of redband trout into diversion ditches.

Strategy 3.1 is recommended for the following reaches in HUC17050104:

- Dry Cr.-2: Reservoir to headwaters

3.2. Replace impassable culverts with suitable redband trout passage structures.

Strategy 3.2 was not recommended for any reaches

3.3. Construct and operate a fish ladder over dam.

Strategy 3.3 is recommended for the following reaches in HUC17050104:

- Shoofly Cr.-2: Private/BLM boundary to Bybee reservoir

3.4. Preserve and enhance native Redband trout habitat and connectivity by seeking innovative and voluntary methods to improve stream flows where it is feasible and consistent with State water laws and Tribal sovereignty.

Strategy 3.4 is not recommended for any reaches in Idaho:

Objective: 4. Improve stream flows to achieve levels needed for redband trout survival and productivity.

- This Objective is recommended for 4 of 17 reaches in HUC 17050108 (ID)
- This Objective is recommended for 1 of 3 reaches in HUC 17050107 (ID)
- This Objective is recommended for 0 of 1 reaches in HUC 17050106 (ID)
- This Objective is recommended for 1 of 1 reaches in HUC 17050105 (ID)
- This Objective is recommended for 2 of 21 reaches in HUC 17050104 (ID)
- This Objective is recommended for 8 of 43 reaches in all HUCs (Idaho portion)

Strategy:

4.1. Improve stream flow on public lands by increasing riparian vegetation.

Strategy 4.1 is recommended for reaches in the following HUC17050108
- Indian Cr.: Bogus Cr. (Lower) – confluence with South Fork Boulder to Section 10
- Rock Cr.-2: From Meadow Cr. to BLM
- Louse Cr.: Includes Cottonwood Cr. From confluence of Jordan Cr. To headwaters
- Louisa Cr.: From confluence with Rock Cr.

Strategy 4.1 is recommended for reaches in the following HUC17050107
- Cottonwood Cr.: From the upper private boundary (section 18) to headwaters

Strategy 4.1 is recommended for reaches in the following HUC17050105
- South Fork Owyhee

Strategy 4.1 is recommended for reaches in the following HUC17050104
- Blue Cr.-3:Blue Cr. Reservoir to headwaters
- Stoneman Cr.: Confluence to headwaters
- Current Cr.: Confluence to headwaters
- Shoofly Cr.-2: Private/BLM boundary to Bybee reservoir
- Dry Cr.-2: Reservoir to headwaters
- Castle Cr: Confluence to headwaters

Objective: 5. Remove nonnative fish population in order to enhance redband trout survival and productivity.

- This Objective is not recommended for any of 43 reaches in all HUCs (Idaho portion)

Strategy:

5.1. Remove nonnative fish population using most appropriate site-specific methods.

Strategy 5.1 was not recommended for any reaches in Idaho.

Table 4.13. Summary of Restoration objectives and strategies by HUC and reach for the Idaho Portion of the Owyhee.

4th Field HUC/ Reach Name	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
HUC 17050108						
Jordan Cr.-1:Jordan Cr. From OR Boundary to BLM boundary section						1.0: Riparian C. Stability H. Diversity L. Flow Oxygen L. Temp. H. Temp. Pollutants
Jordan Cr.-2: From end of #2 to Rail Creek		**2.1**				1.0: H. Diversity Pollutants
Jordan Cr.-3: Rail Cr. Confluence to BLM boundary						1.0: L. Flow Pollutants
Jordan Cr.-4: BLM boundary near Buck Cr. to BLM boundary		**2.1**				1.0: H. Diversity Pollutants
Jordan Cr.-5: BLM boundary section line to BLM boundary upstream of Louse Cr.						1.0: Pollutants
Williams Cr.: BLM segments	**1.1 1.2 1.3**					2.0: C. Stability H. Diversity ~~L. Flow~~ L. Temp. H. Temp.
Duck Cr.: All	**1.1 1.2 1.3**					1.5: Riparian C. Stability ~~F. Sediment~~
South Mountain Creek: Lower BLM upper put state includes Howl Cr. and Coyote Cr	**1.1 1.2 1.3**					1.0: H. Diversity
Rail Cr. : All	**1.1 1.2 1.3**					2.0: Riparian C. Stability H. Diversity

4th Field HUC/ Reach Name	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
						F. Sediment H. Temp. ~~Pollutants~~
Indian Cr.: Bogus Cr. (Lower) – confluence with South Fork Boulder to Section 10				**4.1**		1.0: L. Flow
Combination Cr.: Lower reach of stream	**1.1** **1.2** **1.3**					1.5: Riparian Oxygen
Louisa Cr.: From confluence with Rock Cr.				**4.1**		1.0: Obstruction
Rock Cr.-2: From Meadow Cr. to BLM				**4.1**		1.0: Riparian C. Stability H. Diversity L. Flow Oxygen L. Temp. H. Temp.
Rock Cr.-4: From BLM/PVT boundary in Sec.26 to above Triangle Reservior						1.0: Riparian C. Stability H. Diversity L. Flow Oxygen L. Temp. H. Temp.
Meadow Cr.: Headwaters to confluence with Rock Cr.	**1.1** **1.2** **1.3**					1.0: H. Diversity
Louse Cr.: Includes Cottonwood Cr. From confluence of Jordan Cr. To headwaters	**1.2** **1.3**			**4.1**		1.0: H. Diversity L. Flow
Upper Trout Cr.: From Split Rock Canyon to headwaters, including Nichols, Wood Canyon creeks						1.5: ~~L. Flow~~
HUC 17050107						
Upper Pleasant Valley	**1.1**					1.0:

4th Field HUC/ Reach Name	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
Cr.: From the top of Sec. 7 to headwaters	**1.2** **1.3**					C. Stability
Cottonwood Cr.: From the upper private boundary (section 18) to headwaters				**4.1**		1.5: L. Flow
Middle Fork Owyhee : Oregon State line to headwaters	**1.1** **1.2**					0.5: Riparian
HUC 17050106						
Little Owyhee: From the Nevada State line to the confluence with South Fork Owyhee	**1.1** **1.2**	**2.1**				1.0: H. Diversity Oxygen L. Temp. H. Temp. Pollutants
HUC 17050105						
South Fork Owyhee	**1.1** **1.2**			**4.1**		
HUC 17050104						
Blue Cr.-3:Blue Cr. Reservoir to headwaters				**4.1**		1.0: L. Flow
Shoofly Cr.-1: Confluence to BLM boundary						1.0: Riparian H. Diversity L. Flow
Shoofly Cr.-2: Private/BLM boundary to Bybee reservoir			**3.3**			1.0: H. Flow L. Flow Obstruction
Owyhee River DVIR portion: Mouth of canyon to NV state line						1.0: Riparian C. Stability H. Diversity L. Flow H. Temp.
Battle Cr.-2: Section 10 to above state section 36						1.0: H. Temp.
Battle Cr.-3: State section 36 to headwaters						1.0: H. Diversity L. Flow

4th Field HUC/ Reach Name	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
Dry Cr.-1: confluence to reservoir	1.1 1.2	2.1				2.0: Riparian C. Stability H. Diversity F. Sediment H. Flow L. Flow Oxygen L. Temp. H. Temp. Pollutants
Dry Cr.-2: Reservoir to headwaters	1.1		3.1	4.1		1.0: Riparian C. Stability H. Diversity L. Flow H. Temp. Obstruction
Big Springs Cr.-1: confluence to reservoir	1.1 1.2					1.0: H. Temp.
Big Springs Cr.-3: BLM boundary to private	1.1 1.2 1.3					1.0: Riparian H. Temp.
Deep Cr.-1: Confluence to private	1.1 1.2 1.3					1.0: F. Sediment Oxygen H. Temp.
Deep Cr.-2: Private to mid section 10	1.1 1.2 1.3					1.0: F. Sediment Oxygen H. Temp.
Deep Cr.-3: section 10 to Stoneman Cr. Confluence	1.1 1.2 1.3					1.0: F. Sediment
Deep Cr.-4: headwaters including:	1.1 1.2 1.3					1.0: Riparian C. Stability F. Sediment
Stoneman Cr.: Confluence to headwaters	1.1			4.1		1.0: C. Stability L. Flow
Current Cr.: Confluence to headwaters	1.1 1.2			4.1		1.0: C. Stability

4th Field HUC/ Reach Name	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
						L. Flow
Smith Cr.: Confluence to headwaters including	1.1 1.2 1.3					1.0: F. Sediment
Castle Cr.: Confluence to headwaters including	1.1 1.2			4.1		1.0: Riparian F. Sediment H. Flow L. Flow H. Temp. Obstruction
Red Canyon Cr.: Confluence to headwaters including	1.1 1.2					1.0: H. Temp.
Petes Cr.: Confluence to headwaters including	1.1 1.2					1.0: H. Temp.
Pole Cr.-2: Camas confluence to headwaters						1.0: L. Flow H. Temp.

Redband Trout Objective and Strategy Summary for the Nevada Portion of the Owyhee Subbasin

Part I. Nevada Protection Objectives and Strategies

Protection Objective: 1. Improve streamside riparian habitat and bank stability.

- This Protection Objective is recommended for 24 of 26 reaches in HUC 17050105 (NV)
- This Protection Objective is recommended for 27 of 31 reaches in HUC 17050104 (NV)
- This Protection Objective is recommended for 51 of 57 reaches in all HUCs (Nevada portion)

Protection Objective 1 Strategy1:

1.1. Implement State and BLM riparian, fisheries and water resources Management Actions and Allocations standards and objectives from the Owyhee Resource Management Plan and Bruneau Management Framework Plan on watersheds with redband trout habitat.

Strategy 1.1 is not recommended for any reaches in Nevada:

Protection Objective 1 Strategy 2:

1.2. Implement State and BLM Standards and Guides, grazing management objectives and guidelines on watersheds with redband trout spawning and rearing habitats.

Strategy 1.2 is not recommended for any reaches, located in HUC 17050105:

Strategy 1.2 is recommended for the following reaches, located in HUC 17050104:

- McCann Cr-5 mile occupied RBT, low desnity RBT

Protection Objective 1 Strategy 3:

1.3. Work with private landowners to improve riparian habitat.

Strategy 1.3 is recommended for the following reaches, located in HUC 17050105:

- T41N R49E sec4 to Head Waters- Occupied by RBT year round, 3miles of reach occupied
- Indian Cr. (Trib to S.F. Owyhee)- Occupied RBT through National Forest
- Winters Cr. Trib to Indian Cr-2 miles occupied RBT through National Forest
- Mitchell Cr. Trib to Indian Cr-2 miles occupied RBT through National Forest
- Wall Cr. Trib to Indian Cr-1 Mile occupied RBT through National Forest
- Silver Cr. (Trib to S.F. Owyhee)- 2 miles occupied RBT through National Forest
- Breakneck Cr-2 miles occupied RBT
- Cap Winn Cr- Occupied RBT
- Doby George- Occupied RBT
- Columbia Cr- Occupied RBT, Low number (200's), Brook Trout abundant
- Blue Jacket Cr- Occupied RBT (700), Brook Trout
- McCann Cr-5 mile occupied RBT, low desnity RBT
- Water Pipe Canyon (trib to Taylor Canyon)- 2.5 mile occupied RBT

Strategy 1.3 is recommended for the following reaches, located in HUC 17050104:

- Penrod- RBT occupied entire way
- Gold Cr. (trib to Martin Cr)- 1.8 RBT occupied

Protection Objective 1 Strategy 4:

1.4. Improve livestock management program to improve riparian habitat on Tribal lands.

Strategy 1.4 is not recommended for any reaches, located in HUC 17050105:

Strategy 1.4 is recommended for the following reaches, located in HUC 17050104:

- Skull Cr
- N.F. of Skull Cr
- E.F. of Skull Cr
- Fawn Cr- USFS RBT occupied for sure 4.8miles

Protection Objective 1 Strategy 5:

1.5. Implement USFS livestock utilization standards from Forest Plan revisions on watershed with redband trout priority spawning and rearing habitats.

Strategy 1.5 is recommended for the following reaches, located in HUC 17050105:

- Indian Cr. (Trib to S.F. Owyhee)- Occupied RBT through National Forest
- Winters Cr. Trib to Indian Cr-2 miles occupied RBT through National Forest Mitchell Cr. Trib to Indian Cr-2 miles occupied RBT through National Forest
- Wall Cr. Trib to Indian Cr-1 Mile occupied RBT through National Forest
- Silver Cr. (Trib to S.F. Owyhee)- 2 miles occupied RBT through National Forest
- Breakneck Cr-2 miles occupied RBT
- Cap Winn Cr- Occupied RBT
- Doby George- Occupied RBT
- Columbia Cr- Occupied RBT, Low number (200's), Brook Trout abundant
- Blue Jacket Cr- Occupied RBT (700), Brook Trout
- Scoonover Cr.- Occupied RBT
- Mill Cr- Occupied RBT, Brook trout, included 3 forks

Strategy 1.5 is recommended for the following reaches, located in HUC 17050104:

- Fawn Cr- USFS RBT occupied for sure 4.8miles
- Slaughter House Cr- Occupied RBT 2 miles
- Brown's Gulch (Slaughter house Trib-2.4 miles RBT occupied
- Miller Cr.- 3 mile occupied RBT
- West Fr. (of Slaughterhouse Cr)- 1.5 miles occupied RBT
- North Fr (trib of California Cr)- No RBT, lack of flow(Drought yr)
- Dip Cr-1 mile RBT occupied
- Big Springs Cr- Unoccupied (insufficient flow)
- South Fr. -2 mile RBT occupied

- Pixley-1 mile RBT occupied
- Upper Mill Cr to Rio tinto Mine- occupied RBT whole distance in none drought years
- McCall Cr.- 5.5 miles occupied RBT
- Lime Cr (trib to Van Duzer)- .3 occupied by RBT, Brook Trout prsnt
- Cobb Cr (trib to Van Duzer)- 4.5 RBT occupied
- Wood Gulch- Mine prsnt, 2 mile RBT occupied
- Sheep cr-2 mile RBT occupied, Brook Trout
- Road Canyon-1.2 RBT occupied
- Gravel Cr- Lower 0.1 RBT occupied (spawning ground)
- Badger Cr. -7 miles RBT occupied, some livestock concerns, fair condition, 1600 fish
- Beaver Cr.- All occupied by RBT
- Martin Cr. (trib to Penrod)- 4.5 RBT occupied, Brook Trout
- Gold Cr. (trib to Martin Cr)- 1.8 RBT occupied

Protection Objective 2. Control pollution from mining activities.

- This Protection Objective is recommended for 0 of 26 reaches in HUC 17050105 (NV)
- This Protection Objective is recommended for 1 of 31 reaches in HUC 17050104 (NV)
- This Protection Objective is recommended for 1 of 57 reaches in all HUCs (Nevada portion)

Protection Objective 2 Strategy 1:

2.1 Use Best Management Practices to mine tailings and polluted areas to remediate pollution.[6]

Strategy 2.1 is recommended for the following reaches in HUC17050104

- E.F. Owyhee Duck Valley Indian Reservation border to Patsville (Mill Cr)- U.S.F.S.

Protection Objective 3. Restore redband trout connectivity.

- This Protection Objective is recommended for 27 of 26 reaches in HUC 17050105 (NV)
- This Protection Objective is recommended for 7 of 31 reaches in HUC 17050104 (NV)

[6] Use Best Management Practices to Rio Tinto Mine tailings and polluted areas to remediate pollution.

- This Protection Objective is recommended for 34 of 57 reaches in all HUCs (Nevada portion)

Protection Objective 3 Strategy 1:

3.1. Add fish screens to diversion structures to prevent downstream migration of redband trout into diversion ditches.

Strategy 3.1 is recommended for the following reaches in HUC17050105.

- T41N R49E sec4 to Head Waters- Occupied by RBT year round, 3miles of reach occupied
- Indian Cr. (Trib to S.F. Owyhee)- Occupied RBT through National Forest
- Winters Cr. Trib to Indian Cr-2 miles occupied RBT through National Forest
- Mitchell Cr. Trib to Indian Cr-2 miles occupied RBT through National Forest
- Wall Cr. Trib to Indian Cr-1 Mile occupied RBT through National Forest
- Silver Cr. (Trib to S.F. Owyhee)- 2 miles occupied RBT through National Forest
- Harrington Cr- Unsurveyed, Prvt Land, Probable RBT
- Marsh Cr.- Occupied RBT
- Boyd Cr- Occupied RBT
- Jack Cr- Occupied RBT, no brook trout surveyed in last 2yrs(used to be abundant
- Snow Canyon Cr- Occupied RBT, 5 mi occupied
- Burns Cr.(Trib to Jarritt Canyon-1.5 mile occupied on National Forest, Trout Prsnt
- Schmidtt Cr.- 4 miles occupied
- McCann Cr-5 mile occupied RBT, low desnity RBT
- Taylor Canyon Cr (trib to S.F. Owyhee)- 2 miles occupied RBT, BT common

Strategy 3.1 is recommended for the following reaches in HUC17050104.

- Slaughter House Cr- Occupied RBT 2 miles
- Trail Cr-8.2 occupied RBT, Brook Trout(MGT concern)
- Van Duzer Cr. (Trib to Trail Cr)- 5 mile occupied, Brook Trout (MGR concen)

Protection Objective 3 Strategy 2:

3.2. Replace impassable culverts with suitable redband trout passage structures.

Strategy 3.2 is recommended for the following reaches in HUC17050105.

- Scoonover Cr.- Occupied RBT
- Dorsey- Occupied RBT
- Coffin Cr.- Occupied RBT
- Jack Cr- Occupied RBT, no brook trout surveyed in last 2yrs(used to be abundant
- Taylor Canyon Cr (trib to S.F. Owyhee)- 2 miles occupied RBT, BT common
- Water Pipe Canyon (trib to Taylor Canyon)- 2.5 mile occupied RBT

Strategy 3.2 is recommended for the following reaches in HUC17050104.

- Dip Cr-1 mile RBT occupied
- Pixley-1 mile RBT occupied
- Hutch Cr-1mile RBT occupied, Brook Trout
- Timber Gulch-0.35 RBT occupied, Brook Trout

Protection Objective 3 Strategy 3:

3.3. Construct and operate a fish ladder over dam.

Strategy 3.3 is recommended for the following reaches in HUC17050105.

- Chicken Cr- Occupied RBT
- Cap Winn Cr- Occupied RBT
- Doby George- Occupied RBT
- Columbia Cr- Occupied RBT, Low number (200's), Brook Trout abundant
- Blue Jacket Cr- Occupied RBT (700), Brook Trout
- Mill Cr- Occupied RBT, Brook trout, included 3 forks

Strategy 3.3 is not recommended for any reaches in HUC17050104.

Protection Objective 3 Strategy 4:

3.4. Preserve and enhance native Redband trout habitat and connectivity by seeking innovative and voluntary methods to improve stream flows where it is feasible and consistent with State water laws and Tribal sovereignty..

Strategy 3.4 is not recommended for any reaches in Nevada.

Protection Objective: 4. Improve stream flows to achieve levels needed for redband trout survival and productivity.

- This Objective is recommended for 0 of 26 reaches in HUC 17050105 (NV)
- This Objective is recommended for 0 of 31 reaches in HUC 17050104 (NV)

- This Objective is recommended for 0 of 57 reaches in all HUCs (Nevada portion)

Protection Objective 4 Strategy 1:

4.1. Improve stream flow on public lands by increasing riparian vegetation.

Strategy 4.1 is not recommended for any reaches in Nevada:

The summary of protection objectives and strategies for the Nevada Portion of the Owyhee is presented in table 4.14.

Table 4.14. Summary of Protection objectives and strategies by HUC and reach for the Nevada Portion of the Owyhee.

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
HUC 17050105						
T41N R49E sec4 to Head Waters- Occupied by RBT year round, 3miles of reach occupied	1.3		3.1			C. Stability Obstruction
Indian Cr. (Trib to S.F. Owyhee)- Occupied RBT through National Forest	1.3 1.5		3.1			~~Pollutants~~ Riparian Obstruction
Winters Cr. Trib to Indian Cr-2 miles occupied RBT through National Forest	1.3 1.5		3.1			Obstruction Riparian
Mitchell Cr. Trib to Indian Cr-2 miles occupied RBT through National Forest	1.3 1.5		3.1			Obstruction Riparian
Wall Cr. Trib to Indian Cr-1 Mile occupied RBT through National Forest	1.3 1.5		3.1			Obstruction Riparian
Silver Cr. (Trib to S.F. Owyhee)- 2 miles occupied RBT through National Forest	1.3 1.5		3.1			Obstruction Riparian
Breakneck Cr-2 miles occupied RBT	1.3 1.5					~~Obstruction~~ Riparian
Cap Winn Cr- Occupied RBT	1.3 1.5		3.3			C. Stability

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
						H. Diversity Obstruction
Doby George- Occupied RBT	1.3 1.5		3.3			C. Stability H. Diversity Obstruction
Columbia Cr- Occupied RBT, Low number (200's), Brook Trout abundant	1.3 1.5		3.3			Obstruction Riparian
Blue Jacket Cr- Occupied RBT (700), Brook Trout	1.3 1.5		3.3			Obstruction Riparian
Harrington Cr- Unsurveyed, Prvt Land, Probable RBT			3.1			Obstruction
Marsh Cr.- Occupied RBT			3.1			Obstruction
Boyd Cr- Occupied RBT			3.1			Obstruction
Scoonover Cr.- Occupied RBT	1.5		3.2			Obstruction Riparian
Dorsey- Occupied RBT			3.2			Obstruction
Coffin Cr.- Occupied RBT			3.2			Obstruction
Jack Cr- Occupied RBT, no brook trout surveyed in last 2yrs(used to be abundant)			3.1 3.2			Obstruction
Chicken Cr- Occupied RBT			3.3			Obstruction
Mill Cr- Occupied RBT, Brook trout, included 3 forks	1.5		3.2			Obstruction Riparian
Snow Canyon Cr- Occupied RBT, 5 mi occupied			3.1			Obstruction
Burns Cr.(Trib to Jarritt Canyon-1.5 mile occupied on National Forest, Trout Prsnt			3.1			Obstruction
Schmidtt Cr.- 4 miles			3.1			Obstruction

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
occupied						
McCann Cr-5 mile occupied RBT, low desnity RBT	1.2 1.3		3.1			C. Stability H. Flow Obstruction
Taylor Canyon Cr (trib to S.F. Owyhee)- 2 miles occupied RBT, BT common			3.1 3.2			Obstruction
Water Pipe Canyon (trib to Taylor Canyon)- 2.5 mile occupied RBT	1.3		3.2			Obstruction Riparian
HUC 17050104						
Skull Cr	1.4					Riparian
N.F. of Skull Cr	1.4					Riparian
E.F. of Skull Cr	1.4					Riparian
Fawn Cr- USFS RBT occupied for sure 4.8miles	1.4 1.5					Riparian H. Temp.
E.F. Owyhee Duck Valley Indian Res border to Patsville (Mill Cr)- U.S.F.S.		2.1				Pollutants
Slaughter House Cr- Occupied RBT 2 miles	1.5		3.1			C. Stability H. Diversity F. Sediment Obstruction
Brown's Gulch (Slaughter house Trib- 2.4 miles RBT occupied	1.5					C. Stability H. Diversity F. Sediment ~~Obstruction~~
Miller Cr.- 3 mile occupied RBT	1.5					C. Stability H. Diversity

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
						F. Sediment ~~Obstruction~~
West Fr. (of Slaughterhouse Cr)- 1.5 miles occupied RBT	1.5					C. Stability H. Diversity F. Sediment
North Fr (trib of California Cr)- No RBT, lack of flow(Drought yr)	1.5					H. Temp.
Dip Cr-1 mile RBT occupied	1.5		3.2			C. Stability H. Diversity F. Sediment Obstruction
Big Springs Cr- Unoccupied (insufficient flow)	1.5					C. Stability H. Diversity F. Sediment ~~Obstruction~~
South Fr. -2 mile RBT occupied	1.5					Riparian
Pixley-1 mile RBT occupied			3.2			Obstruction
Upper Mill Cr to Rio tinto Mine- occupied RBT whole distance in none drought years	1.5					Riparian C. Stability H. Diversity F. Sediment
McCall Cr.- 5.5 miles occupied RBT	1.5					Riparian C. Stability H. Diversity F. Sediment

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
Trail Cr-8.2 occupied RBT, Brook Trout(MGT concern)			3.1			L. Flow Obstruction
Van Duzer Cr. (Trib to Trail Cr)- 5 mile occupied, Brook Trout (MGR concen)			3.1			L. Flow Obstruction
Lime Cr (trib to Van Duzer)- .3 occupied by RBT, Brook Trout prsnt	1.5					C. Stability
Cobb Cr (trib to Van Duzer)- 4.5 RBT occupied	1.5					Riparian C. Stability H. Diversity F. Sediment
Wood Gulch- Mine prsnt, 2 mile RBT occupied	1.5					Riparian C. Stability H. Diversity F. Sediment ~~Obstruction~~
Hutch Cr-1mile RBT occupied, Brook Trout			3.2			Obstruction
Timber Gulch-0.35 RBT occupied, Brook Trout			3.2			Obstruction
Sheep cr-2 mile RBT occupied, Brook Trout	1.5					Riparian C. Stability H. Diversity F. Sediment ~~Obstruction~~
Road Canyon-1.2 RBT occupied	1.5					Riparian C. Stability

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
						H. Diversity F. Sediment ~~Obstruction~~
Gravel Cr- Lower 0.1 RBT occupied (spawning ground)	1.5					Riparian
Badger Cr. -7 miles RBT occupied, some livestock concerns, fair condition, 1600 fish	1.5					Riparian C. Stability
Beaver Cr.- All occupied by RBT	1.5					Riparian C. Stability
Penrod- RBT occupied entire way	1.3					Riparian C. Stability
Martin Cr. (trib to Penrod)- 4.5 RBT occupied, Brook Trout	1.5					C. Stability
Gold Cr. (trib to Martin Cr)- 1.8 RBT occupied	1.3 1.5					Riparian C. Stability

Part II. Nevada Restoration Objectives and Strategies

Restoration Objective: 1. Improve streamside riparian habitat and bank stability.

- This Restoration Objective is recommended for 23 of 23 reaches in HUC 17050105 (NV)
- This Restoration Objective is recommended for 26 of 32 reaches in HUC 17050104 (NV)
- This Restoration Objective is recommended for 49 of 55 reaches in all HUCs (Nevada portion)

Strategies:

1.1. Implement State and BLM riparian, fisheries and water resources Management Actions and Allocations standards and objectives from the

Owyhee Resource Management Plan and Bruneau Management Framework Plan on watersheds with redband trout habitat.

Strategy 1.1 is not recommended for any reaches Nevada

1.2. Implement State and BLM Standards and Guides, grazing management objectives and guidelines on watersheds with redband trout spawning and rearing habitats.

Strategy 1.2 is recommended for the following reaches in HUC17050105

Lower boundry of Petan Ranch to Red Cow Cr.- Red Band prsnt seasonally(Spring) during good water yrs when sutiable water temps
From Red Cow to Hot cr.- RBT Occupied yr round, low density
T41N R49E sec4 to Head Waters- Occupied by RBT year round, 3miles of reach occupied
Amazon- Ephemerial, no record of RBT
Big Cottonwood Trib-1mile occupied by RBT
McCann Cr-5 mile occupied RBT, low desnity RBT

Strategy 1.2 is recommended for the following reaches in HUC17050104

Hay meadow Cr- - only native dace present
E. F. Owyhee Above Wildhorse Res to head waters- Spotted Frog habitat

1.3. Work with private landowners to improve riparian habitat.

Strategy 1.3 is recommended for the following reaches in HUC17050105

Lower boundry of Petan Ranch to Red Cow Cr.- Red Band prsnt seasonally(Spring) during good water yrs when sutiable water temps
From Red Cow to Hot cr.- RBT Occupied yr round, low density
T41N R49E sec4 to Head Waters- Occupied by RBT year round, 3miles of reach occupied
Winters Cr.- Recently occupied, but not currently, historic habitat (no record), stocked in 1972 with RBT, ceased in 2000due to fire/livestock grazing
Indian Cr. (Trib to S.F. Owyhee)- Occupied RBT through National Forest
Frost Cr.- Low number of RBT
Cap Winn Cr- Occupied RBT
Doby George- Occupied RBT
Deep Cr. Trib to S.F. Owyhee
Red Cow Cr.- Occupied 1mile by RBT
Amazon- Ephemerial, no record of RBT
Big Cottonwood Trib-1mile occupied by RBT
McCann Cr-5 mile occupied RBT, low desnity RBT
Water Pipe Canyon (trib to Taylor Canyon)- 2.5 mile occupied RBT

Strategy 1.3 is recommended for the following reaches in HUC17050104

E.F. Owyhee Mill Cr.to Badger Cr- U.S.F.S.

Allegheny- Native Dace only
Hay meadow Cr- - only native dace present
Thompson Cr (hay meadow trib)- no fish present in drough yrs
Sweet Cr-0.5 RBT occupied
Rosebud Cr- Native Dace only
N.F. of Deep Cr- No RBT, lack of flow(Drought yr)
Middle Fork of Deep Cr-2 mile occupied RBT
S.F of Deep Cr-3 miles RBT occupied
E. F. Owyhee Above Wildhorse Res to head waters- Spotted Frog habitat
Hanks Cr trib to Upper E.F Owyhee- Dace prsnt, habitat concerns (livestocke) no RBT

1.4. Improve livestock management program to improve riparian habitat on Tribal lands

Strategy 1.4 is not recommended for any reaches in HUC17050105

Strategy 1.4 is recommended for the following reaches in HUC17050104

- E.F. Owyhee ID-NV state line to Paradise Point Diversion- Irrigated hay fields, No RBT habitat
- E.F. Owyhee Paradise Point to Duck Valley Indian Res border- DVIR
- Skull Cr
- N.F. of Skull Cr
- E.F. of Skull Cr
- Jones Cr
- Granite- probably fishless

1.5. Implement USFS livestock utilization standards from Forest Plan revision on watershed with redband trout priority spawning and rearing habitats.

Strategy 1.5 is recommended for the following reaches in HUC17050105

- Frost Cr.- Low number of RBT
- Cap Winn Cr- Occupied RBT
- Doby George- Occupied RBT

Strategy 1.5 is recommended for the following reaches in HUC17050104

- Allegheny- Native Dace only
- Cold Spring (trib to Allegheny)- Native Dace only
- Riffe Cr (Deep Cr)- 3 mile occupied RBT, beaver ponds
- N.F. of Deep Cr- No RBT, lack of flow(Drought yr)
- Middle Fork of Deep Cr-2 mile occupied RBT
- S.F of Deep Cr-3 miles RBT occupied

Restoration Objective 2. Control pollution from mining activities.

- This Restoration Objective is recommended for 0 of 23 reaches in HUC 17050105 (NV)
- This Restoration Objective is recommended for 3 of 32 reaches in HUC 17050104 (NV)
- This Restoration Objective is recommended for 3 of 55 reaches in all HUCs (Nevada portion)

Strategies:

2.1 Use Best Management Practices to mine tailings and polluted areas to remediate pollution.[7]

Strategy 2.1 is recommended for the following reaches in HUC17050104:

- E.F. Owyhee ID-NV state line to Paradise Point Diversion- Irrigated hay fields, No RBT habitat
- E.F. Owyhee Duck Valley Indian Res border to Patsville (Mill Cr)- U.S.F.S.
- Lower Mill Cr to S.F Owyhee River- Unoccupied, pollution, mine tailings

Restoration Objective 3. Restore redband trout connectivity.

- This Restoration Objective is recommended for 8 of 23 reaches in (NV)
- This Restoration Objective is recommended for 13 of 32 reaches in (NV)
- This Restoration Objective is recommended for 21 of 55 reaches in all HUCs (Nevada portion)

Strategies:

3.1. Add fish screens to diversion structures to prevent downstream migration of redband trout into diversion ditches.

Strategy 3.1 is recommended for the following reaches in HUC17050105:

- T41N R49E sec4 to Head Waters- Occupied by RBT year round, 3miles of reach occupied
- Silver Cr. (Trib to S.F. Owyhee)- 2 miles occupied RBT through National Forest
- White Rock Cr.- Unoccupied, probably historic, mining influence

Strategy 3.1 is recommended for the following reaches in HUC17050104:

[7] Use Best Management Practices to Rio Tinto Mine tailings and polluted areas to remediate pollution.

- E.F. Owyhee Duck Valley Indian Res border to Patsville (Mill Cr)- U.S.F.S.
- North Fr (trib of California Cr)- No RBT, lack of flow(Drought yr)

3.2. Replace impassable culverts with suitable redband trout passage structures.

Strategy 3.2 is recommended for the following reaches in HUC17050105:

- Water Pipe Canyon (trib to Taylor Canyon)- 2.5 mile occupied RBT

Strategy 3.2 is recommended for the following reaches in HUC17050104:

- Hutch Cr-1mile RBT occupied, Brook Trout
- Timber Gulch-0.35 RBT occupied, Brook Trout

3.3. Construct and operate a fish ladder over dam.

Strategy 3.3 is not recommended for any reaches in HUC17050105:

Strategy 3.3 is recommended for the following reaches in HUC17050104:

- E.F. Owyhee ID-NV state line to Paradise Point Diversion- Irrigated hay fields, No RBT habitat

3.4. Preserve and enhance native Redband trout habitat and connectivity by seeking innovative and voluntary methods to improve stream flows where it is feasible and consistent with State water laws and Tribal sovereignty.

Strategy 3.4 is recommended for the following reaches in HUC17050105:

- Lower boundry of Petan Ranch to Red Cow Cr.- Red Band prsnt seasonally(Spring) during good water yrs when sutiable water temps
- hot creek to McCann -Prvt Land, Brook Trout prsnt in Spring Heads, RBT are seasonal, White Fish yr round
- T41N R49E sec4 to Head Waters- Occupied by RBT year round, 3miles of reach occupied
- McCann Cr-5 mile occupied RBT, low desnity RBT

Strategy 3.4 is recommended for the following reaches in HUC17050104:

- E.F. Owyhee ID-NV state line to Paradise Point Diversion- Irrigated hay fields, No RBT habitat
- California Cr- Min. occupied RBT by headwater of Cr.
- Trail Cr-8.2 occupied RBT, Brook Trout(MGT concern)
- Van Duzer Cr. (Trib to Trail Cr)- 5 mile occupied, Brook Trout (MGR concen)
- E.F. Owyhee Badger Cr. To Wildhorse Res.- U.S.F.S.

- Wildhorse Res
- Deep Cr trib to Wildhorse (E.F. Owyhee)- 1.5 miles occupied RBT, some on prvt land?
- Clear Cr trib to (Deep Cr)- no fish present in drough yrs

Restoration Objective: 4. Improve stream flows to achieve levels needed for redband trout survival and productivity.

- This Restoration Objective is recommended for 0 of 23 reaches in HUC 17050105 (NV)
- This Restoration Objective is recommended for 0 of 32 reaches in HUC 17050104 (NV)
- This Restoration Objective is recommended for 0 of 55 reaches in all HUCs (Nevada portion)

Strategy:

4.1. Improve stream flow on public lands by increasing riparian vegetation.

Strategy 4.1 is not recommended for any reaches in Nevada.

Restoration Objective: 5. Remove nonnative fish population in order to enhance redband trout survival and productivity.

- This Restoration Objective is recommended for 1 of 23 reaches in HUC 17050105 (NV)
- This Restoration Objective is recommended for 0 of 32 reaches in HUC 17050104 (NV)
- This Restoration Objective is recommended for 1 of 55 reaches in all HUCs (Nevada portion)

Strategy:

5.1. Remove nonnative fish population using most appropriate site-specific methods.

Strategy 5.1 is recommended for reaches in the following HUC17050105.

- hot creek to McCann -Prvt Land, Brook Trout prsnt in Spring Heads, RBT are seasonal, White Fish yr round

The summary of restoration objectives and strategies for the Nevada Portion of the Owyhee is presented in (Table 4.15).

Table 4.15. Summary of Restoration objectives and strategies by HUC and reach for the Nevada Portion of the Owyhee.

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
HUC 17050105						
Lower boundry of Petan Ranch to Red Cow Cr.- Red Band prsnt seasonally(Spring) during good water yrs when sutiable water temps	1.2 1.3		3.4			Riparian C. Stability ~~H. Flow~~ Obstruction
From Red Cow to Hot cr.- RBT Occupied yr round, low density	1.2 1.3					~~H. Flow~~ ~~Obstruction~~
hot creek to McCann - Prvt Land, Brook Trout prsnt in Spring Heads, RBT are seasonal, White Fish yr round			3.4		5.1	Obstruction
T41N R49E sec4 to Head Waters- Occupied by RBT year round, 3miles of reach occupied	1.2 1.3		3.1 3.4			C. Stability Obstruction
Winters Cr.- Recently occupied, but not currently, historic habitat (no record), stocked in 1972 with RBT, ceased in 2000due to fire/livestock grazing	1.3					C. Stability H. Temp. Obstruction
Sheep Cr. Res to T46n R51E sec 11- Int/Dry, no RBT, spring down migration						Obstruction
T46n R51e sec 11 to head waters						Obstruction
Indian Cr. (Trib to S.F. Owyhee)- Occupied RBT through National Forest	1.3					Pollutants
Silver Cr. (Trib to S.F. Owyhee)- 2 miles			3.1			Obstruction

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
occupied RBT through National Forest						
White Rock Cr.- Unoccupied, probably historic, mining influence			3.1			Obstruction
Cottonwood Canyon Cr.- Unoccupied, probably historic, mining influence						Obstruction
Bull Run Cr.-S.F. Owyhee to Bull Run Canyon- Diverted for Agriculture use						Obstruction
Mouth of Bull Run Canyon to Cap Winn Cr.- probably recruitment from upstream tribs						Obstruction
Frost Cr.- Low number of RBT	1.1 1.3					C. Stability H. Diversity Obstruction
Cap Winn Cr- Occupied RBT	1.1 1.3					C. Stability H. Diversity Obstruction
Doby George- Occupied RBT	1.1 1.3					C. Stability H. Diversity Obstruction
Deep Cr. Trib to S.F. Owyhee	1.3					H. Diversity
S.F Owyhee to Head Waters- Unoccupied, RBT probably present historically						N/A (no scores)
Red Cow Cr.- Occupied 1mile by RBT	1.3					C. Stability

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
Amazon- Ephemerial, no record of RBT	1.2 1.3					C. Stability ~~Obstruction~~
Big Cottonwood Trib- 1mile occupied by RBT	1.2 1.3					C. Stability
McCann Cr-5 mile occupied RBT, low desnity RBT	1.2 1.3		3.4			C. Stability L. Flow Obstruction
Water Pipe Canyon (trib to Taylor Canyon)- 2.5 mile occupied RBT	1.3		3.2			Obstruction Riparian
HUC 17050104						
E.F. Owyhee ID-NV state line to Paradise Point Diversion- Irrigated hay fields, No RBT habitat	1.4	2.1	3.3 3.4			C. Stability L. Flow Pollutants Obstruction
E.F. Owyhee Paradise Point to Duck Valley Indian Res border- DVIR	1.4					C. Stability H. Diversity
Skull Cr	1.4					Riparian
N.F. of Skull Cr	1.4					Riparian
E.F. of Skull Cr	1.4					Riparian
Jones Cr	1.4					Riparian
Granite- probably fishless	1.4					Riparian
E.F. Owyhee Duck Valley Indian Res border to Patsville (Mill Cr)- U.S.F.S.		2.1	3.1			Pollutants
California Cr- Min. occupied RBT by headwater of Cr.			3.4			L. Flow
North Fr (trib of California Cr)- No RBT,			3.1			H. Temp.

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
lack of flow(Drought yr)						
E.F. Owyhee Mill Cr.to Badger Cr- U.S.F.S.	1.3					H. Diversity
Lower Mill Cr to S.F Owyhee River- Unoccupied, pollution, mine tailings		2.1				Riparian H. Diversity Pollutants
Allegheny- Native Dace only	1.1 1.3					L. Flow
Cold Spring (trib to Allegheny)- Native Dace only	1.1					L. Flow
Trail Cr-8.2 occupied RBT, Brook Trout(MGT concern)			3.4			L. Flow Obstruction
Van Duzer Cr. (Trib to Trail Cr)- 5 mile occupied, Brook Trout (MGR concen)			3.4			L. Flow Obstruction
Hutch Cr-1mile RBT occupied, Brook Trout			3.2			Obstruction
Timber Gulch-0.35 RBT occupied, Brook Trout			3.2			Obstruction
E.F. Owyhee Badger Cr. To Wildhorse Res.- U.S.F.S.			3.4			Obstruction
Wildhorse Res			3.4			L. Flow Obstruction
Hay meadow Cr- - only native dace present	1.2 1.3					L. Flow
Thompson Cr (hay meadow trib)- no fish present in drough yrs	1.3					L. Flow
Sweet Cr-0.5 RBT occupied	1.3					L. Flow
Rosebud Cr- Native Dace only	1.3					L. Flow
Deep Cr trib to Wildhorse (E.F. Owyhee)- 1.5 miles			3.4			L. Flow

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
occupied RBT, some on prvt land?						
Clear Cr trib to (Deep Cr)- no fish present in drough yrs			3.4			L. Flow
Riffe Cr (Deep Cr)- 3 mile occupied RBT, beaver ponds	1.1					L. Flow
N.F. of Deep Cr- No RBT, lack of flow(Drought yr)	1.1 1.3					L. Flow
Middle Fork of Deep Cr- 2 mile occupied RBT	1.1 1.3					L. Flow
S.F of Deep Cr-3 miles RBT occupied	1.1 1.3					L. Flow
E. F. Owyhee Above Wildhorse Res to head waters- Spotted Frog habitat	1.2 1.3					F. Sediment
Hanks Cr trib to Upper E.F Owyhee- Dace prsnt, habitat concerns (livestock) no RBT	1.3					Riparian

Redband Trout Objective and Strategy Summary for the Oregon Portion of the Owyhee Subbasin

Part I. Oregon Protection Objectives and Strategies

Protection Objective: 1. Improve streamside riparian habitat and bank stability.

- This Protection Objective is recommended for 3 of 16 reaches in HUC17050110
- This Protection Objective is recommended for 3 of 16 reaches in HUC17050108
- This Protection Objective is recommended for 7 of 16 reaches in HUC17050107
- This Protection Objective is recommended for 13 of 16 reaches in all HUCs (Oregon portion)

Protection Objective 1 Strategy1:

1.1. Implement State and BLM riparian, fisheries and water resources Management Actions and Allocations standards and Protection Objectives from the Owyhee Resource Management Plan and Bruneau Management Framework Plan on watersheds with redband trout habitat.

(Strategy 1.1 is specific to the Idaho portion of the Owyhee Subbasin.)

Protection Objective 1 Strategy 2:

1.2. Implement State and BLM Standards and Guides, grazing management Protection Objectives and guidelines on watersheds with redband trout spawning and rearing habitats.

Strategy 1.2 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Protection Objective 1 Strategy 3:

1.3. Work with private landowners to improve riparian habitat.

Strategy 1.3 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Protection Objective 1 Strategy 4:

1.4. Improve livestock management program to improve riparian habitat on Tribal lands.

Strategy 1.4 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Protection Objective 1 Strategy 5:

1.5. Implement USFS Livestock utilization standards from Forest Plan revision on watershed with redband trout priority spawning and rearing habitats.

(Strategy 1.5 is specific to the Nevada portion of the Owyhee Subbasin.)

Protection Objective 1 Strategy 6:

1.6. Implement grazing management appropriate for riparian pastures.

Strategy 1.6 is recommended for the following reaches, located in HUC17050110:

- Owyhee R-2- DC Dam to RM28
- Dry Creek- Dry Creek upstream to Crowley Road
- Owyhee R-4-High Water upstream to Jordan Cr.

Strategy 1.6 is recommended for the following reaches, located in HUC17050108:

- Jordan Creek- Mouth to State Line
- Cow Creek- Mouth to State Line
- Owyhee R-5- Confl. Jordan Creek upstream to State line

Strategy 1.6 is recommended for the following reaches, located in HUC17050107:

- NF Owyhee- Mouth to State line
- Antelope Creek R-3- Road upstream to Headwaters
- WLO R-1- Mouth upstream to Anderson Crossing
- WLO R-2- Anderson Crossing to headwaters

Protection Objective 1 Strategy 7:

1.7. Improve riparian areas to increase vegetation shading where feasible..

Strategy 1.7 is recommended for the following reaches, located in HUC17050110:

- Dry Creek- Dry Creek upstream to Crowley Road

Strategy 1.7 is recommended for the following reaches, located in HUC17050108:

- Jordan Creek- Mouth to State Line
- Cow Creek- Mouth to State Line

Strategy 1.7 is recommended for the following reaches, located in HUC17050107:

- NF Owyhee- Mouth to Sline
- Middle Fork-Idaho Segment
- Antelope Creek R-1- Mouth upstream to corrals (~8 mi)
- Antelope Creek R-2- Corrals upstream to Star Valley Road (dry segment)
- Antelope Creek R-3- SV Road upstream to Headwaters
- WLO R-1- Mouth upstream to Anderson Crossing
- WLO R-2- Anderson Crossing to headwaters

Protection Objective 1 Strategy 8:

1.8 Increase riparian vegetation to increase bank stability.

Strategy 1.8 is recommended for the following reaches, located in HUC17050110:

- Dry Creek- Dry Creek upstream to Crowley Road

Strategy 1.8 is recommended for the following reaches, located in HUC17050108:

- Jordan Creek- Mouth to State Line
- Cow Creek- Mouth to State Line

Strategy 1.8 is recommended for the following reaches, located in HUC17050107:

- NF Owyhee- Mouth to State line

- Middle Fork-Idaho Segment ()
- Antelope Creek R-1- Mouth upstream to corrals (~8 mi)
- Antelope Creek R-2- Corrals upstream to Star Valley Road (dry segment)
- Antelope Creek R-3- SV Road upstream to Headwaters
- WLO R-1- Mouth upstream to Anderson Crossing
- WLO R-2- Anderson Crossing to headwaters

Protection Objective 1 Strategy 9:

1.9 Increase riparian vegetation to increase channel complexity and channel form.

Strategy 1.9 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Protection Objective 1 Strategy 10:

1.10 Improve riparian vegetation to reduce fine sedimentation.

Strategy 1.10 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Protection Objective 2. Control pollution from mining activities.

- This Protection Objective is recommended for none of the 16 reaches in the Oregon portion of the Owyhee.

Protection Objective 2 Strategy 1:

2.1 Use Best Management Practices to mine tailings and polluted areas to remediate pollution.

Strategy 2.1 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Protection Objective 3. Restore redband trout connectivity.

- This Protection Objective is recommended for 2 of 16 reaches in HUC17050108
- This Protection Objective is recommended for 2of 16 reaches in all HUCs

Protection Objective 3 Strategy 1:

3.1. Add fish screens to diversion structures to prevent downstream migration of redband trout into diversion ditches.

Strategy 3.1 is recommended for the following reaches in HUC17050108

- Jordan Creek- Mouth to State Line
- Cow Creek- Mouth to State Line

Protection Objective 3 Strategy 2:

3.2. Replace impassable culverts with suitable redband trout passage structures.

Strategy 3.2 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Protection Objective 3 Strategy 3:

3.3. Construct and operate a fish ladder over dam.

Strategy 3.3 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Protection Objective 3 Strategy 4:

3.4. Preserve and enhance native Redband trout habitat and connectivity by seeking innovative and voluntary methods to improve stream flows where it is feasible and consistent with State water laws and Tribal sovereignty.

Strategy 3.4 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Protection Objective 3 Strategy 5:

3.5. Provide passage of irrigated structures.

Strategy 3.5 is recommended for the following reaches in HUC17050108.

- Jordan Creek- Mouth to State Line
- Cow Creek- Mouth to State Line

Protection Objective: 4. Improve stream flows to achieve levels needed for redband trout survival and productivity.

- This Protection Objective is not recommended for any reaches in all HUCs

Protection Objective 4 Strategy 1:

4.1. Improve stream flow on public lands by increasing riparian vegetation.

Strategy 4.1 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Protection Objective 4 Strategy 2:

4.2. Improve irrigation efficiency.

Strategy 4.2 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

The summary of protection objectives and strategies for the Oregon Portion of the Owyhee.is presented in table 4.16.

Table 4.16. Summary of Protection objectives and strategies by HUC and reach for the Oregon Portion of the Owyhee.

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	O6	Min. QHA Score ↦ Limiting Factor(s)
17050110 Lower Owyhee							
Owyhee R-1- Mouth to Owyhee Ditch Co Dam (RM14)							Oxygen (CT)
Owyhee R-2- DC Dam to RM28[8]	1.6						H. Temp. (CT)
Owyhee R-3- Dam to Upstream High Water (RM80)							N/A
Dry Creek- Dry Creek upstream to Crowley Road[9]	1.6 1.7 1.8						No scores
Owyhee R-4- High Water upstream to	1.6						H. Temp. (CT)

8 Grazing management may include season of use, fencing, and rest.
9 Grazing management may include season of use, fencing, and rest.
10 Most of this Owyhee River reach is in HUC 17050110; however, the upper one mile of this river reach is in HUC 17050107. Appropriate grazing management has been implemented on BLM portion.

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	O6	Min. QHA Score ↦ Limiting Factor(s)
Jordan Cr[10]							
Rinehart Creek- Mouth to falls[11]							C Stability (RP)
17050108 Jordan Creek							
Jordan Creek- Mouth to State Line[12]	1.6 1.7 1.8		3.1 3.5				H diversity (RP)
Cow Creek- Mouth to State Line[13]	1.6 1.7 1.8		3.1 3.5				F sediment (RP)
Owyhee R-5- Confl. Jordan Creek upstream to State line[14]	1.6						F. Sediment (CT)
17050107 Middle Owyhee							
NF Owyhee- Mouth to State line[15]	1.6 1.7 1.8						H. Temp. (CT)
Middle Fork Owyhee – (headwaters are in Idaho Segment)[16]	1.7 1.8						Pollutants (CT)
Antelope Creek R-1- Mouth upstream to corrals (~8 mi)[17]	1.7 1.8						H diversity (RP)
Antelope Creek R-2- Corrals upstream to Star	1.7 1.8						H Flow (RP)

[11] Limiting factors in this segment result from natural processes
[12] Primarily private land and agricultural use. Grazing management may include early season use, fencing, and rest.
[13] Primarily private land and agricultural use. Grazing management may include early season use, fencing, and rest.
[14] Appropriate grazing management has been implemented on BLM reaches.
[15] Grazing management may include early season use, fencing, and rest.
[16] Primarily private land. Grazing management may include season of use, fencing, and rest.
[17] Limiting factors result from natural processes. Grazing management may include season of use, fencing, and rest.

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	O6	Min. QHA Score ↦ Limiting Factor(s)
Valley Road (dry segment)[18]							
Antelope Creek R-3- SV Road upstream to Headwaters[19]	1.6 1.7 1.8						L Flow (RP)
West Little Owyhee R-1- Mouth upstream to Anderson Crossing[20]	1.6 1.7 1.8						F. Sediment (CT)
West Little Owyhee R-2- Anderson Crossing to headwaters[21]	1.6 1.7 1.8						L. Flow (CT)

Part II. Oregon Restoration Objectives and Strategies

Restoration Objective: 1. Improve streamside riparian habitat and bank stability.

- This Restoration Objective is recommended for 3 of 6 reaches in HUC17050110
- This Restoration Objective is recommended for 3 of 3 reaches in HUC17050108
- This Restoration Objective is recommended for 6 of 6 reaches in HUC17050107
- This Restoration Objective is recommended for 12 of 15 reaches in all HUCs

Restoration Objective 1 Strategy1:

1.1. Implement State and BLM riparian, fisheries and water resources Management Actions and Allocations standards and Restoration Objectives from the Owyhee Resource Management Plan and Bruneau

[18] Limiting factors result from natural processes (lack of perennial flow). Grazing management may include season of use, fencing, and rest.
[19] Grazing management may include early season use, fencing, and rest.
[20] Appropriate grazing management has been implemented (exclusion). Appropriate grazing management has been implemented on BLM reaches.
[21] Appropriate grazing management has been implemented (exclusion). Grazing management may include season of use, fencing, and rest.

Management Framework Plan on watersheds with redband trout habitat.

(Strategy 1.1 is specific to the Idaho portion of the Owyhee Subbasin.)

Restoration Objective 1 Strategy 2:

1.2. Implement State and BLM Standards and Guides, grazing management Restoration Objectives and guidelines on watersheds with redband trout spawning and rearing habitats.

Strategy 1.2 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Restoration Objective 1 Strategy 3:

1.3. Work with private landowners to improve riparian habitat.

Strategy 1.3 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Restoration Objective 1 Strategy 4:

1.4. Improve livestock management program to improve riparian habitat on Tribal lands.

Strategy 1.4 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Restoration Objective 1 Strategy 5:

1.5. Implement USFS livestock utilization standards from Forest Plan version on watershed with redband trout priority spawning and rearing habitats.

(Strategy 1.5 is specific to the Nevada portion of the Owyhee Subbasin.)

Restoration Objective 1 Strategy 6:

1.6. Implement grazing management appropriate for riparian pastures.

Strategy 1.6 is recommended for the following reaches, located in HUC17050110:

- Dry Creek- Dry Creek upstream to Crowley Road

Strategy 1.6 is recommended for the following reaches, located in HUC17050108:

- Cow Creek- Mouth to State Line
- Owyhee R-5- Confl. Jordan Creek upstream to Sline

Strategy 1.6 is recommended for the following reaches, located in HUC17050107:

- NF Owyhee- Mouth to Sline
- Antelope Creek R-3- SV Road upstream to Headwaters
- WLO R-1- Mouth upstream to Anderson Crossing
- WLO R-2- Anderson Crossing to headwaters

Restoration Objective 1 Strategy 7:

1.7. Improve riparian areas to increase vegetation shading where feasible..

Strategy 1.7 is recommended for the following reaches, located in HUC17050110:

- Dry Creek- Dry Creek upstream to Crowley Road
- Owyhee R-4- High water upstream to Jordan Cr.

Strategy 1.7 is recommended for the following reaches, located in HUC17050108:

- Jordan Creek- Mouth to State Line
- Cow Creek- Mouth to State Line
- Owyhee R-5- Confluence Jordan Creek upstream to Sline

Strategy 1.7 is recommended for the following reaches, located in HUC17050107:

- NF Owyhee- Mouth to Sline
- Middle Fork-Idaho Segment ()
- Antelope Creek R-1- Mouth upstream to corrals (~8 mi)
- Antelope Creek R-2- Corrals upstream to Star Valley Road (dry segment)
- Antelope Creek R-3- SV Road upstream to Headwaters
- WLO R-1- Mouth upstream to Anderson Crossing
- WLO R-2- Anderson Crossing to headwaters

Restoration Objective 1 Strategy 8:

1.8. Increase riparian vegetation to increase bank stability..

Strategy 1.8 is recommended for the following reaches, located in HUC17050110:

- Dry Creek- Dry Creek upstream to Crowley Road
- Owyhee R-4- High water upstream to Jordan Cr.

Strategy 1.8 is recommended for the following reaches, located in HUC17050108:

- Jordan Creek- Mouth to State Line

Strategy 1.8 is not recommended for any reaches located in HUC17050107:

Restoration Objective 1 Strategy 9:

1.9. Increase riparian vegetation to increase channel complexity and channel form.

Strategy 1.9 is recommended for the following reaches, located in HUC17050108:

- Cow Creek- Mouth to State Line
- Owyhee R-5- Confl. Jordan Creek upstream to Sline

Strategy 1.9 is recommended for the following reaches, located in HUC17050107:

- NF Owyhee- Mouth to Sline

Restoration Objective 1 Strategy 10:

1.10.Improve riparian vegetation to reduce fine sedimentation.

Strategy 1.10 is recommended for the following reaches, located in HUC17050107:

- Middle Fork-Idaho Segment ()
- Antelope Creek R-1- Mouth upstream to corrals (~8 mi)
- Antelope Creek R-2- Corrals upstream to Star Valley Road (dry segment)
- Antelope Creek R-3- SV Road upstream to Headwaters
- WLO R-1- Mouth upstream to Anderson Crossing
- WLO R-2- Anderson Crossing to headwaters

Restoration Objective 2. Control pollution from mining activities.

- This Restoration Objective is recommended for none of 16 reaches in all HUCs

Restoration Objective 2 Strategy 1:

2.1 Use Best Management Practices to mine tailings and polluted areas to remediate pollution.

Strategy 2.1 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Restoration Objective 3. Restore redband trout connectivity.

- This Restoration Objective is recommended for 2 of 16 reaches in HUC17050108
- This Restoration Objective is recommended for 2 of 16 reaches in all HUCs

Restoration Objective 3 Strategy 1:

3.1. Add fish screens to diversion structures to prevent downstream migration of redband trout into diversion ditches.

Strategy 3.1 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Restoration Objective 3 Strategy 2:

3.2. Replace impassable culverts with suitable redband trout passage structures.

Strategy 3.2 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Restoration Objective 3 Strategy 3:

3.3. Construct and operate a fish ladder over dam.

Strategy 3.3 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Restoration Objective 3 Strategy 4:

3.4. Preserve and enhance native Redband trout habitat and connectivity by seeking innovative and voluntary methods to improve stream flows where it is feasible and consistent with State water laws and Tribal sovereignty.

Strategy 3.4 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Restoration Objective 3 Strategy 5:

3.5. Provide passage of irrigated structure.

Strategy 3.5 is recommended for the following reaches in HUC17050108.

- Jordan Creek- Mouth to State Line
- Cow Creek- Mouth to State Line

Restoration Objective: 4. Improve stream flows to achieve levels needed for redband trout survival and productivity.

- This Restoration Objective is recommended for 2 of 16 reaches in HUC17050108
- This Restoration Objective is recommended for 2 of 16 reaches in all HUCs

Restoration Objective 4 Strategy 1:

4.1. Improve stream flow on public lands by increasing riparian vegetation.

Strategy 4.1 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

Restoration Objective 4 Strategy 2:

4.2. Improve irrigation efficiency.

Strategy 4.2 is recommended for the following reaches, located in HUC17050108:

- Jordan Creek- Mouth to State Line
- Cow Creek- Mouth to State Line

Restoration only:

Restoration Objective: 5. Remove nonnative fish population in order to enhance redband trout survival and productivity.

- This Restoration Objective is recommended for none of 16 reaches in all HUCs

Restoration Objective 5 Strategy 1:

5.1. Remove nonnative fish population using most appropriate site-specific methods.

Strategy 5.1 is not recommended for any reaches in the Oregon portion of the Owyhee Subbasin.

The summary of restoration objectives and strategies for the Oregon Portion of the Owyhee.is presented in table 4.17.

Table 4.17. Summary of RestorationObjectives and strategies by HUC and reach for the Oregon Portion of the Owyhee.

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
17050110 Lower Owyhee						
Owyhee R-1- Mouth to Owyhee Ditch Co Dam (RM14)						Oxygen (CT)
Owyhee R-2- DC Dam to RM28						H. Temp. (CT)
Owyhee R-3- Dam to Upstream High Water (RM80)						N/A (CT) No scores (CT) N/A (RP)

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
						No scores (RP)
Dry Creek- Dry Creek upstream to Crowley Road[22]	1.6 1.7 1.8					H. Temp. (CT)
Owyhee R-4- High Water upstream to Jordan Cr[23]	1.7 1.8					F. Sediment (CT) H. Temp. (CT) Pollutants (CT) F sediment (RP) C complexity (RP) H temps (RP)
Rinehart Creek- Mouth to falls[24]						F. Sediment (CT) F sediment (RP) C stability (RP) Riparian c (RP)
17050108 Jordan Creek						
Jordan Creek- Mouth to State Line[25]	1.7 1.8		3.5	4.2		L. Flow (CT) H. Temp. (CT) L. Flow (RP) C stability (RP) H. Temp (RP)
Cow Creek- Mouth to State Line[26]	1.6 1.7 1.9		3.5	4.2		Riparian (CT) L. Flow (CT)

[22] Grazing management may include early season use, fencing, and rest.
[23] Appropriate grazing management has been implemented on BLM reaches
[24] Limiting factors result from natural processes. Appropriate grazing management has been implemented on BLM reaches.
[25] Primarily private land and agricultural use. Grazing management may include early season use, fencing, and rest.

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
						H. Temp. (CT) L flows (RP) Riparian (RP) C complexity (RP)
Owyhee R-5- Confl. Jordan Creek upstream to State line[27]	1.6 1.7 1.9					H. Temp. (CT) H. Temp (RP) C complexity (RP) C form. (RP)
17050107 Middle Owyhee						
NF Owyhee- Mouth to State line[28]	1.6 1.7 1.9					Riparian (CT) H. Temp. (CT) Riparian C (RP) H. Temp (RP) C complexity (RP).
Middle Fork-Idaho Segment ()[29]	1.7 1.10					Riparian (CT) Riparian C (RP) F sediment (RP) Oxygen (RP)
Antelope Creek R-1- Mouth upstream to corrals (~8 mi)[30]	1.7 1.10					F. Sediment (CT) F. Sediment (RP) L flow (RP) Oxygen (RP)

[26] Primarily private land and agricultural use. Grazing management may include early season use, fencing, and rest.
[27] Appropriate grazing management has been implemented (exclusion). Appropriate grazing management has been implemented on BLM reaches.
[28] Grazing management may include early season use, fencing, and rest.
[29] Primarily private land. Grazing management may include early season use, fencing, and rest.
[30] Limiting factors result from natural processes. Grazing management may include early season use, fencing, and rest.

4th Field HUC / Stream Reach	O1	O2	O3	O4	O5	Min. QHA Score ↦ Limiting Factor(s)
Antelope Creek R-2- Corrals upstream to Star Valley Road (dry segment)[31]	1.7 1.10					F. Sediment (CT) H flows (RP) L flows (RP)
Antelope Creek R-3- SV Road upstream to Headwaters[32]	1.6 1.7 1.10					Riparian (CT) H. Diversity (CT) Oxygen (CT) H. Temp. (CT) C complexity (RP) Oxygen (RP) H. Temp. (RP)
WLO R-1- Mouth upstream to Anderson Crossing[33]	1.6 1.7 1.10					F. Sediment (CT) H. Temp. (CT) F. Sediment (RP) H. Temp (RP) C complexity (RP).
WLO R-2- Anderson Crossing to headwaters[34]	1.6 1.7 1.10					H. Temp. (CT) H. Temp (RP) C form (RP) Riparian C. (RP)

[31] Limiting factors result from natural processes (lack of perennial flow).Natural conditions. Grazing management may include early season use, fencing, and rest.
[32] Grazing management may include early season use, fencing, and rest.
[33] Appropriate grazing management has been implemented (exclusion). Appropriate grazing management has been implemented on BLM reaches.
[34] Appropriate grazing management has been implemented (exclusion). Grazing management may include early season use, fencing, and rest.

4.4.2 Objectives and Strategies for Terrestrial Habitats

To address and mitigate the impacts of the federal hydropower system, Congress passed the Pacific Northwest Electric Power Planning and Conservation Act (Public Law 96-501) and the Northwest Power Planning Council was created. The NWPCC, through its Columbia River Basin Fish and Wildlife Program, address and mitigate the impacts of the hydrosystem in the Columbia River Basin. The vision of the program is "a Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife, mitigating across the basin for the adverse effects to fish and wildlife caused by the development and operation of the hydrosystem and providing benefits from fish and wildlife valued by the people of the region"(NWPCC 2000). Early versions of the program directed regional fish and wildlife managers to systematically assess wildlife habitat losses for all federal hydropower projects in the basin – in order to provide for equitable mitigation.

The Owyhee subbasin supports a diversity of wildlife and plant species. Much of the subbasin has been identified as a "Center of Biodiversity" and rated as having high ecological integrity by ICBEMP (Quigely and Arbelbide 1997). This subbasin supports the largest population of California bighorn sheep in the U.S.[35] as well as being part of the largest contiguous center of shrub-steppe biodiversity in the Interior Columbia River Basin (Quigely and Arbelbide 1997, Schnitzspahn et al. 2000). The purpose of the Owyhee Subbasin Management Plan is to provide a systematic basis to prioritize Objectives and Strategies based on best science and direct involvement of local stakeholders.

4.4.2.1 Terrestrial – Short-term Objectives and Strategies

The ongoing projects sponsored by the Shoshone-Paiute Tribes form the nucleus of goals, objectives, and strategies for terrestrial habitat restoration and enhancement in the Owyhee Subbasin – for the short term (i.e., next three years). This foundation will provide a starting point for the development of a more comprehensive and diverse strategic plan for the Owyhee Subbasin for the long term (i.e, the following decade, and beyond). A number of conservation efforts are in progress in the Owyhee Subbasin (refer to the Chapter 3, Inventory of Existing Activities). The following section provides a summary of the goals, objectives and strategies – listed by co-management entity – that were put forth in the Owyhee Subbasin summary (Perugini et al. 2002):

Entity – Shoshone-Paiute Tribes

[35] The original Bighorn Sheep populations in the Owyhee Subbasin were extirpated and have been reintroduced.

Goal: Work cooperatively with federal, state, county and private entities throughout the subbasin to enhance, protect and/or restore fish and wildlife habitat

Objective: Protect, enhance, and/or acquire wildlife mitigation properties in the Middle Snake Province, with emphasis on the Owyhee and Bruneau subbasins.

- Work with local landowners to discus habitat enhancement/protection/ acquisition opportunities.
- Develop method to evaluate habitat enhancement/protection/ acquisition opportunities in the subbasin
- Work collaboratively with interested entities in the subbasins, including, but not limited to: the Nature Conservancy, IDFG, NDOW, local sage grouse working groups, Owyhee Initiative Work Group, BLM, USFS, and NRCS.
- Explore opportunities to develop "grass banks" in Owyhee and Bruneau subbasins

Objective: Coordinate subbasin-wide land acquisitions, conservation easements and riparian habitat improvements.

- Fund and facilitate coordinator position and activities in subbasins where the Shoshone-Paiute Tribes have historical natural resource and cultural interests and rights.
- Facilitate development of cooperative funding and implementation of habitat protection and restoration across state and jurisdictional boundaries

Objective: Protect streams, associated wetlands and riparian areas on Duck Valley Indian Reservation

Entity – The Nature Conservancy

Goals:

- Shrub-steppe habitat – Identify and protect the existing high quality shrub-steppe habitat (late seral condition areas), while moving the fair quality shrub-steppe (mid seral areas) into late seral conditions.
- Springs, spring creek systems, and wetlands: Maintain or improve the ecological conditions of all springs, spring creek systems, and wetlands so as to be rated in Proper Functioning Condition.
- River terrace communities: Maintain the existing condition and quality of all A and B ranked big basin sagebrush/basin wildrye river terrace communities along the South Fork of the Owyhee, and identify and protect similar river terrace communities throughout the Owyhee Canyonlands.

Strategies:

- Develop community supported plans for conservation of key ecological values that also take into account economic and cultural values.
- Direct resources to highest priority projects within the subbasin as identified using a science-driven ecoregional planning process.
- Emphasize protection of existing high quality habitats for a wide range of species and maintain existing areas of undisturbed shrub-steppe habitat.

- Work with willing landowners and land managers to protect priority conservation lands through acquisitions, conservation easements, land exchanges, and management agreements.

Entity – Owyhee County Sage Grouse Working Group (selected goals & objectives)

Goal: Preserve and increase sage grouse populations in Owyhee County.

- Develop maps that identify sage grouse habitat for high priority protection from wildfire.
- Implement sagebrush restoration projects in historic sage grouse habitat.
- Prioritize sites for juniper control activities.

Entity - USDA Natural Resources Conservation Service

Goal: Enhance natural resource productivity to enable a strong agricultural and natural resource sector.

- Maintain, restore, or enhance wetland ecosystems and fish and wildlife habitat.
- Deliver high quality services to the public to enable natural resource stewardship.

4.4.2.1.1 Overview of Short-term Terrestrial Objectives & Strategies

The ongoing Shoshone-Paiute Tribes projects form the nucleus of wildlife and terrestrial habitat restoration objectives and strategies for the Owyhee Subbasin Plan (Table 4.18); refer to the Project Inventory (Chapter 3) for more detail.

Table 4.18. Summary of terrestrial biological objectives and strategies for ongoing BPA-funded fish & wildlife projects sponsored by the Shoshone-Paiute Tribes.

PROJECT/OBJECTIVES	STRATEGIES
Wildlife Inventory and Habitat Evaluation Projects	

PROJECT/OBJECTIVES	**STRATEGIES**
1. Develop and implement terrestrial habitat and wildlife monitoring plan for the Duck Valley Indian Reservation**.**	a. Research, Monitoring &Evaluation (RM&E) – develop a terrestrial habitat and wildlife monitoring plan; conduct habitat Analysis of DVIR using Landsat Thematic Mapper satellite image taken of reservation; groundtruthing; and delineation of habitat types and area extent. Incorporate habitat data into monitoring plan in subsequent iteration of plan; conduct habitat evaluation (HEP methodology), b. Conduct wildlife monitoring: (1). Spotted frog presence/absence surveys; (2). Sage grouse lek surveys; (3). Waterfowl production surveys; (4). Bat surveys; (5) Raptor surveys; (6). Point counts for avian species; (7). Small mammal surveys; (8). Amphibian and reptile surveys; (9). Big game surveys; (10). White-faced ibis surveys; (11). Pygmy rabbit survey.
Riparian Habitat Enhancement and Restoration	
1. Protect specific springs from livestock impacts – based on revision of list of springs in proposal. 2. Protect specific streams from livestock impacts –In coordination with Project 2000-079 and field observations. 3. Conduct fishery and habitat surveys	a. Cooperative management/Research – identify, prioritize and locate springs in need of protection (priority to suspected redband trout streams), b. Habitat Restoration – implement protective measures of springs (minimum of 6 springs per year); implement protective measures (fencing riparian areas/fixing road crossings) on streams and/or headwaters (appr. 6-10 miles of fence, troughs, culverts, etc). c. Research, Monitoring & Evaluation (RM&E) – implement PFC assessment; conduct population estimates, size structure, condition, locations (GPS) in coordination with Project 2000-079.
Land Acquisition -- Southern Idaho Wildlife Mitigation	
1. Identify parcels for acquisition or conservation easement 2. Identify sites for habitat enhancement activities 3. Protect 2500 HUs of wildlife habitat and associated aquatic habitat through fee-title acquisition or conservation easement 4. Protect 500 HUs of wildlife habitat and associated aquatic habitat through habitat enhancement activities	a. Research, Monitoring &Evaluation (RM&E) – perform broadscale habitat analysis of province using GIS data from ICDC, NNHP, NRCS, GAP Analysis; conduct baseline HEP treatment/enhancement areas; conduct baseline survey of property (GPS fences, habitat extents, aerial photos, noxious weed survey); conduct baseline aquatic resources evaluation (PFC at minimum); conduct baseline wildlife surveys b. draft property management plan that details O&M and M&E. c. Coordinate enhancement efforts -- consult with state and federal agency biologists, the Nature Conservancy, USFS, IDFG, Nature Conservancy, Northeastern Nevada Stewardship Group, Owyhee Initiative work group, local sage grouse work groups to identify high priority species/areas. d. Land/easement acquisition – negotiate with willing land owners to buy easements and/or fee-titles. e. Cooperative Co-management -- Identify cost-sharing

PROJECT/OBJECTIVES	STRATEGIES
	opportunities, develop enhancement plan, conduct NEPA compliance, and develop necessary MOUs – with cooperating agency(ies) f. Land/easement Acquisition – acquire fee title or easement to appropriate parcels of land. g. Habitat Restoration – control noxious weeds;construct/repair/maintain fencing; conduct stream protection activities (water troughs, etc.); rehabilitate/restore habitat by planting native seed stock or by transplanting native plants; manipulate vegetation (seeding, prescribed burns, chaining) to achieve enhancement objectives.
Reservoir Riparian Habitat Enhancement	
1. Protect shoreline and inlet streams from degradation. 2. Disseminate information to public. 3. Work with Owyhee Schools on volunteer projects. 4. Update and review Operations and Maintenance and Monitoring and Evaluation Plan	a. Habitat restoration – plant native trees/willows and grasses along shoreline and tributaries to Lake Billy Shaw b. Control grazing impacts – install water troughs/stock ponds to keep stock away from reservoir/fences c. Education & public outreach – monthly newspaper articles/quarterly to city paper; update & maintain signs to alert public to new fishing facility; have students aid in planting trees/willows/grasses. d. Monitor & evaluate – collect and summarize data on biological and economic aspects of the Lake Billy Shaw Project.

4.4.2.1.2 Wildlife Mitigation in the Mid-Snake Province and Owyhee Subbasin

Three hydroelectric projects, Anderson Ranch, Black Canyon and Deadwood were constructed in the Middle Snake Province. The Shoshone-Paiute wildlife mitigation project[36] addresses mitigation opportunities for those projects. Although losses to FCRPS dam occurred outside the Owyhee Subbasin, off-site mitigation can occur in the Owyhee Subbasin.

Anderson Ranch

The Anderson Ranch Dam is located in the Payette subbasin and was completed in 1950, inundating and/or impacting 6,516 acres of wildlife habitat along the South Fork Boise River (Chaney and Sather-Blair 1985a). Losses totaling 9,619 Habitat Units (HUs) were assessed for target species (Table 4.19) . Eight cover types were identified in the study

[36] Southern Idaho Wildlife Mitigation Program, Middle Snake Province – Shoshone-Paiute Tribes (Project 199505703)

area and all except the lacustrine open water habitat were reduced as a result of construction of the dam (Table 4.20).

Black Canyon

Black Canyon Dam is located in the Payette subbasin and was completed in 1924, impacting 1,100 acres of wildlife habitat along the Payette River (Chaney and Sather-Blair 1985b). The impact assessment revealed losses of 2,230 HUs (Meuleman et al. 1986). The mitigation plan, completed in 1987 (Meuleman et al. 1987), identified potential mitigation sites which included areas within the Bruneau and Owyhee subbasins.

Deadwood Dam

Deadwood Dam was authorized for construction in 1928 and was completed in 1931. Approximately 3,094 acres of habitat were impacted (Table 4.20) with losses assessed at 7,413 habitat units (HUs) (Table 4.19; Meuleman et al. 1986).

Table 4.19. Wildlife losses associated with hydroelectric projects in the Middle Snake Province (Project 199505703 SOW 2003).

Species	Anderson Ranch	Black Canyon	Deadwood	Total HUs by Species	Mitigation To-Date	Balance Remaining
Mallard	1048	270		1318		1318
Mink	1732	652	987	3371		3371
Yellow Warbler	361		309	670	3	667
Yellow-Rumped Warbler			2626	2626		2626
Black-capped Chickadee	890	68		958		958
Ruffed Grouse	919			919		919
Blue Grouse	1980			1980		1980
Mule Deer	2689	242	2080	5011	54	4957
Peregrine Falcon	1222*					
Canada Goose		214		214		214
Ring-necked Pheasant		260		260		260

Species	Anderson Ranch	Black Canyon	Deadwood	Total HUs by Species	Mitigation To-Date	Balance Remaining
Sharp-tailed Grouse		532		532		532
Spruce Grouse			1411	1411		1411
Totals	**9619**	**2238**	**7413**	**19270**	**57**	**19213****
*Not required to be mitigated						
**1:1 ratio pending resolution of crediting issues regarding 2000 program						

Table 4.20. Habitat gain/loss in acres for Middle Snake Province Dams (Project 199505703 SOW 2003).

Habitat Type	Anderson Ranch	Black Canyon	Dead-wood	Habitat Gain/ Loss (acres)
Deciduous forested wetland	-966	-78	-36	-1080
Deciduous scrub-shrub wetlands	-256	10	-386	-632
Emergent wetland		7		7
Free flowing river	-275	-246	-29	-550
Shrub-steppe	-2200	-530		-2730
Evergreen forest	-280		-2643	-2923
Deciduous shrubland	-270			-270
Agricultural/Pasture	-565	-278		-843
Lacustrine	4740	1057	3094	8891
Other	72	58		130

The Northwest Power Planning Council's current Fish and Wildlife Program's primary wildlife strategy is to "*complete the current mitigation program for construction and inundation losses….(NWPCC 2000).*" To achieve this goal, the Shoshone-Paiute Tribes developed projects to protect, enhance/restore and maintain native riparian, wetland, forest and shrub-steppe habitats (2500 habitat units (HUs) of habitat protection, 500 HUs of habitat enhancements in FY2003) at suitable sites in the Middle Snake Province as mitigation for the construction of Anderson Ranch, Deadwood, and Black Canyon hydroelectric projects. The Tribes, in coordination with the Shoshone-Bannock Tribes and the Idaho Department of Fish and Game, plan to fully mitigate construction losses by 2013. Identified losses at Anderson Ranch, Black Canyon, and Deadwood total 19,270 habitat units (HUs), of which only 57 (.3%) have been mitigated for to-date (this is based on a 1:1 crediting ratio pending resolution of crediting issues surrounding the Council's 2000 Fish and Wildlife Program).

Potential acquisition/easement/enhancement sites will be identified using a number of tools, including, but not limited to: geospatial data, GAP Analysis information, and regional wildlife data. The Shoshone-Paiute Tribes will work extensively with entities interested in protecting fish and wildlife resources in the province, including: the Nature Conservancy, IDFG, Shoshone-Bannock Tribes, BLM Resource Area biologists, USFWS, USFS and private land owners.

Progress towards long-term habitat protection goals will be measured using Habitat Evaluation Procedures (HEP) (USFWS 1981), by conducting Proper Functioning Condition (PFC) assessments (Prichard 1998) and by monitoring fish and wildlife populations. Wherever possible, passive restoration techniques will be employed.

The "Southern Idaho Wildlife Mitigation Program, Middle Snake Province – Shoshone-Paiute Tribes" is an ongoing programmatic project that originated from the Southern Idaho Wildlife Mitigation (SIWM) program[37]. The original SIWM was a regionally focused program that mitigated for construction and inundation losses across the southern portion of Idaho. Due to the change in the Council's Fish and Wildlife Program (2000), the SIWM is now split between two provinces (Middle Snake and Upper Snake Provinces) and among three fish and wildlife management entities (Shoshone-Paiute Tribes, Shoshone-Bannock Tribes and IDFG).

The Southern Idaho Wildlife Mitigation Program, Middle Snake Province – Shoshone-Paiute Tribes (Project 199505703) is consistent with the Council's 2000 Fish and Wildlife Program and has significance in the context of regional planning activities being undertaken in both the Owyhee and Bruneau subbasins. The following excerpts, taken from the NWPCC 2000 Program, illustrates project consistency with the Council's Fish & Wildlife Program:

- The extent of the wildlife mitigation is of particular importance to agencies and tribes in the so-called "blocked" areas, where anadromous fish runs once existed but were blocked by the development of the hydrosystem. While there are limited opportunities for improving resident fish in those areas, resident fish substitution alone seldom is adequate mitigation.
- Wildlife mitigation should emphasize addressing areas of the basin with the highest proportion of unmitigated losses (losses in Middle Snake Province only .3% mitigated to-date)

[37] Southern Idaho Wildlife Mitigation (SIWM) – Shoshone-Bannock Tribes and Idaho Department of Fish and Game (BPA Project #9505700) was the umbrella wildlife mitigation program previously in place that provided funding for mitigation activities in the Middle and Upper Snake Provinces. In addition to the hydroelectric projects identified in this document, the SIWM conducts mitigation activities for Palisades and Minidoka Dams. At the conclusion of FY2002, this program will be dissolved and each entity will propose projects on an individual basis.

- Habitat Strategies -…The Northwest Power Act allows off-site mitigation for fish and wildlife populations affected by the hydrosystem. Because some of the greatest opportunities for improvement lie outside the immediate area of the hydrosystem—in the tributaries and subbasins off the mainstem of the Columbia and Snake Rivers—this program seeks habitat improvements outside the hydrosystem as a means of off-setting some of the impacts of the hydrosystem.
- The program directs significant attention to rebuilding healthy, naturally producing fish and wildlife populations by protecting and restoring habitats and the biological systems within them.
- Wherever feasible, this program will be accomplished by protecting and restoring the natural ecological functions, habitats, and biological diversity of the Columbia River Basin.
- There is an obligation to provide fish and wildlife mitigation where habitat has been permanently lost due to hydroelectric development.
- (regarding) Eliminated Habitat:…In the case of wildlife, where the habitat is inundated, substitute habitat would include setting aside and protecting land elsewhere that is home to a similar ecological community.
- Build from Strength – Efforts to improve the status of fish and wildlife populations in the basin should protect habitat that supports existing populations that are relatively healthy and productive.
- Habitat units identified in Table 11-4 must be acquired in the subbasin in which the lost units were located unless otherwise agreed by the fish and wildlife agencies and tribes in the subbasin.

There is currently no wildlife mitigation plan for the Nevada or Oregon portion of the Owyhee Subbasin that is comparable to the Southern Idaho Wildlife Mitigation Plan.

4.4.2.2 Terrestrial – Long-term Objectives and Strategies[38]

4.4.2.2.1 Overview of Terrestrial Focal Habitats

The Owyhee Subbasin Planning Team identified the following habitat types as focal habitat types (January 28, 2004 consensus):

- Riparian and wetlands
- Shrub-steppe (including sagebrush steppe and salt-scrub shrublands)
- Old Growth western juniper and mountain mahogany woodlands
- Upland aspen forest
- Grasslands

[38] This section is adapted from the draft Bruneau Subbasin Plan (Riparian and wetlands, Shrub-steppe (including sagebrush steppe and salt-scrub shrublands), Old Growth western juniper and mountain mahogany woodlands and Upland aspen forest); the draft Boise/Payette Weiser (Pine/Fir/Mixed Conifer Forests) Subbasin Plan; Middle Snake (Grasslands);and the Owyhee Initiative Proposal (Canyon/Gorge).

- Pine/Fir/Mixed Conifer Forests
- Canyon / Gorge
- Agricultural Lands

The Owyhee Subbasin Planning/Technical Team used the Terrestrial Habitat Problem Statements, Objectives, and Strategies from the draft Bruneau Subbasin Plan (Accessed from the Eco-Vista web site, April 2004) as a "strawman" or model due to time constraits and because the landscape and resource management issues are similar to the Owyhee (Tim Dykstra, Shoshone-Paiute Tribes, Personal Communication). Furthermore, the Bruneau Subbasin Planning Team had spent a great deal of time and inter-agency technical effort in the developing their initial draft, and the Owyhee Subbasin Team did not have the resources to duplicate this level of effort. Additional Problem Statements, Objectives, and Strategies were derived from the draft Boise/Weiser/Payette Subbasin Plan and the Owyhee Initiative. The summary of problems and objectives in relation to the terrestrial wildlife habitat limiting factors within Owyhee Subbasin is presented in Table 4.21. The formatting of the problem statements, objectives and strategies is generally consistent with guidance in the Technical Guide (NWPCC 2001).

Table 4.21. Problems and objectives addressing factors limiting wildlife habitats and species in the Owyhee Subbasin. (The Owyhee Subbasin Planning Team adapted these from the Draft Bruneau, Draft Mid-Snake, and the Draft Boise/ Weiser/ Payette Subbasin Plans, April 2004)

Terrestrial Wildlife Habitat	
Problem Statement	**Objective**
1. The loss and degradation of **wetland and riparian** areas has negative effects on fish and wildlife species that utilize these habitats.	1.1. Minimize grazing effects in riparian and wetland habitats
	1.2. Minimize adverse effects of roads in riparian and wetland habitats
	1.3. Maintain and restore hydrologic regime in riparian and wetland habitats. Restore natural nutrient cycles or mitigate for damages to aquatic and terrestrial populations due to the loss of marine-derived nutrients.
2. Degradation, fragmentation, and loss of native **shrub-steppe** habitat adversely affects associated terrestrial species.	2.1. Minimize impacts of livestock grazing to native shrub-steppe habitat and terrestrial species
	2.2. Reduce the intensity, frequency, and size of wildfire in shrub-steppe habitats
	2.3. Limit noise disturbance to shrub-steppe wildlife species
	2.4. Reduce the prevalence of crested wheatgrass in shrub-steppe habitats
	2.5. Protect existing high quality shrub-steppe plant communities from nonnative invasive plant species and noxious weeds
3. Habitat condition of **old growth western juniper and mountain mahogany woodland habitats** is degraded by the presence of nonnative invasive plants and noxious weeds.	3.1. Provide habitat for big game and other wildlife species.
4. Changes in species composition and structure of **aspen habitats** have had negative effects on wildlife species. Fire suppression, insect infestation, and grazing have been identified as factors limiting the quality of this habitat type in the subbasin.	4.1. Reduce the impacts of livestock grazing on aspen habitats
	4.2. Maintain viable stands of aspen by through management practices encouraging and/or emulating natural fire processes
	4.3. Retain viable stands of aspen for native terrestrial species associated with upland aspen habitats
5. The loss and degradation of the **grassland** habitats of the subbasin have negatively impacted numerous native plant and animal species dependent on these habitats.	5.1. Protect existing good condition grasslands (see discussion section below for description of how the management agencies of the subbasin define this).
	5.2. Restore degraded grasslands to good condition. Increase the coverage of native perennials, e.g., bluebunch wheatgrass and/or Idaho fescue.
6. Alterations of forest structure is limiting **pine/fir/mixed conifer forest** habitats in some areas of the Owyhee subbasin.	6.1. Protect mature pine/fir/mixed conifer forest habitats by promoting ecological processes (i.e. natural fire regime) that lead to late seral stages while protecting meadow habitats from pine/fir/mixed conifer encroachment. This includes processes that lead to

Terrestrial Wildlife Habitat	
Problem Statement	**Objective**
	forest stability in this habitat type.
7. Some cross-country dirt roads have served as "gateway roads" – allowing dirt bikes and off-road vehicles to carve new routes across remote landscape to **Canyon and Gorge** habitats	Objective 7.1. Restrict illegal roads, and manage cross-country motorized travel to ensure that the ecological integrity of Canyon and Gorge habitats of the Owyhee Subbasin is maintained.
8. Road construction has altered the size, quality, distribution, and spatial relationships in and between habitat patches in the subbasin (**agriculture**).	8.1. Reduce the impact of the transportation system on wildlife and fish populations and habitats.

As the Owyhee Subbasin Plan goes through additional iterations (e.g., on the three-year Provincial Review cycle) new research, monitoring & evaluation information should be incorporated into the objectives and strategies listed in Table 4.21 – via the adaptive management process.

4.4.2.2.2 Riparian and Wetland Habitats

Problem 1. The loss and degradation of riparian and wetland areas in the Owyhee subbasin has negative effects on fish and wildlife species that utilize these habitats. Improper Grazing, roads, and water use have been identified as the primary factors limiting the quality of this habitat type in the subbasin.

Objective 1.1. Minimize effects of improper grazing in riparian and wetland habitats.

Strategy 1.1.1.

Adhere to the Idaho Standards for Rangeland Health and Guidelines for Livestock Grazing Management (BLM 1997).

1. Protect and/or restore riparian and wetland areas by designing grazing schedules that meet vegetative needs, fencing, providing alternative water sources for cattle, replanting native vegetation.
2. Protect existing riparian and wetland areas that support habitat requirements of aquatic and riparian associated terrestrial species.
3. Protect riparian and wetland habitat through land acquisition, conservation easements. This is a strategy that is often not locally supported by counties within the Owyhee Subbasin.
4. Monitor and evaluate effects of grazing in riparian and wetland habitats. Incorporate new information into Strategies A – D through the adaptive management process.

Objective 1.2. Minimize adverse effects of roads (i.e. habitat fragmentation and degradation) in riparian and wetland habitats.

Strategy 1.2.1.
Avoid construction of new roads in or near riparian and wetland habitats.

- Mitigate road effects by considering location, design, construction and operation of roads that currently exist in or are unavoidably built near riparian and wetland habitats.
- Monitor and evaluate the effects of roads in riparian and wetland habitats. Incorporate new information into Strategies A and B through the adaptive management process.

Objective 1.3. Maintain and restore hydrologic regime and nutrients in riparian and wetland habitats.

Strategy 1.3.1 Implement various water management actions appropriate to specific sites (refer to following bulleted list) to enhance riparian conditions.

- Restore beaver to riparian areas (e.g. Sheep Creek other specific areas?).
- Restore stream channels to natural condition (as measured by PFC or other method).
- Restore nutrient loss due to extirpation of anadromous fish populstions
- Apply minimum flows to diversions
- Promote water conservation in the Owyhee subbasin.
- Monitor and evaluate hydrologic conditions of riparian and wetland habitats in the Owyhee subbasin.

Objective 1.4. Restore natural nutrient cycles or mitigate for damages to aquatic and terrestrial populations due to the loss of these nutrients (A study to confirm or reject this statement is proposed in Strategy 1.4.2).

Strategy 1.4.1. Assess nutrient inputs and cycling in the Owyhee Subbasin. Prioritize areas for restoration of nutrient loads.

Strategy 1.4.2. Quantify the impacts, if any, of nutrient reductions on wildlife populations caused by dams.

Strategy 1.4.3. If nutrient levels are demonstrated to be limiting to wildlife, investigate alternatives to restore natural nutrient levels to the subbasin. Integrate with nutrient restoration efforts to benefit aquatics, when possible, to benefit both aquatic and terrestrial species.

Strategy 1.4.4. Monitor and evaluate efforts to restore nutrients to upland areas if any were identified in the proposed study of Strategy 1.4.2. Monitor focal fish and wildlife to assess population response to changes in nutrients. Integrate new information into effort and revise strategies as needed.

Discussion: Prior to hydropower development, the Middle Snake Province supported a diverse community of native anadromous and resident fish populations. The extirpation of anadromous fish stocks from the province has reduced the native salmonid species assemblage and impacted the province ecologically, culturally and economically. Resident fish and wildlife species were impacted through lost productivity (absence of nutrient component attributable to anadromous fish) and habitat degradation. Loss of the once abundant salmonid runs undoubtedly impacted the food supply of many wildlife populations and impaired the functioning of the ecosystem as a whole.

The flow of nutrients into the subbasin has been altered by the construction of dams and the reduction of anadromous fish runs through the subbasin. The reduction of these nutrient flows has potentially impacted numerous wildlife species and the subbasins ecosystem as a whole. A study to quantify the impact of reduced nutrient inputs into the subbasin will allow for more a more in-depth understanding of ecosystem processes and more effective management of the subbasins resources.

Mike Hanley, a local rancher (Public Outreach Comment April 2004) provided documentation on the magnitude of salmon carcasses in the Owyhee River – related from John Harney a longtime resident of Duck Valley: "*When salmon come, they die in the water. Some wash up on the banks and others catch on gravel bars. It smelled so bad you can't ride a horse to the river*." This observation is actually quite significant from an ecological perspective. It is a well known natural phenomenon that as soon as adult salmon enter fresh water during their spawning migration, that their physiology begins to change, and ultimately the anadromous salmon are programmed to die after spawning in the upriver tributaries. Since Pacific salmon die within a few days of spawning, the nutrients contained in their carcasses become available to the ecosystem, in our case far inland from the ocean where the nutrients were derived. These salmon-transported nutrients are important for the maintenance of ecosystem biodiversity and fish production (Stockner and Ashley 2003). In Idaho streams, Thomas et al. (2003) reviewed the role of marine derived nutrients and concluded that nutrient delivery by anadromous salmon may have been ecologically significant under historic spawning densities.

At present, it is not possible to enhance nutrient enrichment via reestablishment of salmon runs in the Owyhee Subbasin. Other options include the development of innovative technologies to reduce the impact of upstream storage reservoirs on nutrient inputs or the addition of salmon carcasses or other nutrient sources into selected oligotrophic waters within the subbasin. More information and time are needed for careful consideration of such alternatives.

As the Owyhee Subbasin Plan goes through additional iterations (e.g., on the three-year Provincial Review cycle) new research, monitoring & evaluation information should be incorporated into the objectives and strategies listed above – via the adaptive management process.

4.4.2.2.3 Shrub-steppe Habitat

Problem 2. Degradation, fragmentation, and loss of native shrub-steppe habitat in the Owyhee subbasin adversely affects associated terrestrial species. Improper Grazing, fire, noise pollution, nonnative invasive plants and noxious weeds have been identified as the primary factors limiting the quality of this habitat type and terrestrial species in the subbasin.

Objective 2.1. Minimize impacts of improper livestock grazing to native shrub-steppe habitat and terrestrial species within the Owyhee subbasin.

Strategy 2.1.1. Implement various livestock grazing management actions appropriate to specific sites (refer to following bulleted list) to enhance shrub-steppe habitat conditions.

- Protect shrub-steppe habitat through land acquisition, conservation easements, however, this is a strategy that is often supported by counties within the Owyhee Subbasin.
- Adjust season of use and stocking rates of livestock grazing to maintain vegetative structure and composition; minimize soil compaction, erosion, and nonnative invasive plant/noxious weed propagation in shrub-steppe habitat.
- Ensure viability of sage grouse populations – In known sage grouse source and key habitats, implement grazing management practices that would maintain habitat criteria for breeding, brood rearing, and wintering (Connelly et al. 2000)
- Implement Owyhee County, ID and Nevada Department of Wildlife Sage Grouse Working Group Management Plans.

Table 4.22. Characteristics of sagebrush rangeland needed for productive sage grouse populations (from Connelly et al. 2000).

	Breeding		Brood rearing		Winter	
	Height (cm)	Canopy (%)	Height (cm)	Canopy (%)	Height (cm)	Canopy (%)
Mesic sites[a]						
Sagebrush	40-80	15-25	40-80	10-25	25-35	10-30
Grass-forb	>18c	≥25d	variable	>15	N/A	N/A
Arid sitesa						
Sagebrush	30-80	15-25	40-80	10-25	25-35	10-30
Grass-forb	>18c	≥15	variable	>15	N/A	N/A
Area[b]	>80		>40		>80	

a. Mesic and arid sites should be defined on a local basis; annual precipitation, herbaceous understory, and soils should be considered
b. Percentage of seasonal habitat needed with indicated conditions
c. Measured as "droop height"; the highest naturally growing portion of the plant
d. Coverage should exceed 15% for perennial grasses and 10% for forbs; values should be substantially greater if most sagebrush has a growth form that provides little lateral cover
e. Values for height and canopy coverage are for shrubs exposed above snow

- Adhere to recommendations and guidelines of existing state and federal management plans for bighorn sheep (IDFG, NDOW, BLM,ODFW).
- Maintain existing designated big game winter range – Develop grazing management strategies to protect big game winter range. Refine winter range designations by collecting data on big game herds that move between Idaho, Oregon and Nevada.
- Support the development and implementation of effective restoration methods in shrub-steppe plant communities.
- Monitor and evaluate impacts of livestock grazing to native shrub-steppe habitat and terrestrial species within the Owyhee subbasin.
- Incorporate new information into these strategies through the adaptive management process.

Objective 2.2. Reduce the intensity, frequency and size of wildfire in shrub-steppe habitats of the Owyhee subbasin.

Strategy 2.2.1. Implement various rangeland fire management actions appropriate to specific sites (refer to following bulleted list) to enhance shrub-steppe habitat conditions.

- Develop and fund effective restoration methods and work to restore areas damaged by fire to native vegetative communities, through the reduction of cheatgrass densities and seeding with native plant species.
- Establish and fund native seed and seedling production for post-wildfire rehabilitation.
- Monitor and evaluate the protection and restoration efforts of shrub-steppe habitat impacted by wildfire in the Owyhee subbasin.
- Incorporate new information into these strategies through the adaptive management process.
- Consider the use of fire to control the expansion of juniper outside their historic range.
- Reduce noxious weeds.

Objective 2.3. Limit noise disturbance to shrub-steppe wildlife species.

Strategy 2.3.1. Implement various noise pollution actions appropriate to specific sites (refer to following bulleted list) to enhance shrub-steppe habitat conditions.

- Limit military training disturbance (e.g. people, aircraft, and emitter sites) of sage grouse and bighorn sheep by adhering to avoidance actions and seasonal restrictions outlined in the Mountain Home Airforce Base Integrated Natural Resource Management Plan (CH2MHill 2004).
- Research, monitor and evaluate noise impacts to wildlife species in the Owyhee subbasin. Incorporate new information into Strategy A through the adaptive management process.

Objective 2.4. Reduce the prevalence of crested wheatgrass in the shrub-steppe habitats of the Owyhee subbasin.

Strategy 2.4.1. Implement various weed control actions appropriate to specific sites (refer to following bulleted list) to enhance shrub-steppe habitat conditions.

- Work to restore shrub-steppe habitat in areas currently dominated by crested wheatgrass. Prioritize areas where sagebrush connectivity could be established or expanded (e.g. specific sites).
- Develop and support methods promoting the establishment of native plant species in areas dominated by crested wheatgrass.
- Monitor and evaluate the prevalence of crested wheatgrass in the Owyhee subbasin.
- Incorporate new information into these strategies/actions through the adaptive management process.

Objective 2.5. Protect existing high quality shrub-steppe plant communities while reducing the extent and density of nonnative invasive plant species and noxious weeds in the Owyhee subbasin.

Strategy 2.5.1. Implement various weed control actions appropriate to specific sites (refer to following bulleted list) to enhance shrub-steppe habitat conditions.

- Identify and prioritize shrub-steppe habitat for protection from nonnative invasive plant species and noxious weeds.
- Control cheatgrass invasion and expansion - Develop methods with further study for cheatgrass eradication and restoration of these areas with native plant species.
- Prevent reproduction – minimize ground disturbing activities in shrub-steppe habitats highly susceptible to invasion by nonnative plant species and noxious weeds.
- Prevent seed dispersal – encourage the use of weed free seeds and feeds.
- Prevent seed dispersal – develop and implement programs and policies designed to limit the transportation of weed seeds from vehicles and livestock.
- Increase public participation – develop education and awareness programs in noxious weed identification, spread prevention and treatment.
- Prevent establishment – minimize establishment of new invasives by supporting early detection and eradication programs.
- Prioritize for treatment – Identify and prioritize areas for treatment of nonnative invasive plants and noxious weeds.
- Treat areas infested with nonnative invasive plants and noxious weeds – implement the most economical and effective treatment methods for reducing densities or eliminating populations of nonnative invasive plants and noxious weeds.
- Encourage best practices – where appropriate, encourage the use of biological control agents as a long-term control strategy without the potentially negative financial and environmental impacts of widespread herbicide use.
- Support Cooperative Weed Management Area(s) (CWMAs) within the Owyhee subbasin (Idaho's Strategic Plan for Managing Noxious Weeds) that will facilitate cooperative partnerships and probability of success for Strategies A – F.
- Monitor and evaluate the effort to protect shrub-steppe communities from nonnative invasive plants and noxious weeds.
- Incorporate new information into strategies/actions through the adaptive management process.
- Collect information on presence and population status of pygmy rabbits in the Owyhee subbasin.

4.4.2.2.4 Old Growth western juniper and mountain mahogany woodlands

Problem 3. Habitat condition of western juniper and mountain mahogany woodland habitats is influenced by the presence of nonnative invasive plants/noxious weeds, fire suppression and grazing.

Objective 3.1. Provide habitat for big game and other wildlife species - Maintain vegetative composition and structure of old growth western juniper and mountain mahogany woodland habitats in the Owyhee subbasin.

Strategy 3.1.1 Implement various weed control actions appropriate to specific sites (refer to following bulleted list) to enhance old growth western juniper and mountain mahogany woodland habitats conditions.

- Implement strategies to prevent and control nonnative invasive plant species and noxious weeds.
- Monitor and evaluate the condition of old growth western juniper and mountain mahogany woodland habitats of the Owyhee subbasin.
- Incorporate new information into these strategies/actions and the management and protection of these habitats through the adaptive management process.
- Implement prescribed fire to control and reverse juniper invasion out of its historic range and into shrub-steppe communities.

4.4.2.2.5 Upland Aspen

Problem 4. Changes in species composition and structure of aspen habitats in the Owyhee subbasin has had negative effects on wildlife species. Fire suppression insect infestation, and grazing have been identified as factors limiting the quality of this habitat type in the subbasin.

Objective 4.1. Reduce the impacts of livestock grazing on aspen habitats in the subbasin

Strategy 4.1.1. Implement various grazing management actions appropriate to specific sites (refer to following bulleted list) to enhance upland aspen woodland habitat conditions.

- Protect small, isolated aspen stands with exclosures during the growing period.
- Monitor and evaluate the effects of livestock grazing in upland aspen habitat.
- Incorporate new information into strategies/actions above through the adaptive management process.

Objective 4.2 Maintain viable stands of aspen by through management practices encouraging and/or emulating natural fire processes.

Strategy 4.2. Implement various fire management actions appropriate to specific sites (refer to following bulleted list) to enhance upland aspen woodland habitat conditions.

- Maintain aspen stands with a variety of size classes across the landscape through treatments (clearcuts or burns) 40 – 240 acres (15 – 100 ha) in size (Debyle and Winokur 1985).

- Prevent conifer encroachment – Implement fire management in upland aspen that promotes moderately intense fires with rotations of 40 – 80 years.
- Monitor and evaluate the effects of fire in the maintenance of a mosaic of upland aspen habitat.
- Incorporate new information into strategies/actions above through the adaptive management process.

Objective 4.3. Retain viable stands of aspen for native terrestrial species associated with upland aspen habitats.

Strategy 4.3.1. Implement various forest management actions appropriate to specific sites (refer to following bulleted list) to enhance upland aspen woodland habitat conditions.

- Protect sensitive raptor species (e.g., northern goshawk and peregrine falcon) nesting territories from timber harvest.
- Monitor and evaluate raptor populations and their associated prey species in the Owyhee subbasin.
- Monitor condition and composition of aspen stands in the Owyhee subbasin. Incorporate new information into Strategies A and B through the adaptive management process.

4.4.2.2.6 Grasslands Habitat

Problem 5. The loss and degradation of the grassland habitats of the subbasin have negatively impacted native plant and animal species dependent on these habitats.

Objective 5.1. Protect existing good condition grasslands (see discussion section below for description of how the management agencies of the subbasin define this).

Strategy 5.1.1. Continue to inventory, map, and establish the condition of grassland habitats within the subbasin

Strategy 5.1.2. Identify priority grassland areas for maintenance- give priority to larger intact remnants and those that contain rare species.

Strategy 5.1.3. Maintain high quality grassland habitats through land acquisition, fee title acquisitions, conservation easements, or land exchanges. This is a strategy that is often not locally supported by counties within the Owyhee Subbasin.

Strategy 5.1.4. Implement noxious weed prevention and limit of the impacts of improper grazing on the ecosystem.

Strategy 5.1.5. Monitor and evaluate the effectiveness of grassland protection strategies and the response of wildlife and fish focal, T+E, and sensitive species. Modify Strategies as necessary based on new information.

Discussion:
The subbasin's high quality grasslands is providing important habitat for grassland dependent species. The BLM and Forest Service have begun efforts to identify high quality grassland habitats in the subbasin anthese efforts need to be expanded and continued.

Identifying and protecting high quality grassland areas in the subbasin should be a priority. The BLM and Forest Service have begun efforts to identify high quality grassland habitats in the subbasin and these efforts need to be expanded and continued. Once the highest quality areas in the subbasin are identified, the need for protection should be assessed. Large intact areas that may be capable of supporting area dependent grassland species like the grasshopper sparrow or areas with rare or endangered elements should be given priority.

Objective 5.2. Restore degraded grasslands to good condition. Increase the coverage of native perennials, including bluebunch wheatgrass and/or Idaho fescue.

Strategy 5.2.1. Continue to research techniques for effectively restoring grassland habitats, and reducing or eliminating noxious weeds and cheatgrass.

Strategy 5.2.2. Establish the role of fire in maintaining natural grassland systems. Research its potential as a restoration tool.

Strategy 5.2.3. On abandoned agricultural areas plant native grasses, forbs and shrubs which will provide food and cover for wildlife.

Strategy 5.2.4. Implement grazing strategies that reduce the impact of improper grazing management on native grassland.

Strategy 5.2.5. Restore grassland habitats--actively improve or create native grassland habitats through noxious weed control, management practices and seeding with native species.

Strategy 5.2.6. Continue existing programs that work to acquire and restore grassland habitats. Develop new programs to acquire and restore grassland habitats.

Strategy 5.2.7. Monitor and evaluate the effectiveness of grassland restoration in the subbasin and the response of wildlife and fish focal, T+E, and sensitive species to changes in condition and area of grassland. Modify Strategies as necessary based on new information.

Discussion:

The primary causes of grassland degradation in the subbasin have been the introduction of noxious weeds and cheatgrass.

Once established cheatgrass outcompetes native bunchgrasses and is very difficult to remove. In the past, efforts at restoring areas dominated by cheatgrass have been marginally successful at best. The development of more successful and cost effective techniques for reducing and eliminating cheatgrass and restoring native bunchgrass communities, would have immeasurable benefits to grassland restoration efforts and grassland dependant wildlife species. The development of more cost effective methods for reducing the prevalence of noxious weeds in the subbasin would have similar benefits.

Fire frequencies in grassland habitats of the subbasin are thought to have been more common historically. Fire frequency in grassland habitats of the area have been reduced as a result of fire suppression. But conditions in the subbasin are changing shrubs have become more decadent and the litter that has accumulated beneath vegetation creates the potential for fires that are more severe and spread more rapidly. Cheatgrass dries early in the season and its invasion has caused an earlier fire season and the possibility of increased fire frequency. Light and moderate burns enhance bluebunch wheatgrass but severe burns have the potential to negatively affect the species (Johnson 1998). Idaho fescue is more susceptible to fire especially during the late summer and may require several years for recovery, but is unlikely to be eliminated by fire (Wright et al. 1979).

More research is need into the role of fire in grassland ecosystems and its potential as a restoration tool. Early spring burning has been proposed as a management tool for reducing fuel loads and the risk of intense fire but can increase invasion by noxious weeds.

4.4.2.2.7 Pine/Fir/Mixed Conifer Forest

Problem 6. Pine/fir forest communities have been inadequately protected and enhanced by past land and forest management practices.

Objective 6.1. Inventory and map existing mature ponderosa pine/Douglas fir forests in the Owyhee Subbasin and refine enhancement measures.

Strategy 6.1.1. Inventory and map existing mature ponderosa pine/Douglas fir forest habitats at a finer scale than currently available.

Strategy 6.1.2. Prioritize pine/fir forest communities for protection at a finer scale. Give higher priority to larger remnants and those with highest potential to be lost .

Strategy 6.1.3. Protect existing mature ponderosa pine communities through land purchase, fee title acquisitions, conservation easements, land exchanges or other strategies. This is a strategy that is often not locally supported by counties within the Owyhee Subbasin.

Strategy 6.1.4. Protect pine/fir forest communities, where appropriate to the habitat type, using prescribed burning and/or understory removal (timber management) to restore the natural fire regime, while protecting mature stands from stand-replacing fire events. Manage timber harvest by protecting large, old trees and, promoting succession to late seral stages.

Strategy 6.1.5. Continue existing programs that work to restore low elevation pine/fir forests. Develop new programs to restore mature ponderosa pine forests.

Strategy 6.1.6. Monitor and evaluate effectiveness of protection activities to reduce negative impacts to wildlife species. Integrate new information into Strategies 1 and 2. Modify implementation strategies as necessary.

Discussion:
The loss of pine/fir forest is primarily a result of timber harvest, and encroachment by other species following fire suppression. Under historic fire regimes, stands were usually maintained in a late seral single layer structure. This forest type is maintained by fire and is vulnerable to fire exclusion. Reductions in pine/fir habitats, has negatively impacted native focal wildlife species.

Needles, cones, buds, pollen, twigs, bark, seeds, and associated fungi and insects provide food for many species of birds and mammals. Pine/Fir forests provide numerous species of birds and mammals with shelter at each stage of growth but are particularly valuable in mature stands and as snags, where they provide spacious housing for numerous cavity dwelling species and valuable perch trees. This xeric, open canopy forest type also provides ungulate winter range and serves as movement corridors in winter. Carnivores benefit from concentrated ungulate prey populations on winter range in this type.

Maintenance of stands of pine/fir forests in areas where the habitats were historically dominant will help to preserve wildlife dependent on the various pine/fir forest habitat types. The TT believes protection of mature stands is important. Thinning and prescribed burns of smaller trees are two methods suggested for protecting mature stands. Restoration of the natural fire regimes to historic norms should be long-term goal. The focus on mature seral stages does not imply other seral stages aren't important, only that the mature stage is the most limited seral stage in this habitat type at this time.

4.4.2.2.8 Canyon/Gorge

Problem Statement 7: Some cross-country dirt roads have served as "gateway roads" – allowing dirt bikes and off-road vehicles to carve new routes across remote landscape to Canyon and Gorge habitats. These new illegal routes fragment important wildlife habitat, destroy sensitive plant species and displace sensitive wildlife. Noxious weeds and human-caused fires are also spread along new roads through previously undisturbed landscapes.

Objective 7.1. Restrict illegal roads, and manage cross-country motorized travel to ensure that the ecological integrity of Canyon and Gorge habitats of the Owyhee Subbasin is maintained.

Strategy 7.1.1. Develop measures – in conjunction with Owyhee County, Idaho and other local governmental entities – to manage cross-country motorized travel and limit unauthorized new roads that provide access to wildlands and protected areas within the Canyon/Gorge habitats of the Owyhee Subbasin.

Strategy 7.1.2. Work with Owyhee County, Idaho, and other local governmental entities in Oregon and Nevada — to enhance the management of plants, wildlife and fish in Canyon and Gorge habitats.

Dissussion: These Canyon-Gorge habitat enhancement strategies will benefit key wildlife species such as sage grouse, raptors, and bighorn sheep. Owyhee County could be the first county in Idaho to ban cross-country, off-trail travel and ensure that the huge proliferation of illegal roads that has impacted remote regions of the Owyhee Subbasin.

4.4.2.2.9 Agriculture Lands

Problem 8. Road construction has altered the size, quality, distribution, and spatial relationships in and between habitat patches in the Owyhee Subbasin

Objective 8.1. Reduce the impact of the transportation system on wildlife and fish populations and habitats.

Strategy 8.1.1. Continue efforts to identify and refine delineation of important big game summer and winter range. Use this information in the development of travel plan, to reduce the impact of human disturbance on big game.

Strategy 8.1.2. Utilize signage to reduce road kills of wildlife on major state and county roads.

Strategy 8.1.3. Monitor and evaluate efforts to reduce the impact of roads and road usage on the fish and wildlife populations of the Owyhee Subbasin. Modify implementation strategies as necessary.

Discussion: Roads have been documented to have numerous negative effects on fish and wildlife populations. Wisdom et al. (2000) identified 13 factors consistently associated with roads in a manner deleterious to terrestrial vertebrates.

4.4.2.3 Socioeconomic Factors Affecting Terrestrial Wildlife Habitats

The "Socioeconomic" section contains objectives and strategies addressing the human components of protecting and enhancing wildlife populations and their habitats (source Draft Bruneau Subbasin Plan). These components were reviewed by the Owyhee Planning Team as necessary to successfully implementing the Owyhee Subbasin Management Plan (Table 4.23). Recommendations for further data collection or prioritization were noted where data gaps limit the development of sound biological objectives and strategies.

Table 4.23. Problems and objectives addressing socioeconomic factors limiting wildlife habitats and species in the Owyhee Subbasin. (The Owyhee Subbasin Planning Team adapted these from the Draft Bruneau Subbasin Plan, April 2004).

Socioeconomic Factors Affecting Habitats	
Problem Statement	**Objective**
S1. The management of both public and private lands impacts local communities and their economies. Historically, socioeconomic needs have not been adequately balanced with fish and wildlife needs	S1.1. Balance fish and wildlife needs with socioeconomic needs and limitations.
	S1.2. Maximize socioeconomic benefits as much as possible while implementing the Owyhee Subbasin Plan
S2. Many important cultural uses of the Owyhee subbasin are impacted by fish and wildlife activities. Tribal, non-tribal and local industry users all face difficulty in maintaining cultural uses.	S2.1. Protect and foster cultural uses of natural resources in the Owyhee Subbasin.

Problem S1: The management of both public and private lands in the Owyhee Subbasin impacts local communities and their economies. Historically, socioeconomic needs have not been adequately balanced with fish and wildlife needs.

Objective S1.1: Balance fish and wildlife needs with socioeconomic needs and limitations.

Strategy S1.1.1 Identify actions and methods to balance fish and wildlife needs with socioeconomic needs and limitations.

- Develop a list of available programs and resources for funding.
- Develop a list of community needs.
- Integrate information from strategies one and two with local watershed protection, restoration and management planning.

- Develop low cost tools for assessing economic impacts and benefits of fish and wildlife projects.
- Involve communities in finer scale efforts (than this plan) of subbasin planning, and in program and project planning
- Coordinate plan implementation with federal, tribal, state, local, and other interests, and avoid program and project duplication.
- Seek formal local support for programs and project proposals.
- Seek alternative funding sources (refer to Appendix 3.x).

When seeking funding, it is important to balance socioeconomic needs with fish and wildlife needs. The end result should be to consider socioeconomic impacts as well as biological impacts in seeking solutions to the problems. To do this, it is important to determine more specifically the social and economic factors important to gauging benefits and impacts of restoring and protecting fish and wildlife in the Owyhee Subbasin. Low cost tools need to be developed that can be used by subbasin planners to determine economic impacts and benefits of projects. These tools should be developed at the regional level, since the same tools will be useful for all subbasins in the Columbia Basin.

Economic and social factors play an important role in determining the effective and efficient implementation of habitat-related improvement or protection strategies. When they are not considered as part of protection and restoration activities, they can undermine success and reduce activity effectiveness.

Objective S1.2: Maximize socioeconomic benefits as much as possible while implementing the Owyhee Subbasin Plan.

Strategy S1.2.1:

- Efforts should be made where possible to utilize labor forces, contractors, and suppliers from the surrounding area when implementing habitat improvement projects.
- Minimize negative impacts of management activities on local communities when possible.
- Maximize economic benefits of plan--for land purchases or easements, efforts should be made to minimize loss of local government revenues.
- Minimize impacts on surrounding community culture and custom.
- Monitor & evaluate the economic efficiency and impacts of projects as part of prioritization process in the subbasin.

Problem S2: Many important cultural uses of the Owyhee subbasin are impacted by fish and wildlife activities. Tribes are continually losing traditions that keep their cultures alive, traditions that relate back to natural resources. Non tribal users also face difficulty in maintaining cultural uses. Local industries that support these users suffer or benefit from impacts on these uses.

Objective S2.1: Protect and foster cultural uses of natural resources in the Owyhee Subbasin.

Strategy 2.1.1.

- Integrate information on important tribal and non tribal cultural practices into project selection and implementation.
- Provide information and education on important tribal and non tribal cultural practices to land managers, regulatory agencies, policy makers.

Discussion: The goal is to maximize benefit to resources. Healthy fish and wildlife populations provide economic and cultural benefits. The economy of the Owyhee is a natural resource-based economy. Additional social values, in addition to economics, need to be considered when implementing activities. Through the protection of federally managed public lands comes the protection of treaty rights. The living culture of the tribes is reliant on the harvest of resources from the federally managed public lands. General changes to land management in the area impact traditions and cultural uses. The Owyhee County Natural Resource Committee operates as a recognized liason between the county and its residents and federal and state agencies active in the county. This committee will be involved in discussions of federal and state natural resource issues in the Owyhee subbasin. This group needs to be involved in decision making about culture and custom, and recreation issues in the Owyhee subbasin.

Recreation is cultural activity discussion. Explain importance of recreation in the subbasin.

4.5 Consistency with ESA/CWA Requirements

In recent years, two federal laws have had a major impact on protection of water quality and aquatic life -- and have resulted in significantly increased watershed protection efforts in the Columbia Basin. These federal laws are the Endangered Species Act (ESA) and the Clean Water Act (CWA). The Endangered Species Act is administered by the National Marine Fisheries Service (NMFS) for marine and anadromous species, and the U.S. Fish and Wildlife Service (USFWS) for resident fish & wildlife. The ESA is intended to protect species that are threatened or endangered of extinction. Major activities carried out under the ESA include:

- Evaluation of scientific data and listing of threatened and endangered species;
- Designation of critical habitat areas for threatened or endangered species;
- Consultation with other federal agencies, to insure that federal agency actions do not damage listed species;
- Development and/or review of restoration plans to restore listed species; and,
- Enforcement of the ESA where actions directly or indirectly are harming listed species.

While the ESA focuses on listed species, the CWA focuses mostly on water quality. The overall goal of the Clean Water Act is for all waters in the U.S. to be "fishable and swimmable". States are required to develop protective instream standards. Where those standards are not consistently met, a recovery plan must be developed and implemented. These recovery plans are referred to as Total Maximum Daily Loads (TMDL's) and the implementation plans (Water Quality Management Plans) that accompany the TMDL reports. TMDL's and the resulting implementation and improvement of water quality are important mechanisms to support the regional effort to restore healthy populations of salmon, resident fish & wildlife throughout the Columbia Basin.

The Northwest Power Planning Council is aware that a large number of watershed and subbasin level activities are ongoing, throughout the Columbia Basin, that incorporate technical assessments and planning. The Council intends to rely on the information gathered in those activities as much as possible and does not intend for the Subbasin Planning process to undermine or displace these ongoing efforts. However, for purposes of the Council's Fish & Wildlife Program, it is important to compile this information in a consistent format and to develop a comprehensive knowledge base that permits the coordination of Bonneville-funded activities and planning under the Endangered Species Act and Clean Water Act.

4.5.1 Endangered Species Act Requirements

In general, the NMFS and the USFWS intend to use the Northwest Power and Conservation Council's subbasin plans as building blocks at the local watershed level – to help formulate recovery planning for threatened and endangered species within the Columbia Basin. However, since anadromous fish have been completely extirpated from the Owyhee Subbasin for decades, the NMFS anadromous fish recovery efforts are not relevant to the Owyhee Subbasin Plan. At present five species of wildlife inhabit the Owyhee Subbasin that are listed at threatened (T) or endangered (E) under the Endangered Species Act:

(1) the bald eagle (T);
(2) the gray wolf (E);
(3) the grizzly bear (T), and
(4) the lynx (T).

The USFWS has recovery plans in place for all these ESA-listed species. Currently; the USFWS is not developing any new Recovery Plans for resident fish & wildlife in the Owyhee Subbasin. Thus there is no direct link between the Owyhee Subbasin Plan and the development of ESA recovery plans at this time.

The only native salmonid species that is currently known to have self-sustaining populations in the Owyhee Subbasin is the redband trout (*Oncorhynchus mykiss gairdneri*). This sub-species is currently not listed under the ESA. Redband trout belongs to the same biological species as the anadromous steelhead (*Oncorhynchus* *mykiss*) which was extirpated from the Owyhee Subbasin in 1933. Bull trout (*Salvelinus confluentus*) – listed under the ESA as "threatened" – is found in adjacent river systems (such as the Bruneau); however, self-sustaining populations of this species are not known to exist in the Owyhee Subbasin.

Currently two species of birds and three species of mammals that inhabit the Owyhee Subbasin are listed as threatened or endangered species under the Federal ESA (Table 4.24).

Table 4.24. Summary of animal species inhabiting the Middle Snake Ecological Province that are listed as "threatened" or "endangered" by state and federal management agencies {Source: IBIS on (11/5/2003) www.nwhi.org/ibis **; endangered.fws.gov/recovery}.**

Common Name	Scientific Name	State Status	Federal Status
Columbia Spotted Frog	*Rana luteiventris*	**ID:** Species of Concern	Candidate
	Listed Amphibians:	**0**	**0**
Bald Eagle	*Haliaeetus leucocephalus*	**ID:** Endangered	Threatened
		OR: Threatened	
Peregrine Falcon	*Falco peregrinus*	**ID:** Endangered	De-Listed
		OR: Endangered	
Yellow-billed Cuckoo	*Coccyzus americanus*	**ID:** Species of Concern	Candidate
		OR: Candidate Species	
	Listed Birds:	**3**	**2**
Gray Wolf	*Canis lupus*	**ID:** Endangered	Endangered
		OR: Endangered	
Kit Fox	*Vulpes velox*	**OR:** Threatened	
Grizzly Bear	*Ursus arctos*	**ID:** Threatened	Threatened
Wolverine	*Gulo gulo*	**OR:** Threatened	
Lynx	*Lynx canadensis*	**ID:** Species of Concern	Threatened
	Listed Mammals:	**4**	**3**
	Listed Reptiles:	**0**	**0**
	Total Listed Species:	**7**	**5**

At this time no amphibians or reptiles inhabiting the Owyhee subbasin are listed under the Federal ESA. The Columbia spotted frog, however, is a candidate species that will be evaluated for possible listing.

The bald eagle and the snowy plover are listed under the ESA as threatened species; in addition the peregrine falcon is listed by Oregon and Idaho as endangered. Federally listed mammals are the gray wolf (endangered), grizzly bear (threatened), and the lynx (threatened). In addition, Oregon lists the kit fox and the wolverine as threatened.

Two populations of sage grouse were recently (2003-2004) considered as candidates for listing under the ESA – "western" sage grouse and "eastern" sage grouse. The U.S. Fish and Wildlife Service determined, however, that the petitions to list these subgroups of sage grouse failed to show that "western" or "eastern" sage grouse are genetically distinct – either as a subspecies or a distinct population segment – from each other or from the greater sage-grouse populations. Therefore, USFWS decided that they are not eligible for listing under the ESA.

The pygmy rabbit (*Brachylagus idahoensis*) is patchily distributed in the sagebrush-dominated areas of Oregon, California, Nevada, Utah, Idaho, Montana, Wyoming, and Washington. It is a state-listed species in Washington, but not in the three states encompassing the Owyhee Subbasin. It may be considered an indicator species for sagebrush habitats since it is found only in productive, dense sage habitat with deep soil and it is uniquely dependent upon sagebrush, which comprises up to 99% of its winter diet. The Pygmy Rabbit was not selected as a focal species by the Owyhee Subbasin Planning Team, partially due to the concern among stakeholders that the ultimate outcome would be a restriction of human activity – that in turn would produce an adverse economic impact:

> "If the Pygmy Rabbit is selected as a focal species by the Subbasin Planning Team, the next step in the process will be to develop and recommend restoration and/or recovery plans for the species. In that the plans will be related to human activities that can be controlled; any selected restoration/recovery activity will likely be on the order of a restriction of human activity. Such restrictions will produce an adverse economic effect not only on the individuals involved in that activity but on the county economy as a whole. With the lack of knowledge available on the species and the questions that are raised by the Idaho State Study, such restrictions and potential economic harm are not supportable. What the group should determine to do with the Pygmy Rabbit, rather than using is as a focal species, is to select the species for more study in order to provide for funding of projects to address the data gaps indicated in the study." (Issue Paper by Jim Desmond, Owyhee County).

They also cited a lack of data, and need for additional studies within Owyhee Subbasin. Three pygmy rabbit issue papers are provided on the Owyhee Subbasin web site at the following link: www.Owyhee.US :

- Owyhee Watershed Council and the Malheur County Soil and Water Conservation District. 2004. Purpose for not listing the Pygmy Rabbit as a focal species in the Owyhee Subbasin Plan
- Desmond, J. 2004. Regarding the use of pygmy rabbit as a focal species in the Owyhee Subbasin Planning effort. Owyhee County Natural Resources Committee.
- Paul. K. and T. Dykstra. 2004. Justification for pygmy rabbit (Brachylagus idahoensis) as a focal species.

In addition, an information paper on pygmy rabbit habitats and sampling protocols is posted at the same web iste address:

- Ulmschneider, H., D. Hays, H. Roberts,, T. Forbes, D. Armentrout, P. Lauridson, J. Himes, E. Sequin, J. Rachlow, M. Haworth, T. Katzner, and R. Rauscher. 2004. Surveying for pygmy rabbits (Brachylagus idahoensis). Third Draft - Feb. 10, 2004. Principal author: Bureau of Land Management, Boise, Idaho.

The USFWS and the Bureau of Land Management (BLM) are the primary federal agencies responsible for the management of species such as sage grouse and pygmy rabbit – that inhabit the sage brush dominated regions of the Columbia Basin. The USFWS has funded ongoing projects to work with federal and state agencies as well as private organizations to conserve the greater sage-grouse and its habitat through voluntary partnerships on both public and private lands. Since 2001, the USFWS has provided Utah with $2.4 million and Washington with $730,000 for the restoration of sagebrush habitat. Through its Landowner Incentive Program, the agency also provided $1.4 million to Montana to improve the management of sagebrush habitat on private lands there. Over the past five years, the Bureau of Land Management has worked with several western states on cooperative sage-grouse conservation projects and has established partnerships with communities throughout the West to conserve and restore sage-grouse habitat.

4.5.2 Clean Water Act Requirements

4.5.2.1 Water Quality Standards and Designated Uses

In general, State and Tribal water quality standards are established in cooperation with the US Environmental Protection Agency (EPA) – this facilitates their subsequent approval by EPA. These water quality standards – required under the Clean Water Act – are designed to protect, restore and preserve water quality in areas designated for specific uses. Designated uses include:

- drinking water;
- various water contact activities, including swimming;

- various types of water-based recreation, including fishing; and
- cold, cool, or warm water fish habitat.

"Designated uses" have been identified for most, but not all, water bodies within Idaho, Oregon, and Nevada portions of the Owyhee Subbasin. For those water bodies not yet designated, the presumed existing uses are cold water aquatic life and primary contact recreation. One important use of waters in the Owyhee subbasin is to provide trout habitat that supports fisheries for both naturally-produced native redband trout and hatchery raised fish. Each "designated use" has narrative and numeric criteria that describe the level of water quality necessary to support that use. When a lake, river or stream fails to meet the water quality criteria that support its "designated use," it is considered to be an impaired water body. Specific actions are required under state and federal law to ensure that the "impaired" water body is restored to a healthy fishable, swimmable condition.

The "CWA 303(d) impaired waters list" provides a way for states to identify and prioritize water quality problems. The list also serves as a guide for developing and implementing watershed recovery plans to protect beneficial uses while achieving federal and state water quality standards. Section 305(b) of the federal Clean Water Act (CWA) requires each state to prepare a water quality assessment report every two years. The U.S. Environmental Protection Agency (EPA) compiles the information from the individual state reports and prepares a summary report for Congress on the status of the nation's waters. EPA gives the states guidelines for preparation of 305(b) reports (USEPA 1997). Oftentimes much of the data required in the 305(b) report comes from the assessments done while developing the list of streams that do not meet stream standards as required by Section 303(d) of the CWA – therefore states may choose integrate the reporting requirements of Section 303(d) and 305(b) into one comprehensive report.

The CWA 303(d) list is meant only as a means of identifying water quality problems — not evaluating the causes of water quality problems. Causes of water quality problems are determined when water quality management plans are developed for the watersheds in which the listed segments are located. These plans are often referred to as a *Total Maximum Daily Load* or *TMDL*. A TMDL identifies allowable pollutant loads to a waterbody from both *point* (end of pipe) and *non-point sources* (runoff) that will prevent a violation of water quality standards. A TMDL should also include a margin of safety to ensure protection of the waters.

4.5.2.2 Total Maximum Daily Load (TMDL)

The states together with EPA have a legal, court ordered responsibility to ensure that these impaired waters be dealt with in a timely manner. In practice, this means that a "TMDL" (Total Maximum Daily Load) document must be developed for each impaired water body.

Each TMDL contains the following elements:

- A description of the geographic area to which the TMDL applies;
- Specification of the applicable water quality standards;
- An assessment of the problem, including the extent of deviation of ambient conditions from water quality standards;
- Development of a loading capacity for each pollutant, including those based on surrogate measures (for example, riparian cover) and including flow assumptions used in developing the TMDL;
- Identification of point sources and nonpoint sources;
- Development of Waste Load Allocations for point sources and Load Allocations for nonpoint sources;
- Development of a margin of safety;
- Evaluation of seasonal variations.

The goal of a TMDL is to reduce pollution and attain state water quality standards for each pollutant impairing the water body. A TMDL is both a technical and legal document. – i.e., a written, quantitative assessment of water quality problems and contributing pollutant sources. The TMDL specifies the amount of pollution reduction necessary to meet water quality standards, allocates the necessary pollutant limits among the various sources in the watershed and provides a basis for taking actions needed to restore the water body.

Within the Owyhee Subbasin, several TMDLs (Total Maximum Daily Loads) and 305(b) assessments have been developed or are planned by the three states – Idaho, Oregon and Nevada – that have CWA responsibilities in the Owyhee Subbasin.:

Idaho	• Upper Owyhee (IDEQ 2003) • North Fork and Middle Fork Owyhee (IDEQ 2003) • South Fork Owyhee (IDEQ 2003) • 2002-03 Integrated 303(d)/305(b) Report (IDEQ 2003)
Nevada	• East Fork Owyhee River and Mill Creek (NDEP 2004).
Oregon	• Upper Owyhee (ODEQ planned for 2009) • Middle Owyhee (ODEQ planned for 2009) • Crooked Rattlesnake (ODEQ planned for 2009) • Jordan (ODEQ planned for 2009) • Lower Owyhee (ODEQ planned for 2009) • 2000 Water Quality Management 305(b) Report (ODEQ 2000)

Since the TMDL is a legal, as well as a technical document it must include:

⇒ A description of applicable water quality standards
⇒ An identification of existing sources of pollution
⇒ A technical assessment of the impairment
⇒ The loading capacity for each pollutant
⇒ Load allocations for point sources and waste load allocations for nonpoint sources

⇒ A margin of safety that takes into account the uncertainty of the data collected, the seasonal variation, and unknowns factors
⇒ An analysis of future water quality standards attainment
⇒ Public participation and documentation EPA has the responsibility to approve or disapprove TMDLs on the basis of the above elements.

The complicated process for developing and implementing Total Maximum Daily Loads (TMDLs) in Idaho is illustrated in Figure 4.6. Since the TMDL encompasses both a technical and legal processes, the states generally set up mechanisms for technical collaboration, public review and comment, and policy review. In Idaho, the following advisory groups are formed for the coordinated development of TMDLs:

Although the advisory groups are not mandatory at this time, the following technical and watershed advisory groups are usually formed to provide local input into Idaho TMDLs. For example, these advisory groups were utilized in the North Fork Owyhee and Mid-Owyhee TMDLs, but were not formed for the South and Upper Owyhee TMDLs.

Technical Advisory Group (TAG) – Comprised of technical experts from state and federal agencies – deal with the legal/technical aspects of a TMDL. The TAG members write the bulk of the TMDL. It is their job to assess and quantify water quality problems, specify the amount of pollution reduction necessary in order to meet water quality standards, and develop options to allocate the necessary pollutant limits among the various sources in the watershed.

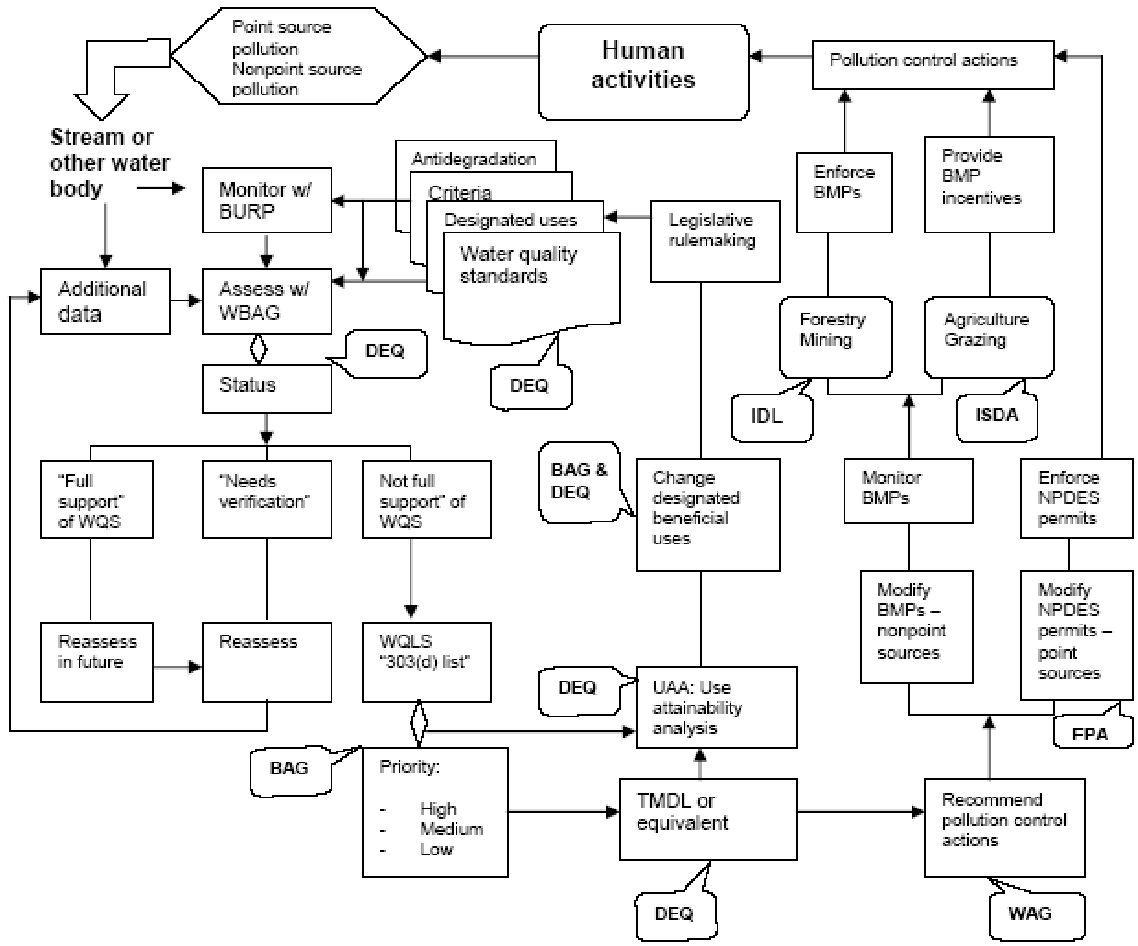
Watershed Advisory Groups (WAGs) – This group provides local public input and guidance to DEQ. The policy/implementation aspects of a TMDL are often directly impacted by the advice of the WAG. The Watershed Advisory Group's key responsibilities are to:

- Advise the TAG on matters of concern to the community;
- Contribute to the education of the residents of the watershed on water quality issues;
- Help identify contributing pollution sources in the watershed;
- Assist in arriving at pollution reduction allocations among contributors;
- Recommend specific actions needed to effectively control sources of pollution; and
- Help develop and set in motion an implementation plan that will meet the "targets" identified in the TMDL.

TMDLs are written by technical experts in water quality and related fields. Each state has the equivalent of the Department of Environmental Quality (DEQ); it has the authority and the responsibility to ensure that TMDLs are completed and submitted to EPA. On tribal lands, the Environmental Protection Agency is likely to lead TMDL efforts with considerable help from the state, the tribes, and other agencies. The EPA has the responsibility to approve or disapprove all TMDLs. If EPA formally disapproves a state TMDL, it is obligated under the Clean Water Act to issue a new TMDL within 30 days.

In Idaho, the role of the Basin Advisory Groups (BAGs) is one of big picture thinking. The state is divided into six basins and the governor appoints members to a BAG for each basin. The BAGs recommend people for IDEQ to appoint to WAGs, oversee WAGs, and helps to sort through and integrate IDEQ policy and local WAG recommendations. For example, BAGs review funding requests and projects that WAGs submit to them and IDEQ for approval. The Basin Advisory Groups help IDEQ prioritize 319 grants based on agency policy, available dollars, and environmental benefits.

Idaho Approach to Water Quality Management



Processes	Organizations and Agencies
BMP: Best Management Practice	BAG: Basin Advisory Group
BURP: Beneficial Use Reconnaissance Program	DEQ: Department of Environmental Quality
NPDES: National Pollution Discharge Elimination System	EPA: Environmental Protection Agency
TMDL: Total Maximum Daily Load	IDL: Idaho Department of Lands
WBAG: Water Body Assessment Guidance	ISDA: Idaho Department of Agriculture
WQLS: Water Quality-Limited Segment ("303(d) list")	WAG: Watershed Advisory Group
WQS: Water Quality Standards	

Figure 4.6. Flow chart for the development and implementation of TMDLs in the State of Idaho (Source IDEQ March 2004).

In Oregon, DEQ's regions and headquarters share responsibility the development of the TMDL documents. For more complex basins, with a mixture of point sources and nonpoint sources, the modeling and other water quality analyses generally is done by headquarters staff. The regions take the lead in working with watershed councils, Designated Management Agencies, and others interested in or part of the TMDL process. The Oregon TMDL process includes, coordination among:

- ODEQ personnel in regional and headquarters offices;
- local watershed councils,
- interactions with federal, state and local agencies, and
- interested public via a formal public review and comment process.

The first step is to assemble the available stream monitoring data, and determine where there are gaps in the needed information. Other relevant data is assembled and reviewed at this first step, including land uses in the area and location and effluent characteristics of point source dischargers. Information is solicited from agencies and groups outside of ODEQ, for example BLM or the USGS. Where gaps in available data exist, a monitoring plan or study plan is developed. Depending on the data needed, it may be collected by regional staff, DEQ laboratory staff, other willing agencies or volunteers, or by contractors. The draft TMDL is then written by ODEQ staff and reviewed internally by other regions and headquarters staff, and sometimes from experts outside of the Department. Meetings are then held with key stakeholders within the subbasin, including the watershed council(s) – to provide further review of the TMDL document.

The TMDL process also includes a public input process. Depending on the interest in a particular TMDL, one or more informational meetings and public hearings are conducted. Written comments are also solicited and welcome during the public comment period. A written response to comments received is prepared, and based upon the comments the draft TMDL may be revised. The TMDL is then submitted to EPA for review and approval.

4.5.2.3 Impaired Waters pursuant to §303(d) of the Clean Water Act

States are required to submit a report to the U.S. Environmental Protection Agency every two years – that includes a list of impaired waters as defined by the Clean Water Act pursuant to §303(d). This section represents a comprehensive evaluation of water quality for the Owyhee Basin – including data from 303(d) lists prepared by Idaho, Oregon, and Nevada. The impaired waters lists cover the status of streams, rivers, lakes and reservoirs. Water bodies on this list have been determined to be water quality limited, that is, they do not support their beneficial uses or exceed water quality standards.

Monitoring of a comprehensive suite of water quality constituents and habitat conditions is a prerequisite to the compilation of the 303(d) impaired waters list. The presence of the following water pollutants, by river segment, is summarized in subsequent tables:

- Bacteria

- Habitat Alteration
- Nutrients
- [H+ions]
- Temperature
- Ammonia
- Channel Stability
- Metals (Hg)
- Oil/Gas
- Salinity
- Unknown
- Pesticides
- Dissolved Oxygen
- Metals (Unknown)
- Organic
- Sediment
- Flow Alteration
- Total Dissolved Gas

4.5.2.3.1 Assessment of Impaired Waters – Idaho

Assessed water bodies are designated in the draft "*2002-03 Integrated 303(d)/305(b) Report*" (IDEQ 2003) as either supporting or not supporting water quality standards and beneficial uses. Water bodies that do not meet water quality standards are called "water quality limited" or "impaired," and require development of water quality management plans known as Total Maximum Daily Loads (TMDLs) to bring them back into compliance and protect their beneficial uses. Water bodies previously designated impaired that now meet water quality standards are removed from the water quality limited list.

After comprehensive monitoring of water quality parameters is conducted, the data are evaluated for compliance with State and Federal water quality standards – with respect to specified beneficial uses.

The latest 303(d) list prepared by the State of Idaho was compiled in 1998. Water bodies also remain on the 1998 list if they were on the 1996 list and have not been assessed since that time. The Idaho 303(d) list for the Owyhee Subbasin is summarized in Table 4.1; it displays the water quality limited segment number, hydrologic unit number, common water body name, boundaries, the year listed, pollutants for which the water body is listed, number of miles affected, whether these water bodies are on or run through tribal lands, and the year a Total Maximum Daily Load (TMDL) would be submitted to the U.S. Environmental Protection Agency. The list is organized by HUC. The Idaho portion of the Owyhee includes four 4th Field HUCs: Upper Owyhee (17050104), South Fork Owyhee (17050105); Middle Owyhee (17050107); Jordan (17050108). Within each

HUC the segments are listed in the order of their WQLSEG number and not alphabetically. The WQLSEG number can be used to cross reference the large format 1998 303(d) list maps that are available upon request from IDEQ.

About 373 miles of streams (not including standing water and reservoirs) are listed as 303(d) impaired waters in the Idaho portion of the Owyhee Subbasin (Table 4.25). The total mileage of impaired waters includes:

- ⇒ 157 miles in the Upper Owyhee;
- ⇒ 32 miles in the South Fork Owyhee;
- ⇒ 76 miles in the Middle Owyhee; and
- ⇒ 108 miles in the Jordan HUC.

The number of pollutants exceeding water quality standards ranges from one to five per stream reach. Six stream segments have only one pollutant, four have two pollutants, and 14 (58.3%) have three or more pollutants. The stream segments with the most pollutants are: upper Jordan Creek (5), lower Jordan Creek (4), and Louse Creek (4) – all in the Jordan HUC.

Table 4.25. Clean Water Act (CWA) 303(d) list of impaired Idaho waters in the Owyhee Subbasin, developed by IDEQ in 1998. Stream reaches are organized by 4th Field HUC and identified by unique Water Quality Limited Segment (WQLSEG) numbers {Source Idaho DEQ 303(d) list (1998)}.

Seq. #	WQL-SEG	Water Body	Boundaries	Year List	**Year TMDL** Devel.	**Indian Res.**	Pollutants (n) causing listing	Stream Miles
4th Field HUC: UPPER OWYHEE — 17050104								

1	2621	Battle Creek	Headwaters to Owyhee River	1996	2001	0	1	62.33
2	2627	Blue Creek Reservoir		1996	2001	0	1	0.00
3	2616	Castle Creek	Headwaters to Deep Creek	1996	2001	0	2	11.15
4	2614	Deep Creek	Headwaters to Owyhee River	1996	2001	0	2	46.14
5	2621	Juniper Basin Reservoir		1996	2001	0	1	0.00
6	2627	Nickel Creek	Headwaters to Mud Flat Road	1996	2001	0	1	2.79
7	2616	Pole Creek	Headwaters to Deep Creek	1996	2001	0	3	23.98
8	2614	Red Canyon	Headwaters to Owyhee River	1996	2001	0	3	5.22
9	2621	Shoofly Creek	Headwaters to Blue Creek	1996	2001	0	3	5.22
Total Impaired Stream Miles (not including reservoirs) in Upper Owyhee HUC								**156.83**
4th Field HUC: SOUTH FORK OWYHEE — 17050105								
10	2632	South Fork	Owyhee River Nevada Line to Owyhee River	1996	1999	0	3	**32.33**
4th Field HUC: MIDDLE OWYHEE — 17050107								

11	2644	Juniper Creek	Headwaters to N Fk Owyhee River	1996	1999	0	3	11.72
12	2640	Middle Fork Owyhee River	Headwaters to Oregon Line	1996	1999	0	3	8.64
13	2646	Noon Creek	Headwaters to N Fk Owyhee River	1996	1999	0	2	9.13
14	2641	North Fork Owyhee River	Headwaters to Oregon Line	1996	1999	0	1	22.51
15	2645	Pleasant Valley Creek	Headwaters to N Fk Owyhee River	1996	1999	0	3	10.79
16	2642	Squaw Creek	Headwaters to Oregon Line	1996	1999	0	3	13.05
Total Impaired Stream Miles in the Middle Owyhee HUC								**75.84**
4th Field HUC: JORDAN — 17050108								
17	6661	Cow Creek	Headwaters to Oregon Line	1996	2004	0	3	12.28
18	2648	Jordan Creek	Williams Creek to Oregon Line	1996	2004	0	4	9.49
19	2649	Jordan Creek	Headwaters to Williams Creek	1996	2004	0	5	31.48
20	6656	Louisa Creek	Headwaters to Triangle Reservoir	1996	2004	0	3	8.16
21	2660	Louse Creek	Headwaters to Jordan Creek	1996	2004	0	4	9.79
22	2657	Meadow Creek	Headwaters to Rock Creek	1996	2004	0	2	11.93
23	2656	Rock Creek	Headwaters to Triangle Reservoir	1996	2004	0	3	17.28
24	2662	Soda Creek	Headwaters to Cow Creek	1996	2004	0	1	7.51
Total Impaired Stream Miles in the Jordan HUC								**107.92**

<u>Key to Headings on the Table 4.25 above:</u> **HUC**: Hydrologic Unit Code, a unique number describing a series of nested watersheds.
WQLSEG: Water Quality Limited Segment Number; a unique number for each segment.
WATERBODY: Idaho Geographic Society Name for the water body.
ADDS: A segment being added to the 1998 303(d) list.
BOUNDARIES: Extent of segment.
STREAM MILES: Length, in miles, of the listed segment.
POLLUTANTS: Various water quality constituents measured for each reach.
YEAR LIST: The year the water body went on 303(d) list.
YEAR TMDLDU: Year water body scheduled for TMDL development.

Since the 303(d) list was established in 1998, USEPA (2001) has added waters to the list. The additional impaired waters are listed in Table 4.26.

Table 4.26. EPA's Additions to the 1998 Idaho 303(d) List – Owyhee Subbasin waters (U.S. Environmental Protection Agency, January 2001)

HUC	WQLSEG	Waterbody	Boundaries	Pollutant
17050108	2648, 2649	Jordan Creek	Headwaters to Oregon Line	Temperature
17050108	2662	Soda Creek	Headwaters to Cow Creek	Temperature

The specific pollutants that cause water bodies to be listed as "impaired waters" vary from watershed to watershed within the Owyhee Subbasin. Most of the Owyhee is comprised of rural areas where water quality degradation is generally caused by excess sedimentation and elevated stream temperatures (IDEQ TMDL Fact Sheet; Table 4.27). These two pollutants contribute to water quality impairment in 845 listed stream segments in Idaho and 1,207 miles of streams in Nevada. In municipal

Table 4.27. Major pollutant sources, probable causes, and potential solutions in 303(d) listed waters in Idaho and the Owyhee Subbasin (source: Idaho Department of Environmental Quality web site TMDL fact sheet http://www.deq.state.id.us/water/tmdls/Idaho_TMDL_Fact_Sheet.pdf).

Pollutant	Cause	Solution
Sediment *574 water bodies in the state of Idaho list sediment as a pollutant.*	Although sedimentation of a water body occurs naturally, excess sedimentation of lake or stream beds clouds the water. Excess sediment reduces sunlight to aquatic plants, covers fish spawning areas and food supplies, and serves as a transport mechanism for nutrients, pathogens, and heavy metals. Roads along the water body, lack of vegetation along a streambank and overgrazing or logging in the surrounding riparian areas are the primary causes of excess sediment within a water body.	Excess erosion and sedimentation can be reduced by applying management measures to control the volume and flow rate of runoff water from farmlands, such as conservation tillage. Reducing grazing intensity along the streambank by providing alternate sources of water and shade will also help to improve water quality. Discharges from animal feeding operations can be limited by storing and managing facility wastewater and runoff with an appropriate waste management system.
Temperature *271 water bodies in the state of Idaho list temperature as a pollutant*	An increase in water temperature promotes algal growth, decreases dissolved oxygen levels, and degrades aquatic habitat for fisheries. Increased temperature may be a result of removing vegetation that would otherwise shade the stream, slowing water in a stream by damming, or reducing total water flow through diversions or withdrawals.	Plant riparian vegetation that provides shade to the stream. Find ways to increase water use efficiency to reduce water withdrawals during the warm summer months. Look for opportunities in your area to create wetlands, riparian buffers, parklands and storm water management systems that improve the ability of the watershed to capture and retain rainfall to increase summer flow rates.
Nutrients *213 water bodies in the state of Idaho list nutrients as a pollutant.*	Nutrients such as phosphorus, nitrogen, and potassium in the form of fertilizers, manure, sludge, irrigation water, legumes, and crop residues are applied to enhance crop production. When nutrients are applied in excess of the plants. needs, nutrients may wash into aquatic ecosystems where they can cause excess plant growth. Excess nutrients may reduce swimming and boating opportunities, create a foul taste or odor, and kill fish by reducing the amount of dissolved oxygen in the water and increasing the pH.	Farmers can implement nutrient management plans which help maintain high yields and save money on the use of fertilizers while reducing nutrient loading to a nearby waterbody. Nutrients resulting from the discharge of animal feeding operations can be limiting by storing and managing facility wastewater and runoff with an appropriate waste management system. Improved irrigation water management can reduce nutrient runoff into the surface water or can reduce deep percolation of nutrients into the ground water.
Bacteria *127 water bodies in the state of Idaho list bacteria as a pollutant*	Bacteria may indicate the presence of potentially harmful pathogens. The major sources of fecal contamination include improperly functioning septic systems, sewage treatment plants, livestock, wildlife, and urban land uses.	Plant riparian vegetation to capture polluted runoff and runoff from reaching the water and reduce or prevent livestock from entering the waterway. Properly maintaining septic systems and animal feeding operations waste management

		systems can also reduce fecal coliform contamination.

Source: EPA Office of Water: http://oaspub.epa.gov/waters/state_rept.control?_state=ID

areas, pollutants usually include bacteria, oil and grease, and dissolved oxygen. In waters downstream from industrial or mining areas, heavy metals may be at the top of the list. In the Oregon portion of the Owyhee Subbasin, temperature, dissolved oxygen and heavy metals are leading contributors to 303(d) listings.

The specific pollutant problems for 303(d) listed waters in the Idaho portion of the Owyhee are summarized in Table 4.28. As for the state-wide assessment, sediment and temperature are at the top of the list – exceeding water quality standards in 88% and 63%, respectively, of the Owyhee Subbasin waters on the 303(d) list. Flow alterations is the third most prevalent cause of pollution – causing water quality problems in 54% of the waters listed in the Idaho portion of the Owyhee Subbasin. Potential pollutants that did not cause the 303(d) listing of any streams in the Idaho portion of the Owyhee Subbasin in the 1998 assessment are: dissolved oxygen, channel stability, habitat alteration, ammonia, nutrients, organics, salinity, total dissolved gas, and unknown constituents.

Table 4.28. Water quality parameters that contribute to the CWA 303(d) listings of Idaho waters in the Owyhee Subbasin, developed by IDEQ in 1998. Stream reaches are organized by 4th Field HUC and identified by unique Water Quality Limited Segment (WQLSEG) numbers {Source Idaho DEQ 303(d) list (1998)}.

Seq. #	WQL-SEG	Water Body	BA	QALT	MTH	MTU	O/G	PST	pH	SED	TEMP
4th Field HUC: UPPER OWYHEE — 17050104											
1	2621	Battle Creek	1	0	0	0	0	0	0	0	0
2	2627	Blue Creek Reservoir	0	0	0	0	0	0	0	1	0
3	2616	Castle Creek	0	0	0	0	0	0	0	1	1
4	2614	Deep Creek	0	0	0	0	0	0	0	1	1
5	2621	Juniper Basin Reservoir	0	0	0	0	0	0	0	1	0
6	2627	Nickel Creek	0	0	0	0	0	0	0	1	0
7	2616	Pole Creek	0	1	0	0	0	0	0	1	1
8	2614	Red Canyon	0	1	0	0	0	0	0	1	1
9	2621	Shoofly Creek	0	1	0	0	0	0	0	1	1
4th Field HUC: SOUTH FORK OWYHEE — 17050105											
10	2632	S.F. Owyhee River from mainstem Owyhee to NV Line	0	1	0	0	0	0	0	1	1
4th Field HUC: MIDDLE OWYHEE — 17050107											
11	2644	Juniper Creek	0	1	0	0	0	0	0	1	1
12	2640	Middle Fork Owyhee River	0	1	0	0	0	0	0	1	1
13	2646	Noon Creek	0	0	0	0	0	0	0	1	1
14	2641	North Fork Owyhee River	1	0	0	0	0	0	0	0	0
15	2645	Pleasant Valley Creek	0	1	0	0	0	0	0	1	1
16	2642	Squaw Creek	0	1	0	0	0	0	0	1	1
4th Field HUC: JORDAN — 17050108											
17	6661	Cow Creek	0	1	0	0	0	0	0	1	1
18	2648	Jordan	1	0	0	0	1	1	0	1	0

		Creek -- Williams Cr. to OR									
19	2649	Jordan Creek -- Headwaters to Williams Creek	1	0	1	0	1	1	0	1	0
20	6656	Louisa Creek	0	1	0	0	0	0	0	1	1
21	2660	Louse Creek	0	1	0	1	0	0	1	1	0
22	2657	Meadow Creek	0	1	0	0	0	0	0	0	1
23	2656	Rock Creek	0	1	0	0	0	0	0	1	1
24	2662	Soda Creek	0	0	0	0	0	0	0	1	0
Water Bodies (n) with Problem with Pollutant			4	13	1	1	2	2	1	21	15
Percent with Pollutant			17%	54%	4%	4%	8%	8%	4%	88%	63%

Key for Water Quality Parameters in Table 4.28 (above).

Abbreviation	Water Quality Parameter
BA	Bacteria
HALT	Habitat Alteration
NUT	Nutrients
pH	[H+ ions]
TEMP	Temperature
NH3	Ammonia
CHS	Channel Stability
MTH	Metals (Hg)
O/G	Oil/Gas
SAL	Salinity
UNKN	Unknown
PST	Pesticides
DO	Dissolved Oxygen
MTU	Metals (Unknown)
ORG	Organic
SED	Sediment
QALT	Flow Alteration
TDG	Total Dissolved Gas

According to IDEQ's accounting system 92,948 miles of water exist in Idaho, and about half of the state's water has been monitored and assessed with respect to Clean Water Act requirements (IDEQ 2003). The following list identifies lakes and stream segments in the Owyhee subbasin not assessed as of the 2002-03 Integrated 303(d)/305(b) Report (Table 4.29).

Table 4.29. List of water bodies (lakes and streams) not assessed in the Owyhee Subbasin, as of the 2002-03 Integrated 303(d)/305(b) Report (IDEQ 2003).

Basin	***Segment Name***	***Units (lake acres or stream miles)***
Lakes and reservoirs not assessed in the Owyhee Subbasin (IDEQ 2003)		
HUC 17050104		
ID17050104SW018_02T		1.62
ID17050104SW005_02T		7.31
ID17050104SW017_02T		1.16
ID17050104SW016_02T		2.15
ID17050104SW008L_0LT	Boyle Creek	417.36
ID17050104SW008_03T	Boyle Creek	2.49
ID17050104SW008_02T	Boyle Creek	3.45
ID17050104SW008L_0L	Boyle Creek Reservoir (Mt. View Lake)	0
ID17050104SW008_03	Boyle Creek Reservoir (Mt. View Lake)	0
ID17050104SW008_02	Boyle Creek Reservoir (Mt. View Lake)	0
ID17050104SW020_02	Henry Lake	170.5
ID17050104SW005_02	Juniper Creek - 1st and 2nd order	28.63
ID17050104SW005_03	Juniper Creek - 3rd order	5.25
ID17050104SW019_02	Juniper Lake	387.95
ID17050104SW016_02	Little Jarvis Lake	279.55
ID17050104SW018_02	Ross Lake	999.15
ID17050104SW017_02	Rough Little Lake	329.96
Summary for 'HUC' = 17050104	**(17 detail records)**	**Sum= 2636.**
***HUC** 17050105*		
ID17050105SW003_04	Bull Camp Reservoir	4.61
ID17050105SW003_03	Bull Camp Reservoir	1.62
ID17050105SW003_02	Bull Camp Reservoir	16.33
ID17050105SW004_02	Homer Wells Reservoir	86
ID17050105SW004_04	Homer Wells Reservoir	6.33
ID17050105SW004_03	Homer Wells Reservoir	12.43
Summary for 'HUC' = 17050105	***(6 detail records)***	**Sum** ***127.3***
List of streams not assessed in the Owyhee Subbasin (IDEQ 2003)		
HUC 17050104		
ID17050104SW011_02T		18.68
ID17050104SW007_02T		9.28
ID17050104SW021_02T		11.36

ID17050104SW011_03T		0.34
ID17050104SW006_02T		90.19
ID17050104SW009_02T		39.78
ID17050104SW006_05T		1.54
ID17050104SW006_03T		2.29
ID17050104SW004_02T		0.82
ID17050104SW033_02	Beaver Creek - 1st and 2nd order	47.55
ID17050104SW033_03	Beaver Creek - 3rd order	3.7
ID17050104SW033_04	Beaver Creek - 4th order	2.57
ID17050104SW025_02	Big Springs Creek - 1st and 2nd	35.89
ID17050104SW025_03	Big Springs Creek - 3rd order	3.99
ID17050104SW007_05T	Blue Creek	23.58
ID17050104SW007_04	Blue Creek - Blue Creek Reservoir Dam to mouth	
ID17050104SW007_05	Blue Creek - Blue Creek Reservoir Dam to mouth	1.41
ID17050104SW007_03	Blue Creek - Blue Creek Reservoir Dam to mouth	4.99
ID17050104SW007_02	Blue Creek - Blue Creek Reservoir Dam to mouth	40.3
ID17050104SW013_02	Blue Creek - source to Blue Creek Reservoir Dam	80.2
ID17050104SW007_03T	Boyle Creek	0.8
ID17050104SW029_02	Camas Creek - 1st and 2nd order	40.16
ID17050104SW029_03	Camas Creek - 3rd order	7.31
ID17050104SW030_02	Camel Creek - 1st and 2nd order	28.58
ID17050104SW030_03	Camel Creek - 3rd order	2.12
ID17050104SW032_02	Castle Creek - 1st and 2nd order	44.58
ID17050104SW027_05	Dickshooter Creek - source to mouth	14.43
ID17050104SW027_02	Dickshooter Creek - source to mouth	107.68
ID17050104SW027_03	Dickshooter Creek - source to mouth	6.27
ID17050104SW027_04	Dickshooter Creek - source to mouth	0.04
ID17050104SW009_03T	Dry Creek	5.67
ID17050104SW024_02	Dry Creek - 1st and 2nd order	27.03
ID17050104SW015_03	Harris Creek - source to mouth	9.03
ID17050104SW015_02	Harris Creek - source to	46.35

	mouth	
ID17050104SW004_02	Juniper Creek - 1st and 2nd order	58.87
ID17050104SW004_03	Juniper Creek - 3rd order	4.53
ID17050104SW004_04	Juniper Creek - 4th order	9.37
ID17050104SW012_02	Little Blue Creek - source to mouth	49.95
ID17050104SW012_03	Little Blue Creek - source to mouth	5.83
ID17050104SW031_04	Nickel Creek - source to mouth	
ID17050104SW031_03	Nickel Creek - source to mouth	9.7
ID17050104SW001_03	Owhyee River - 3rd order	8.85
ID17050104SW006_06T	Owyhee River	30.76
ID17050104SW001_02	Owyhee River - 1st and 2nd order	109.26
ID17050104SW006_05	Owyhee River - Idaho/Nevada border to Juniper Creek	0
ID17050104SW006_02	Owyhee River - Idaho/Nevada border to Juniper Creek	20.17
ID17050104SW006_06	Owyhee River - Idaho/Nevada border to Juniper Creek	7.86
ID17050104SW006_03	Owyhee River - Idaho/Nevada border to Juniper Creek	0
ID17050104SW009_03	Papoose/Mud Creek complex	0
ID17050104SW009_02	Papoose/Mud Creek complex	0
ID17050104SW010_03	Payne Creek - source to mouth	11.24
ID17050104SW010_04	Payne Creek - source to mouth	0.71
ID17050104SW010_02	Payne Creek - source to mouth	41.65
ID17050104SW026_02a	Piute Creek	71.3
ID17050104SW003_02	Piute Creek - 1st and 2nd order	102.32
ID17050104SW003_03	Piute Creek - 3rd order	8.79
ID17050104SW003_04	Piute Creek - 4th order	6.35
ID17050104SW028_04	Pole Creek - 4th order	12.13
ID17050104SW014_05	Shoofly Creek - source to mouth	0.21
ID17050104SW011_02	Squaw Creek - source to mouth	38.85
ID17050104SW011_03	Squaw Creek - source to mouth	1.11
ID17050104SW002_02	Unnamed Tributaries and playas of YP Desert (T14S,	13.79

	R04W)	
ID17050104SW021_02	Unnamed Tributary - source to mouth (T15S, R01W, Sec. 01)	5.98
ID17050104SW022_02	Yatahoney Creek - 1st and 2nd order	
ID17050104SW022_03	Yatahoney Creek - 3rd order	7.22
Summary for 'HUC' = 17050104	***(65 detail records)***	**Sum *1458.3***
HUC 17050105		
ID17050105SW005_02	Coyote Flat - source to mouth	30.33
ID17050105SW005_03	Coyote Flat - source to mouth	4.72
ID17050105SW001_02	South Fork Owyhee River - Idaho/Nevada border to mouth	127.7
ID17050105SW001_04	South Fork Owyhee River - Idaho/Nevada border to mouth	1.34
ID17050105SW001_03	South Fork Owyhee River - Idaho/Nevada border to mouth	1.25
ID17050105SW002_02	Spring Creek - source to mouth	46.56
ID17050105SW002_03	Spring Creek - source to mouth	6.12
Summary for 'HUC' = 17050105	***(7 detail records)***	**Sum *218.01***
HUC 17050106		
ID17050106SW001_03	Little Owyhee River - Idaho/Nevada border to mouth	16.5
ID17050106SW001_02	Little Owyhee River - Idaho/Nevada border to mouth	77.29
ID17050106SW002_02	Tent Creek- Idaho/Oregon border to mouth	33.62
ID17050106SW002_03	Tent Creek- Idaho/Oregon border to mouth	7.54
ID17050106SW002_04	Tent Creek- Idaho/Oregon border to mouth	4.54
Summary for 'HUC' = 17050106	***(5 detail records)***	**Sum *139.48***
HUC 17050107		
ID17050107SW011_03	Cabin Creek - source to mouth	2.59
ID17050107SW013_02	Cherry Creek - source to Idaho/Oregon border	52.07

ID17050107SW013_03	Cherry Creek - source to Idaho/Oregon border	3.84
ID17050107SW007_02	Cottonwood Creek - 1st and 2nd order	22.34
ID17050107SW003_02	Field Creek - source to Idaho/Oregon border	
ID17050107SW002_02	Oregon Lake Creek - source to Idaho/Oregon border	7.39
ID17050107SW001_03	Owyhee River - South Fork Owyhee River to Idaho/Oregon border	1.21
ID17050107SW001_02	Owyhee River - South Fork Owyhee River to Idaho/Oregon border	34.8
ID17050107SW001_07	Owyhee River - South Fork Owyhee River to Idaho/Oregon border	9.18
ID17050107SW005_02	Pole Creek - source to Idaho/Oregon border	17.87
ID17050107SW014_02	Soldier Creek - source to Idaho/Oregon border	30.17
Summary for 'HUC' = 17050107	***(11 detail records)***	**Sum *192.57***
	HUC 17050108	
ID17050108SW023_02	Baxter Creek - source to Idaho/Oregon border	6.94
ID17050108SW005_05	Big Boulder Creek - confluence of North and South Fork Boulder	7.63
ID17050108SW005_02	Big Boulder Creek - confluence of North and South Fork Boulder	44.56
ID17050108SW005_03	Big Boulder Creek - confluence of North and South Fork Boulder	4.57
ID17050108SW009_02	Combination Creek - source to mouth	12.33
ID17050108SW021_04	Cow Creek - 4th order	4.3
ID17050108SW016_02	Deer Creek - source to mouth	13.66
ID17050108SW020_02	Hooker Creek - source to Idaho/Oregon border	7.11
ID17050108SW004_04 J	ordan Creek - 4th order	5.64
ID17050108SW001_05	Jordan Creek - 5th order	13.35
ID17050108SW012_04	sephine Creek - source to mouth	8.35
ID17050108SW012_02	osephine Creek - source to mouth	45.44
ID17050108SW012_03	Josephine Creek - source to	4.79

	mouth	
ID17050108SW002_02	Lone Tree Creek - source to mouth	29.23
ID17050108SW002_03	Lone Tree Creek - source to mouth	6.08
ID17050108SW008_02	Mammoth Creek - source to mouth	
ID17050108SW007_03	North Fork Boulder Creek - source to mouth	2.31
ID17050108SW007_05	North Fork Boulder Creek - source to mouth	3.86
ID17050108SW007_02	North Fork Boulder Creek - source to mouth	30.12
ID17050108SW013_03	Rock Creek - 3rd order	13.29
ID17050108SW010_02	Rock Creek -Triangle Reservoir Dam to mouth	28.67
ID17050108SW010_05	Rock Creek -Triangle Reservoir Dam to mouth	5.16
ID17050108SW011_02	Rose Creek - source to mouth	13.61
ID17050108SW006_04	South Fork Boulder Creek - source to mouth	3.11
ID17050108SW006_03	South Fork Boulder Creek - source to mouth	8.42
ID17050108SW006_02	South Fork Boulder Creek - source to mouth	53.63
ID17050108SW019_02	Trout Creek - source to Idaho/Oregon border	33.78
ID17050108SW019_03	Trout Creek - source to Idaho/Oregon border	7.03
ID17050108SW003_03	Williams Creek - source to mouth	2.23
ID17050108SW003_02	Williams Creek - source to mouth	20.33
Summary for 'HUC' = 17050108	***(30 detail records)***	

4.5.2.3.2 Assessment of Impaired Waters – Nevada

The state-wide Nevada (2002) 303(d) Impaired Waters List identifies approximately 1,474 river miles as impaired, an increase of about 600 miles from the 1998 303(d) list. The most common causes of impairment for all listed streams is nutrient, metals, sediment, temperature, totals dissolved solids, pH and other parameters (Table 4.30).

Table 4.30. Summary of impaired iaterbodies and associated parameters in Nevada.

Parameter	Impaired Rivers, miles	Impaired Lakes/Reservoirs, acres	Impaired Wetlands, acres
TOTAL	1,474	76,928	19,511
Nutrients	1,070	2,830	185
Metals	1,066	0	19,326
Sediment	672	0	0
Temperature	535	0	0
Total Dissolved Solids	251	35,500	185
pH	41	4,616	185
Other	19	36,812	0

The impaired 303(d) waters for the Nevada portion of the Owyhee Subbasin are listed in Table 4.31.

Table 4.31. Impaired waters in the Nevada portion of the Owyhee Subbasin, Snake River Basin (Source: http://ndep.nv.gov/bwqp/303list.pdf).

Waterbody ID	NAC Reference	Waterbody Name	Reach Description	Size	Units	Existing TMDLs	Pollutant or Stressor of Concern
NV03-OW-18	445A.222	East Fork Owyhee River	Wildhorse Reservoir to Mill Creek	13.75	miles	Draft TMDL (2004)	Iron (total) Temperature Total phosphorus Total suspended solids Turbidity
NV03-OW-19	445A.223	East Fork Owyhee River	Mill Creek to Duck Valley Indian Reservation	7.71	miles	Draft TMDL (2004)	Total phosphorus Total suspended solids Turbidity
NV03-OW-25-B	445A.225	Wildhorse Reservoir	entire Reservoir	2,830	acres	None	pH Total phosphorus
NV03-OW-27	445A.225	SF Owyhee River -	Above Stateline	75.0	miles	None	Temperature
NV03-OW-100	Tributary to SF Owyhee River - 445A.225	Snow Creek	Below Jerritt Canyon Project	6.0	miles	None	Total dissolved solids
NV03-OW-101	Tributary to SF Owyhee River - 445A.225	Jerritt Creek	Below Jerritt Canyon Project	6.0	miles	None	Total dissolved solids
NV03-OW-102	Tributary to SF Owyhee River - 445A.225	Mill Creek	Below Jerritt Canyon Project	1.0	miles	None	Total dissolved solids
NV03-OW-34-C	Tributary to EF Owyhee River - 445A.223	Mill Creek	Above East Fork Owyhee River	1.44	miles	Draft TMDL (2004)	Cadmium (total) Copper (dissolved) Copper (total) Dissolved oxygen Iron (total) pH Temperature Total dissolved

							solids Total phosphorus Total suspended solids Turbidity

Nevada has several final and draft TMDLs for various water bodies – mostly in central and southern Nevada. The East Fork Owyhee River (Wildhorse Reservoir to Mill Creek), first appeared on the 1996 303(d) list for total phosphorus, total dissolved solids (TDS), total suspended solids (TSS), turbidity and iron. In 1998, the lower reach of the East Fork Owyhee River (Mill Creek to Duck Valley Reservation) was added to the list for the same pollutants. The decision to include these water bodies on the 1996 and 1998 303(d) Lists were based upon data and information collected by NDEP. In 2002, the listing for the upper reach of the East Fork Owyhee River (Wildhorse Reservoir to Mill Creek) was expanded (based upon NDEP data) to include temperature. In 2002, Mill Creek was added to the 303(d) List due to exceedence of the cadmium (total), copper (dissolved and total), dissolved oxygen, iron (total), phosphorus, total dissolved solids, total suspended solids, temperature, turbidity and pH standards. Data collected by NDEP and corroborated by RTWG supported inclusion of these constituents into the 303(d) List for Mill Creek.

In January 2004, a Total Maximum Daily Loads for the East Fork Owyhee River and Mill Creek was completed as a review draft (Nevada Division of Environmental Protection, January 2004). The covered water quality parameters for the East Fork Owyhee River and Mill Creek are:

East Fork Owyhee River	**Mill Creek**
⇒ Iron (total) ⇒ Phosphorus (total) ⇒ Total Suspended Solids ⇒ Turbidity ⇒ Temperature	⇒ Cadmium (total) ⇒ Phosphorus (total) ⇒ Copper (total; dissolved) ⇒ Temperature ⇒ Dissolved Oxygen ⇒ Total Dissolved Solids ⇒ Iron (total) ⇒ Total Suspended Solids ⇒ pH ⇒ Turbidity

For each of these pollutants of concern, this report includes a discussion for the following categories:
• Problem Statement
• Source Analysis

• Target Analysis
• Pollutant Load Capacity and Allocation
• Future Needs

4.5.2.3.3 Assessment of Impaired Waters – Oregon

The federal Clean Water Act requires states to undertake specific activities to protect the quality of their waters. The Oregon Department of Environmental Quality (ODEQ) has the responsibility for developing water quality standards that protect *beneficial uses* of rivers, streams, lakes and estuaries. Beneficial uses include drinking water, cold water fisheries, industrial water supply, recreation and agricultural uses. Once standards are established, ODEQ monitors water quality and reviews available data and information to determine if these standards are being met and water is protected.

Oregon DEQ recently completed the 303(d) list for the 2002 cycle (detailed information is available at: http://www.deq.state.or.us/wq/303dlist/303dpage.htm). The 303(d) list includes data submitted by individuals, organizations and government agencies as well as DEQ's own monitoring data. The final list is accompanied by a list of priorities that target resources for correcting water quality problems (ODEQ 2003). The 2002-303(d) list includes more than 13,300 stream miles that are listed for at least one water quality pollutant. State-wide, exceedances of temperature and bacteria are the most prevalent, followed by dissolved oxygen. The 1998-303(d) list included more than 13,700 stream miles that were listed for at least one pollutant. About 5,000 miles have been added since the 1998 303(d) list for at least one pollutant.

Since 1998, ODEQ has "de-listed" or removed more than 6,000 miles for at least one pollutant. Water bodies are de-listed for three reasons:

- EPA has approved water quality management plans and Total Maximum Daily Load (TMDL) determinations for listed segments of rivers and streams.
- New data indicates the water body meets water quality standards.
- The assessment methodology has changed since the previous 303(d) list.

Streams and rivers are not placed on the 303(d) list until sufficient data are available that indicate an exceedance of *water quality standards* has occurred. Currently, ODEQ does not have information on all Oregon water bodies due to insufficient data and/or the quality of the data. Those waters lacking information are not included on the 303 (d) list. Streams and rivers with suspected problems are identified as "Water Bodies of Potential Concern."

The current 303(d) list of impaired water bodies in the Oregon portion of the Owyhee Subbasin is presented in Table 4.51. No records of water quality pollution exist in the ODEQ database for East Little Owyhee HUC 17050106 or the Crooked Rattlesnake HUC 17050109. River mile 0 to 0.9 of the North Fork Owyhee River (within the Middle

Owyhee HUC 17050107) is impaired for beneficial used due to high water temperatures in the summer (1998- 303(d) List). In the Jordan HUC 17050108 – Antelope Reservoir, Jack Creek, and river miles 0 to 54 of Jordan Creek are impaired with mercury pollution. Contamination from a variety of heavy metals is documented for Fletcher Street Drain and Overstreet Drain – within the Lower Owyhee HUC 170501010.

Table 4.32. Impaired waters in the Oregon portion of the Owyhee Subbasin (Source: http://www.deq.state.or.us/wq/303dlist/303dpage.htm ; queries on 03-20-04)

Record ID	Waterbody Name	River Mile	Parameter	Season	List Date	Listing Status
East Little Owyhee – 17050106						
No record	–	–	–	–	–	–
Middle Owyhee – 17050107						
3336	North Fork Owyhee River	0 to 9.6	Temperature	Summer	1998	303(d) List
Jordan – 17050108						
3387	Antelope Reservoir/Jack Creek	4.1 to 8.4	Mercury	Year Around	1998	303(d) List
3386	Jordan Creek	0 to 54.4	Mercury	Year Around	1998	303(d) List
Crooked Rattlesnake – 17050109						
No record	–	–	–	–	–	–
Lower Owyhee – 170501010						
9550	Fletcher Street Drain	0 to 0	Copper	Year Around	2002	303(d) List
9551	Fletcher Street Drain	0 to 0	Iron	Year Around	2002	303(d) List
9552	Fletcher Street Drain	0 to 0	Lead	Year Around	2002	303(d) List
9553	Fletcher Street Drain	0 to 0	Manganese	Year Around	2002	303(d) List
9268	Overstreet Drain	0 to 0	Copper	Year Around	2002	303(d) List
9269	Overstreet Drain	0 to 0	Lead	Year Around	2002	303(d) List
9270	Overstreet Drain	0 to 0	Iron	Year Around	2002	303(d) List
9275	Overstreet Drain	0 to 0	Manganese	Year Around	2002	303(d) List
Crosses HUCs Middle Owyhee/ Lower Owyhee -- 17050107/10						
3426	Owyhee, Lake/Owyhee River	28.7 to 71	Mercury	Year Around	1998	303(d) List
3346	Owyhee River	0 to 18	Fecal Coliform	Summer	1998	303(d) List
3352	Owyhee River	0 to 18	Chlorophyll a	Summer	1998	303(d) List
3389	Owyhee River	0 to 18	DDT	Year Around	1998	303(d) List
3428	Owyhee River	0 to 18	Dieldrin	Year Around	1998	303(d) List

3348	Owyhee River	18 to 28.5	Dissolved Oxygen	Spring/Summer	1998	303(d) List
3425	Owyhee River	18 to 28.5	Dissolved Oxygen	Winter/Spring/Fall	1998	303(d) List
3429	Owyhee River	71.2 to 124.2	Temperature	Summer	1998	303(d) List
3431	Owyhee River	71.2 to 124.2	Mercury	Year Around	1998	303(d) List
9096	Owyhee River	71.2 to 124.2	Temperature	March 1 - June 30	2002	303(d) List
8095	Owyhee River	104 to 120	Dissolved Oxygen	March 1 - June 30	2002	303(d) List
9092	Owyhee River	120 to 142	Temperature	Summer	2002	303(d) List
9093	Owyhee River	120 to 142	Temperature	March 1 - June 30	2002	303(d) List
8096	Owyhee River	161 to 172	Dissolved Oxygen	March 1 - June 30	2002	303(d) List
3430	Owyhee River	165.6 to 191.5	Temperature	Summer	1998	303(d) List
9094	Owyhee River	165.6 to 191.5	Temperature	March 1 - June 30	2002	303(d) List

ODEQ (2000) also reports EPA data listing fish consumption restrictions in Antelope Reservoir, Jordan Creek, Owyhee Reservoir, and 100 miles of the Owyhee River due to excessive mercury levels (Table 4.33). The Oregon State Health Department (1993) issued a fish consumption advisory because mercury values in fish tissue samples from Owyhee Reservoir ranged between 0.65 - 1.77 ppm -- which exceed EPA advisory levels of 0.6 ppm and FDA advisory levels of 1.0 ppm.

Table 4.33. Waterbodies affected by fish and shellfish consumption restrictions due to toxicants (Source EPA Table 4.4-15; ODEQ 2000).

Name of Waterbody and Identification No.	Waterbody Type	Size Affected	Limited Consumption General Population	Cause(s) (pollutants) of Concern
Antelope Reservoir: 34E.ANTE	Lake	3,185 acres	X	Mercury
Jordan Creek: 34E-JORDO	River	69 miles	X	Mercury
Owyhee Reservoir: 34G.OWYH	Lake	13,900 acres	X	Mercury
Owyhee River: 34G-OWYH70	River	100 miles	X	Mercury

Water quality sampling sites monitored by Oregon DEQ in the Owyhee subbasin are summarized in Table 4.34. Additional water quality data collected by other agencies, e.g., BLM and USGS, are also utilized for evaluation of CWA 303(d) impaired waters.

Table 4.34. Oregon DEQ water quality sampling sites in the Oregon portion of the Owyhee River Basin (ODEQ 2000).

Site	STORET Number	LASAR Number	River Mile	Samples per Year
North Fork Owyhee River at Three Forks	405006	12263	1.0	2X
Owyhee River u/s Hot Springs at Three Forks	405005	12262	163.5	2X
Owyhee River at Rome	402407	10730	123.9	2X
Jordan Creek u/s Jordan Valley	405004	12261	53.0	2X
Owyhee River at Sand Springs	405001	12258	105.0	2X
Owyhee River at HWY 201	402406	10729	0.9	6X

Total Maximum Daily Load (TMDL) determinations outline how much pollution a water body can safely handle to support beneficial uses. TMDLs have not been done for any of the 4th field HUCs in the Oregon portion of the Owyhee Subbasin; however the ODEQ has planned for that work to be completed by year 2007.

- Upper Owyhee
- Middle Owyhee
- Crooked Rattlesnake
- Jordan
- Lower Owyhee

Generally, water quality management plans to restore streams and rivers to water quality standards are developed by government agencies in cooperation with landowners. In Oregon, various entities assist in the development of TMDLs:

- If the land is agricultural, then the Oregon Department of Agriculture would work with the landowners in the watershed to devise and implement a management plan (often referred to as a Senate Bill 1010 plan).
- If the land is private or state forest, then the Oregon Department of Forestry implements the Forest Practices Act.
- Federal agencies (such as Forest Service or the Bureau of Land Management) would have responsibility to develop water quality management plans on federal lands.
- In urban and rural areas not covered by other state or federal agencies, cities and counties would develop water quality management plans working closely with local watershed councils.

The above plans are sent to ODEQ for inclusion in an overall watershed plan - which ODEQ would then submit to EPA for approval.

4.6 Research, Monitoring, and Evaluation

4.6.1 Introduction

Understanding the effects of management actions implemented within the Owyhee Subbasin requires replicated observational studies or intensive research-level experiments conducted at different spatial scales over long time periods. Few programs have monitored at such spatial and temporal scales (Bayley 2002; Currens 2002). Recently, however, several groups have drafted integrated monitoring strategies that address many of the concerns associated with spatial and temporal scales.

One program, developed by the Independent Scientific Advisory Board (ISAB) of the Northwest Power and Conservation Council, outlines a monitoring and evaluation plan for assessing recovery of tributary habitat (ISAB 2003). This program describes a three-tiered monitoring approach that includes trend or routine monitoring (Tier 1), statistical (status) monitoring (Tier 2), and experimental research (effectiveness) monitoring (Tier 3). Trend monitoring obtains repeated measurements, usually representing a single spatial unit over a period of time, with a view to quantifying changes over time. Changes must be distinguished from background noise. This type of monitoring does not establish cause-and-effect relationships and does not provide inductive inferences to larger areas or time periods. Statistical monitoring, on the other hand, provides statistical inferences that extend to larger areas and longer time periods than the sample. This type of monitoring requires probabilistic selection of study sites and repeated visits over time. Experimental research monitoring is often required to establish cause-and-effect relationships between management actions and population/habitat response. This requires the use of experimental designs incorporating "treatments" and "controls" randomly assigned to study sites.

According to the ISAB (2003), the value of monitoring is greatly enhanced if the different types of monitoring are integrated. For example, trend and statistical monitoring will help define the issues that should be addressed with more intensive, experimental research monitoring. The latter will identify which habitat attributes are most informative and will provide conclusive information about the efficacy of various restoration approaches. Implementing experimental research in the absence of trend and statistical monitoring would increase uncertainty about the generalization of results beyond the sampling locations. The ISAB (2003) identified the following essential elements of a valid monitoring program.

- Develop a trend monitoring program based on remotely-sensed data obtained from sources such as aerial photography or satellite imagery or both.

- Develop and implement a long-term statistical monitoring program to evaluate the status of fish populations and habitat. This requires probabilistic (statistical) site selection procedures and establishment of common (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.

Another strategy drafted by the Bonneville Power Administration, the U.S. Army Corps of Engineers, the Bureau of Reclamation (collectively referred to as the Action Agencies), and NOAA Fisheries responds to the Federal Columbia River Power System (FCRPS) Biological Opinion issued by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. Although the Action Agencies/NOAA Fisheries Draft Research, Monitoring, and Evaluation (RME) Program was developed before the release of the ISAB (2003) report, it is in many respects consistent with ISAB recommendations. For example, the draft RME Program calls for the classification of all watersheds that have listed fish populations and receive restoration actions. Classification is hierarchical and captures physical/environmental differences spanning from the largest scale (regional setting) down to the channel segment. This component of the draft RME Program comports with Tier 1 Trend Monitoring in the ISAB (2003) plan. Status Monitoring (similar to Tier 2 Statistical Monitoring) and Action Effectiveness Research (similar to Tier 3 Experimental Research) are also included in the RME Program.

Bonneville Power Administration is funding a program to test the Action Agencies/NOAA Fisheries Plan within three subbasins in the Columbia Basin. This program has resulted in the development of a detailed monitoring strategy for the Wenatchee Subbasin. That strategy, referred to as the Upper Columbia Basin Monitoring Strategy (Hillman 2004), includes status-trend monitoring, effectiveness monitoring, and landscape classification of the subbasin. The strategy describes statistical designs, sampling designs, landscape classification, indicators, measuring protocols, and a framework for implementation. Subbasin planners in the upper Columbia Basin are incorporating this strategy into their monitoring and evaluation programs.

About the time the Action Agencies/NOAA Fisheries released their draft program, the Washington Salmon Recovery Funding Board (SRFB) released a draft monitoring and evaluation strategy for habitat restoration and acquisition projects. The document identified implementation, effectiveness, and validation monitoring as key components of their program. The monitoring program is scaled to capture factors operating at different hierarchical levels. At the lowest level (Level 0), the program determines if the action was implemented (implementation monitoring). Level 1 monitoring determines if projects meet the specified engineering and design criteria. Level 2 and 3 monitoring assess the effectiveness of projects on habitat and fish abundance, respectively. Levels 1-3 constitute effectiveness monitoring. Finally, level 4 (validation) monitoring addresses how management and habitat restoration actions, and their cumulative effects, affect fish production within a watershed. This type of monitoring is the most complex and technically rigorous.

The Pacific Northwest Aquatic Monitoring Partnership (PNAMP) recently prepared a draft document that provides recommendations for monitoring in subbasin plans. The recommendations draw heavily from the Upper Columbia Basin Monitoring Strategy (Hillman 2004) and the ISAB (2003). PNAMP recommends a five-step process for designing monitoring and evaluation plans for subbasin plans. Those steps include:

1. Adopt elements of an ecological management framework.
2. Define monitoring objectives.
3. Establish monitoring needs.
4. Develop a data and information archive.
5. Outline an evaluation program.

The Owyhee Monitoring and Evaluation Plan follows this five-step process and includes much of the information contained in the Upper Columbia Basin Monitoring Strategy (Hillman 2004) [39].

It is important to note that this plan does not replace or uproot existing monitoring programs within the Owyhee Subbasin (e.g., BLM monitoring, IDEQ TMDL monitoring, and Soil Conservation District monitoring). Rather, this plan builds a framework that should supplement and complement existing programs. An Owyhee Subbasin Monitoring Committee will be established with the overall goal of overseeing and coordinating monitoring in the basin and making sure that this plan meshes with existing programs.

4.6.2 Ecological Management Framework

The ecological management framework for the Owyhee Subbasin centers on the vision for the basin:

> *"The Owyhee Subbasin will be comprised of and support naturally-sustainable, diverse fish and wildlife populations and their habitats, that contribute to the social, cultural, and economic well-being of the subbasin and society."*

The management plan lists the following short-term (high priority) aquatic objectives/projects and strategies:

Protect and enhance springs and headwater streams from livestock use.

- Identify and prioritize springs and headwater streams that need protection or enhancement.

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[39] This strategy is also the strategy being used by subbasin planners in the Wenatchee, Entiat, Methow, and Okanogan subbasins. Therefore, the Monitoring and Evaluation Strategy within the Owyhee Subbasin Plan will be consistent with other subbasin plans.

- Implement protective measures (fencing) to exclude use by livestock.

Protect Lake Billy Shaw shorelines and inlet streams from degradation.

Plant native trees/willows and grasses along the shoreline and tributaries to Lake Billy Shaw.

Control grazing impacts to these areas by installing water troughs/stock ponds and fencing.

Provide a subsistence and recreational put-and-take fishery in various reservoirs on the Duck Valley Indian Reservation (DVIR).

Manage put-and-take fisheries in reservoirs on the DVIR to maximize survival and harvestable production.

Conduct resident fish inventory and genetic stock assessment on the DVIR.

Assess population structure, including genetic structure, of fish populations on the DVIR.

The management plan lists the following long-term (lower priority) aquatic objectives/projects and strategies:

Improve streamside riparian habitat and bank stability throughout the basin.

Implement State and BLM riparian, fisheries, and water resources Management Actions and Allocations standards and objectives from the Owyhee Resource Management Plan and Bruneau Management Framework Plan on watersheds with redband trout habitat. (Idaho)

Implement State and BLM Standards and Guides, grazing management objectives and guidelines on watersheds with redband trout spawning and rearing habitats. (ID, NV, OR)

Work with private landowners to improve riparian habitat. (ID, NV, OR)

Improve Tribal livestock management program to improve riparian habitat. (ID, NV, OR)

Implement USFS livestock utilization standards from Forest Plan revision on watershed with redband trout priority spawning and rearing habitats. (Nevada)

Implement grazing management appropriate for riparian pastures. (Oregon)

Improve riparian to increase vegetation shading. (Oregon)

Increase riparian to increase bank stability. (Oregon)

Increase riparian to increase channel complexity and channel form. (Oregon)

Improve riparian to reduce fine sedimentation. (Oregon)

Control pollution from mining activities throughout the basin.

Apply Best Management Practices to mine tailings and polluted areas to remediate pollution. (ID, NV, OR)

Apply Best Management Practices to Rio Tinto Mine tailings to remediate pollution of East Fork Owyhee River. (Nevada)

Restore redband trout connectivity throughout the basin.

Add fish screens to diversion structures to prevent downstream migration of redband trout into diversion ditches. (ID, NV, OR)

- Replace impassable culverts with suitable redband trout passage structures.
- Construct and operate a fish ladder over dam. (ID, NV, OR)
- Preserve and enhance native Redband trout habitat and connectivity by seeking innovative and voluntary methods to improve stream flows where it is feasible and consistent with State water laws and Tribal sovereignty. (ID, NV, OR)
- Provide passage of irrigation structures. (Oregon)

Improve instream flows to achieve levels needed for redband trout survival and productivity throughout the basin.

- Increase instream flow on public lands by increasing riparian vegetation. (Idaho)
- Improve irrigation efficiency. (Oregon)

Remove nonnative fish population in order to enhance redband trout survival and productivity throughout the basin. (Restoration only)

- Remove nonnative fish population using most appropriate site-specific methods. (ID, NV, OR)

The management plan lists the following short-term (high priority) terrestrial objectives/projects and strategies:

Protect, enhance, and/or acquire wildlife mitigation properties in the Owyhee subbasin.

- Work with local landowners to discus habitat enhancement/protection/acquisition opportunities.
- Develop methods to evaluate habitat enhancement/protection/acquisition opportunities in the subbasin
- Work collaboratively with interested entities in the subbasins, including, but not limited to: the Nature Conservancy, IDFG, NDOW, local sage grouse working groups, Owyhee Initiative Work Group, BLM, USFS, and NRCS.
- Explore opportunities to develop "grass banks" in Owyhee and Bruneau subbasins

Coordinate subbasin-wide land acquisitions, conservation easements, and riparian habitat improvements.

- Fund and facilitate coordinator position and activities in subbasins where the Shoshone-Paiute Tribes have historical natural resource and cultural interests and rights.
- Facilitate development of cooperative funding and implementation of habitat protection and restoration across state and jurisdictional boundaries

Protect streams, associated wetlands, and riparian areas on the Duck Valley Indian Reservation.

Identify and protect the existing high quality shrub-steppe habitat (late seral condition areas), while moving the fair quality shrub-steppe (mid seral areas) into late seral conditions.

Maintain or improve the ecological conditions of all springs, spring creek systems, and wetlands so as to be rated in Proper Functioning Condition (according to BLM criteria).

Maintain the existing condition and quality of all A and B ranked big basin sagebrush/basin wildrye-river terrace communities along the South Fork of the Owyhee, and identify and protect similar river terrace communities throughout the Owyhee Canyonlands.

- Develop community supported plans for conservation of key ecological values that also take into account economic and cultural values.
- Direct resources to highest priority projects within the subbasin as identified using a science-driven ecoregional planning process.
- Emphasize protection of existing high-quality habitats for a wide range of species and maintain existing areas of undisturbed shrub-steppe habitat.
- Work with willing landowners and land managers to protect priority conservation lands through acquisitions, conservation easements, land exchanges, and management agreements.

Implement landscape-based research, management, and restorative programs that identify current state of scientific knowledge of the area, identify information gaps and needed research, identify and build on successful management strategies and research and restoration projects, and identify management strategies designed to achieve objectives.

Develop and implement “grass banking” in Owyhee County in order to advance research and restoration.

Establish a National Sage Grouse Research and Restoration Area.

Authorize and fund implementation of sagebrush-steppe restoration programs at sites identified by science advisory committee as providing opportunity for high probability of success.

Preserve and increase sage grouse populations in Owyhee County.

- Develop maps that identify sage grouse habitat for high priority protection from wildfire.
- Implement sagebrush restoration projects in historic sage grouse habitat.
- Prioritize sites for juniper control activities.

Enhance natural resource productivity to enable a strong agricultural and natural resource sector.

- Maintain, restore, or enhance wetland ecosystems and fish and wildlife habitat.
- Deliver high quality services to the public to enable natural resource stewardship.

The management plan lists the following long-term (lower priority) terrestrial objectives/projects:

Minimize grazing effects in riparian and wetland habitats.

Minimize adverse effects of roads in riparian and wetland habitats.
Maintain and restore hydrologic regime in riparian and wetland habitats.
Restore natural nutrient cycles or mitigate for damages to aquatic and terrestrial populations due to the loss of marine-derived nutrients.
Minimize impacts of livestock grazing to native shrub-steppe habitat and terrestrial species.
Reduce the intensity, frequency, and size of wildfire in shrub-steppe habitats.
Limit noise disturbance to shrub-steppe wildlife species.
Reduce the prevalence of crested wheatgrass in shrub-steppe habitats.
Protect existing high quality shrub-steppe plant communities from nonnative invasive plant species and noxious weeds.
Provide habitat for big game and other wildlife species.
Reduce the impacts of livestock grazing on aspen habitats.
Maintain viable stands of aspen by through management practices encouraging and/or emulating natural fire processes.
Retain viable stands of aspen for native terrestrial species associated with upland aspen habitats.
Protect existing good condition grasslands.
Restore degraded grasslands to good condition.
Increase the coverage of native perennials, e.g., bluebunch wheatgrass and/or Idaho fescue.
Protect mature pine/fir/mixed conifer forest habitats by promoting ecological processes (i.e. natural fire regime) that lead to late seral stages while protecting meadow habitats from pine/fir/mixed conifer encroachment. This includes processes that lead to forest stability in this habitat type.
Close a few select “gateway” roads, restrict illegal roads, and manage cross-country motorized travel -- to ensure that critical remote wildland Canyon and Gorge habitats of the Owyhee Subbasin are protected.
Reduce the impact of the transportation system on wildlife and fish populations and habitats.
Reduce nutrient (N, P) enrichment problem in the Lower Owyhee River due to irrigation induced return flows in the Lower Owyhee River.

The overall goal of the monitoring and evaluation plan is to determine if the strategies employed meet the objectives and result in sustainable and diverse fish and wildlife populations and habitats that contribute to social, cultural, and economic well-being of the subbasin and society.

4.6.3 Monitoring Objectives

As stated above, the vision for the Owyhee Subbasin is to implement management actions that will result in sustainable and diverse fish and wildlife populations and habitats that contribute to social, cultural, and economic well-being of the subbasin and society. Because it is not reasonable or feasible to monitor all activities planned for the subbasin, this plan selected “short-term” aquatic and terrestrial objectives as high priority projects. The monitoring committee will prioritize long-term objectives. Although this plan will not monitor all management actions for effectiveness, status/trend monitoring will assess cumulative effects of all actions within the subbasin. This will provide planners and decision makers with information necessary to determine if management actions are contributing to the overall vision for the subbasin.

Based on the vision for the subbasin, this monitoring and evaluation plan uses a three-pronged approach, which is based on the following monitoring goals:

1. Describe the ecologic, geologic, and geomorphic setting in the Owyhee Subbasin (Landscape Classification).
2. Assess the status and trend of fish, wildlife, and their habitats in the Owyhee Subbasin (Status/Trend Monitoring).
3. Assess the effectiveness of management actions on fish, wildlife, and their habitats within the Owyhee Subbasin (Effectiveness Monitoring).

Each of these goals is divided into specific monitoring objectives. The plan then identifies a list of indicators that relate directly to the monitoring objectives under each goal. At this time, the plan is lacking many indicators for most terrestrial conditions. Those will be added based on the recommendations of the monitoring committee. The remainder of this plan focuses primarily on aquatic conditions.

Landscape Classification

General Objectives:

1. Describe the regional setting, including ecoregion and geology, of the Owyhee Subbasin.
2. Characterize the drainage basin and geomorphic features of the Owyhee Subbasin.
3. Describe the valley characteristics of the Owyhee Subbasin.
4. Describe the channel characteristics and riparian vegetation within the Owyhee Subbasin.

Indicators:

This plan adopts the classification system described in the Upper Columbia Basin Monitoring Strategy (Hillman 2004), which incorporates the entire spectrum of processes influencing stream features and recognizes the tiered/nested nature of landscape and aquatic features. This system captures physical/environmental differences spanning from the largest scale (regional setting) down to the channel segment (Table 4.35). By recording these descriptive characteristics, managers will be able to assess differential responses of indicator variables to proposed actions within different classes of streams and watersheds. Importantly, the classification work described here fits well with Level 1 monitoring under the ISAB (2003) monitoring and evaluation plan.

Table 4.35. List of classification variables, their corresponding measurement protocols, and temporal sampling frequency. The variables are nested according to spatial scale and their general characteristics. This table is from Hillman (2004).

Spatial scale	General characteristics	Classification variable	Recommended protocols	Sampling frequency (years)
Regional setting	Ecoregion	Bailey classification	Bain and Stevenson (1999)	20
		Omernik classification	Bain and Stevenson (1999)	20
	Physiography	Province	Bain and Stevenson (1999)	20
	Geology	Geologic districts	Overton et al. (1997)	20
Drainage basin	Geomorphic features	Basin area	Bain and Stevenson (1999)	20
		Basin relief	Bain and Stevenson (1999)	20
		Drainage density	Bain and Stevenson (1999)	20
		Stream order	Gordon et al. (1992)	20
Valley segment	Valley characteristics	Valley bottom type	Cupp (1989); Naiman et al. (1992)	20
		Valley bottom width	Naiman et al. (1992)	20
		Valley bottom gradient	Naiman et al. (1992)	20
		Valley containment	Bisson and Montgomery (1996)	20
Channel segment	Channel characteristics	Elevation	Overton et al. (1997)	10
		Channel type (Rosgen)	Rosgen (1996)	10
		Bed-form type	Bisson and Montgomery (1996)	10
		Channel gradient	Overton et al. (1997)	10
	Riparian vegetation	Primary vegetation type	Platts et al. (1983)	5

Status/Trend Monitoring

General Objectives:

1. Assess status and changes in fish and wildlife diversity over time in the Owyhee Subbasin.

2. Assess status and changes in abundance and distribution of redband trout over time in the Owyhee Subbasin.
3. Assess status and changes in surface water quantity and quality over time in the Owyhee Subbasin.
4. Assess status and changes in watershed condition, habitat quality, channel condition, and riparian condition over time in the Owyhee Subbasin.

Indicators:

Indicator variables identified in this plan for status/trend monitoring are consistent with those identified in the Upper Columbia Basin Monitoring Strategy (Hillman 2004) and with most of the indicators identified in the Action Agencies/NOAA Fisheries RME Plan and the WSRFB (2003) monitoring strategy. These indicators were selected for the following reasons:

- They are sensitive to land-use activities or stresses.
- They are consistent with other regional monitoring programs.
- They lend themselves to reliable measurement.
- Physical/environmental indicators relate quantitatively with fish production.

The indicators are also consistent with most of the variables identified by the NMFS (1996) and USFWS (1998) as important attributes of "properly functioning condition." Indeed, NMFS and USFWS use these indicators to evaluate the effects of land-management activities for conferencing, consultations, and permits under the ESA. They are also consistent with the eleven attributes used in the QHA process to assess limiting factors in the Owyhee Subbasin.

Tables 4.36 and 4.37 identify the biological and physical/environmental indicators, respectively, that will be measured for status/trend.

Table 4.36. Biological indicator variables to be monitored in the Upper Columbia River Basin.

General characteristics[1]	Specific indicators
Species Richness (fish and wildlife)	Number of different species
Redband Trout	Abundance and distribution
Macroinvertebrates	Composition
Columbia spotted frogs	Abundance and distribution
Yellow warblers	Abundance and distribution
White-faced ibis	Abundance and distribution
Sage grouse	Abundance and distribution
Mule deer	Abundance and distribution

[1]Other "focal" species will be added depending on the objective of the specific project.

Table 4.37. Physical/environmental indicators for aquatic systems that will be monitored within the Owyhee Subbasin. A similar table will be developed for terrestrial habitats. This table is modified from Hillman (2004).

General characteristics	Specific indicators
Water Quality	Temperature (MWMT and MDMT)
	Turbidity
	Conductivity
	pH
	Dissolved oxygen
Habitat Access	Road crossings
	Diversion dams
	Fishways
Habitat Quality	Dominant substrate
	Embeddedness
	Depth fines
	LWD (pieces/km)
	Pools (pools/km)
	Residual pool depth
	Fish cover
	Side channels and backwaters
Channel condition	Stream gradient
	Width/depth ratio
	Wetted width
	Bankfull width
	Bank stability
Riparian Condition	Riparian structure
	Riparian disturbance
	Canopy cover
Flows and Hydrology	Streamflow
Watershed Condition	Watershed road density
	Riparian-road index
	Land ownership
	Land use

Effectiveness Monitoring

General Objectives:

1. Assess the effects of livestock exclusion from springs and headwater streams on fish and habitat quality and quantity.
2. Assess the effects of plantings and livestock exclusions on Lake Billy Shay shorelines and inlet stream.
3. Assess the effects of riparian management actions on riparian habitat and bank stability.
4. Assess the effects of BMPs on controlling pollution from mining activities.
5. Assess the effects of fish-passage measures on restoring redband trout connectivity.
6. Assess effects of improved riparian conditions and improved irrigation efficiency measures on instream flows needed for redband trout survival and productivity.
7. Assess the effects of reducing non-native populations on the survival and productivity of redband trout.
8. Assess the effects of acquiring wildlife mitigation properties on the abundance and distribution of wildlife in the Owyhee Subbasin.
9. Assess the effects of land conservation easements and riparian habitat improvements on riparian conditions and wildlife abundance and diversity.
10. Assess the effects of moving fair quality shrub-steppe into late-serial conditions on wildlife abundance and diversity.
11. Assess the effects of restoration actions on sagebrush-steppe habitat and sage grouse abundance and distribution.

Indicators:

Indicator variables identified in this plan for effectiveness monitoring are consistent with those identified for status/trend monitoring. In this case, however, the plan does not recommend that all indicators listed above be measured for each action. The plan recommends that only those indicators that are linked directly to the proposed action be measured. In other words, the most useful indicators are likely to be those that represent the first links of the cause-and-effect chain. Because different projects have different objectives and desired effects, investigators only need to measure those indicators directly influenced on the chain of causality between the management action and the effect (Table 4.38).

Table 4.38. Rankings of the usefulness of various physical/environmental indicators to monitoring effects of different actions on aquatic habitats. Rankings vary from 1 = highly likely to be useful; 2 = moderately likely to be useful; and 3 = unlikely to be useful or little relationship, although the indicator may be useful under certain conditions or may help interpret data from a primary indicator. This table is from Hillman (2004). The different classes of habitat actions are from the Action Agencies/NOAA Fisheries RME Plan. A similar table will be developed for terrestrial habitats.

General characteristics	Specific indicators	Different classes of habitat actions							
		Diversion screens	Barrier removal	Sediment reduction	Water quality improvement	Nutrient enhancement	Instream flows	Riparian habitat	Instream structure
Water quality	MWMT/MDMT	3	2	3	1	2	1-2	1	3
	Turbidity	3	1-2	1	1	1	1-2	2	3
	Conductivity	3	2	2	1	1	2	2	3
	pH	3	3	3	1	1	3	2-3	3
	DO	3	2-3	2-3	1	1	1-2	2-3	3
Habitat access	Road crossings	3	1	3	3	3	3	3	3
	Diversion dams	1-2	1	3	3	3	2	3	3
	Fishways	2-3	1	3	3	3	3	3	3
Habitat quality	Dominant substrate	3	2	1	3	3	1-2	2	1-2
	Embeddedness	3	1-2	1	1-2	3	1-2	2	1-2
	Depth fines	3	1-2	1	1-2	2	2	2	1-2
	LWD	3	3	3	3	3	2	1	1
	Pools	3	1-2	1-2	3	3	1-2	1-2	1
	Residual pool depth	3	1-2	1	3	3	1	1-2	1
	Fish cover	3	2	1	1-2	1-2	1	1-2	1
	Off-channel habitat	3	2	2	3	3	1	1-2	1
Channel condition	Stream gradient	2	2	2	2	2	2	2	2
	Width/depth	3	1-2	1-2	3	3	1-2	1-2	1
	Wetted width	3	1-2	1-2	3	3	1-2	1-2	1
	Bankful width	3	1-2	1-2	3	3	1-2	1-2	1
	Bank stability	3	2	1-2	3	3	2	1	1
Riparian condition	Riparian structure	3	3	2	2-3	3	2	1	1-2
	Riparian disturbance	3	3	2	2-3	3	2	1	1-2
	Canopy cover	3	3	2	2-3	3	2	1	1-2
Flows/hydrology	Streamflows	3	1-2	3	3	3	1	2	1-2

Watershed condition	Road density	3	3	1-2	2	3	2-3	2-3	2
	Riparian-road index	3	3	1-2	2	3	2-3	1	2
	Land ownership	2	2	1	1	2-3	1	1	2
	Land use	1-2	1-2	1	1	2-3	1	1	2

4.6.4 Monitoring Needs

This section of the monitoring and evaluation plan describes the types of monitoring that will occur within the Owyhee Subbasin. Each type of monitoring will provide subbasin planners with the information they need to determine if the management actions implemented meet the vision and stated goals of the program. Again, this section focuses primarily on aquatic systems. Methods for monitoring terrestrial conditions will be developed by the monitoring committee. It is a goal of this plan to integrate both the aquatic and terrestrial monitoring components. This should reduce cost and effort.

Landscape Classification

Landscape classification describes the ecologic, geologic, and geomorphic setting in the Owyhee Subbasin. As noted earlier, the entire subbasin will be classified according to ecologic, geologic, and geomorphic criteria. The classification work relies heavily on remote-sensed data and GIS. The majority of this work will be conducted in an office with GIS. It is important, however, to spend time in the field verifying spatial data. This plan recommends that at least 10% of the channel segments identified in the subbasin be verified in the field. These segments will be selected randomly. Additional verification may be needed for those segments that cannot be accurately delineated from remote-sensed data. Variables such as primary riparian vegetation type, channel type, and bed-form type will be verified during field surveys conducted as part of status/trend and effectiveness monitoring.

Because the landscape classification system used here is consistent with the Upper Columbia Basin Monitoring Strategy (Hillman 2004), the protocols described therein will be used in the Owyhee Subbasin.

Status/Tend Monitoring

Because the intent of status/trend monitoring is to describe existing conditions and document changes in conditions over time, it requires temporal and spatial replication and probabilistic sampling. Monitoring the status and trends of populations and habitat characteristics in the Owyhee Subbasin will follow the methods described in the Upper Columbia Basin Monitoring Strategy (Hillman 2004). This approach calls for the implementation of the U.S. Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) design, a spatially-balanced, site-selection process developed for aquatic systems. The monitoring program is spatially explicit, unbiased, and has reasonably high power for detecting trends. The design is sufficiently flexible to use on the scale of multiple large river basins and can be used to estimate species abundance and distribution and freshwater habitat conditions. In addition, the EMAP site-selection approach supports sampling at varying spatial extents.

Specifically, EMAP is a survey design that was developed to describe current status and to detect trends in a suite of indicators. This is accomplished by using rotating panels

(Stevens 2002). Each panel consists of a collection of sites that will have the same revisit schedule over time. This plan recommends the use of six panels, with one panel defining sites visited every year and five panels defining sites visited on a five-year cycle (Table 4.39).

Table 4.39. Rotating panel design for status/trend monitoring within the Owyhee Subbasin. An "X" indicates the years in which sites within each panel are sampled. For example, sites in panel 1 are visited every year, while sites in panel 2 are visited only in years 1, 6, 11, and 16, assuming a 20-year sampling frame.

Panel	Year																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	X					X					X					X				
3		X					X					X					X			
4			X					X					X					X		
5				X					X					X					X	
6					X					X					X					X

Sites will be selected according to the generalized random tessellation stratified design (GRTS) (Stevens 1997; Stevens and Olsen 1999; Stevens and Urquhart 2000; Stevens 2002). The GRTS design achieves a random, nearly regular sample point pattern via a random function that maps two-dimensional space onto a one-dimensional line (linear space). A systematic sample is selected in the linear space, and the sample points are mapped back into two-dimensional space. The GRTS design is used to select samples for all panels.

This plan requires a sample size of 50 sites per panel. This means that GRTS will select a total of 300 sites (6 panels x 50 sites per panel = 300 sites) for the entire Owyhee Subbasin. Two panels of sites will be monitored each year, resulting in a total of 100 sites sampled annually within the Owyhee Subbasin. Some of the sites may fall in areas that are physically inaccessible or cannot be accessed because of landowner denial. Therefore, GRTS will select an additional 300 sites (100% oversample), any one of which can replace an inaccessible site.

The sampling frame for the 300 sites (and the 300 oversample sites) will consist of all portions of first through fifth-order[40] streams (based on 1:100,000 scale USGS topographic maps) with reach gradients less than 12%[41]. These stream segments were selected because most fish spawn and rear in these areas. However, spawning and rearing are not evenly distributed among stream orders or among different gradient classes within stream orders. Therefore, this plan recommends that each stream within

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[40] Stream order is based on Strahler (1952). This method of ordering streams is described in Gordon et al. (1992).

[41] Here, a reach is defined as a 300-m long stretch of stream. Therefore, all 300-m long reaches with a sustained gradient of >12% will be excluded from the sampling frame.

the sampling frame be divided into gradient classes. This plan recommends the following gradient classes: 0-2%, 2-4%, 4-8%, and 8-12%, which correspond roughly to dune-ripple/pool-riffle, plane-bed, step-pool, and cascade channel types, respectively (Montgomery and Buffington 1997; Roni et al. 1999). The first two classes represent response reaches, while the latter two represent transport reaches.

Although redband trout are more likely to spawn in stream segments with gradients less than 4%, it is unclear at this time how sites should be distributed among the four gradient classes. Therefore, this plan recommends that a variety of scenarios be modeled (Table 4.59). The first places 75% of the sites within gradient classes less than 4%, while the second scenario places 70% of the sites within these gradient classes. The third places 60% of the sites in classes with gradients less than 4%. The last examines the first three scenarios under the criteria that only 10% of the sites can fall within fifth-order streams. The purpose here is to limit the number of sites that fall within large streams. The results of these scenarios will be evaluated to see which one most closely fits the objectives of status/trend monitoring in the subbasin.

Table 4.40. Proportion of sample sites distributed among stream gradient classes within a status/trend monitoring zone.

Scenario	Gradient classes			
	0-2%	2-4%	4-8%	8-12%
1	0.45	0.30	0.15	0.10
2	0.45	0.25	0.20	0.10
3	0.30	0.30	0.20	0.20
4	Above scenarios but only 10% of the sites can fall within 5th order streams			

Sampling reaches for status/trend monitoring will vary in size according to the width of the channel. To be consistent with the Upper Columbia Basin Monitoring Strategy (Hillman 2004), sites will be 20 times the average bankfull width with a minimum length of 150 m and a maximum length of 500 m. Site lengths are measured along the thalweg. The upstream and downstream boundaries of a site will be measured with GPS and recorded as UTM. For purposes of re-measurements, these points will also be photographed, marked with permanent markers (i.e., rebar, which can later be found with a metal detector), and carefully identified on maps and site diagrams. Site lengths and boundaries will be "fixed" the first time they are surveyed and they will not change over time even if future conditions change.

In order to estimate precision, 10% of the sites within the subbasin will be sampled by two independent crews each year for five years. This means that each year, 10 randomly selected sites within the Owyhee Subbasin will be surveyed by two different crews. Sampling by the two independent crews will be no more than two-days apart. This will minimize the effects of site changes on estimates of precision.

Indicators and protocols are identified in Tables 4.41 and 4.42. The Upper Columbia Basin Monitoring Strategy (Hillman 2004) describes the indicators and protocols in detail. Some indicators are measured along the length of the site (e.g., biological indicators, LWD, number of pools, bank stability, etc.); others are measured along transects placed within the sites. A transect is a straight line across a stream channel, perpendicular to the flow, along which certain habitat features are measured at pre-determined intervals. Status/trend monitoring sites will be divided into 11 evenly-spaced transects by dividing the site into 10 equidistant intervals with "transect 1" at the downstream end of the site and "transect 11" at the upstream end of the site.

Data collected within the EMAP design will be analyzed according to the statistical protocols outlined in Stevens (2002). The Horvitz-Thompson or π-estimator is recommended for estimation of population status. Multi-phase regression analyses are recommended for estimating the distribution of trend statistics. These approaches are fully explained in Diaz-Ramos et al. (1996) and Stevens (2002).

Table 4.41. Recommended protocols and sampling frequency for biological indicators for aquatic systems.

General characteristics	Specific indicators	Recommended protocol	Sampling frequency
Species richness	Number of species	Dolloff et al. (1996); Reynolds (1996); Van Deventer and Platts (1989)	Annual
Species abundance	Numbers of individuals	Dolloff et al. (1996); Reynolds (1996); Van Deventer and Platts (1989)	Annual
Redband trout redds	Abundance	Mosey and Murphy (2002)	Annual
	Distribution	Mosey and Murphy (2002)	Annual
Macroinvertebrates	Composition	Peck et al. (2001); Hillman (2004)	Annual

Table 4.42. Recommended protocols and sampling frequency of physical/environmental indicator variables for aquatic systems. Table is modified from Hillman (2004).

General characteristics	Specific indicators	Recommended protocols	Sampling frequency[1]
Water Quality	MWMT/MDMT	Zaroban (2000)	Annual/Continuous (hourly)
	Turbidity	OPSW (1999)	Annual/Continuous (hourly)
	Conductivity	OPSW (1999)	Annual/Continuous (hourly)
	pH	OPSW (1999)	Continuous (hourly)
	DO	OPSW (1999)	Continuous (hourly)
Habitat Access	Road crossings	Parker (2000); WDFW (2000)	Annual
	Diversion dams	WDFW (2000)	Annual
	Fishways	WDFW (2000)	Annual
Habitat Quality	Dominant substrate	Peck et al. (2001)	Annual
	Embeddedness	Peck et al. (2001)	Annual
	Depth fines	Schuett-Hames (1999)	Annual
	LWD (pieces/km)	BURPTAC (1999)	Annual
	Pools per kilometer	Hawkins et al. (1993); Overton et al. (1997)	Annual
	Residual pool depth	Overton et al. (1997)	Annual
	Fish cover	Peck et al. (2001)	Annual
	Off-channels habitats	WFPB (1995)	Annual
Channel condition	Stream gradient	Peck et al. (2001)	Annual
	Width/depth ratio	Peck et al. (2001)	Annual
	Wetted width	Peck et al. (2001)	Annual
	Bankfull width	Peck et al. (2001)	Annual
	Bank stability	Moore et al. (2002)	Annual
Riparian Condition	Structure	Peck et al. (2001)	Annual
	Disturbance	Peck et al. (2001)	Annual
	Canopy cover	Peck et al. (2001)	Annual
Flows and	Streamflow	Peck et al. (2001)	Continuous

Hydrology			
Watershed Condition	Watershed road density	WFC (1998); Reeves et al. (2001)	5 years
	Riparian-road index	WFC (1998)	5 years
	Land ownership	n/a	5 years
	Land use	Parmenter et al. (2003)	5 years

[1]See Hillman (2004) for description of sampling frequency.

Implementation Monitoring

Implementation monitoring is concerned with whether or not a project was implemented properly. This is related to Tier 4 monitoring under the Action Agencies/NOAA Fisheries RME Program and Levels 0 and 1 monitoring under the SRFB Program. Implementation monitoring addresses the types of actions implemented, how many were implemented, where they were implemented, and how much area or stream length was affected by the action. Indicators for implementation monitoring will include visual inspections, photographs, and field notes on numbers, location, quality, and area affected by the action. Success will be determined by comparing field notes with what was specified in the proposals (detailed descriptions of engineering and design criteria). Thus, the proposals will serve as the benchmark for implementation monitoring. Any deviations from specified engineering and design criteria will be described in detail.

Effectiveness Monitoring

Because effectiveness monitoring attempts to explain cause-and-effect relationships (e.g., effect of a tributary project on fish abundance), it is important to include as many elements of valid statistical design as possible. An appropriate design recommended by the Action Agencies/NOAA Fisheries (2003), ISAB (2003), WSRFB (2003), and the Upper Columbia Basin Monitoring Strategy (Hillman 2004) is the Before-After-Control-Impact or BACI design (Stewart-Oaten et al. 1986, 1992; Smith et al. 1993). This type of design is also known as a Control-Treatment Paired or CTP design (Skalski and Robson 1992), or Comparative Interrupted Time Series design (Manly 1992). Although names differ, the designs are essentially the same. That is, they require data collected simultaneously at both treatment and control sites before and after treatment. These data are paired in the sense that the treatment and control sites are as similar as possible and sampled simultaneously. Replication comes from collecting such paired samples at a number of times (dates) both before and after treatment. Spatial replication is possible if the investigator selects more than one treatment and control site.[42] The pretreatment sampling serves to evaluate success of the pairings and establishes the relationship

[42] The use of several test and control sites is recommended because it reduces spatial confounding. In some instances it may not be possible to replicate treatments, but the investigator should attempt to replicate control sites. These "Beyond BACI" designs and their analyses are described in more detail in Underwood (1996).

between treatment and control sites before treatment. This relationship is later compared to that observed after treatment.

The success of the design depends on indicator variables at treatment and control sites "tracking" each other; that is, maintaining a constant proportionality (Skalski and Robson 1992). The design does not require exact pairing; indicators simply need to "track" each other. Such synchrony is likely to occur if similar climatic and environmental conditions equally influence sampling units (NRC 1992). Precision of the design can be improved further if treatment and control stream reaches are paired according to a hierarchical classification approach (described above). Thus, indicator variables in stream reaches with similar climate, geology, geomorphology, and channel types should track each other more closely than those in reaches with only similar climates.

It is important for control and treatment sites to be independent; treatment at one site cannot affect indicators in another site. The NRC (1992) recommends that control data come from another stream or from an independent reach in the same stream. In addition, sites to be treated should be selected randomly. Randomization eliminates site location as a confounding factor and removes the need to make model-dependent inferences (Skalski and Robson 1992). Hence, conclusions carry the authority of a “true” experiment and will generally be more reliable and less controversial. In many cases, however, treatments will not be randomly assigned to sites. In this case, studies will be “causal-comparative,” rather than “true” experimental studies. Although the approach (BACI design) is the same for both types of studies, one must be careful generalizing results from causal-comparative studies. Results from causal-comparative studies usually apply only to the reach in which the study was conducted.

Sampling units (sites) for effectiveness monitoring will be selected according to a stratified random sampling design. The plan requires that streams or stream segments to be treated with some action(s) will be classified according to the hierarchical classification system (described under Landscape Classification). Once classification identifies non-overlapping strata, sampling sites are then selected randomly within each stratum. The same process occurs within control or reference areas, which are similar to treatment areas based on classification. The number of sites within each stratum will be proportional to the size of the stratum. That is, a larger stratum will receive more sites than a smaller stratum.

Sampling sites for effectiveness monitoring will vary in size according to the width of the channel. To be consistent with the Upper Columbia Basin Monitoring Strategy (Hillman 2004), sites will be 20 times the average bankfull width with a minimum length of 150 m and a maximum length of 500 m. Site lengths are measured along the thalweg. The upstream and downstream boundaries of a site will be measured with GPS and recorded as UTM. For purposes of re-measurements, these points will also be photographed, marked with permanent markers (e.g., rebar, which can later be found with a metal detector), and carefully identified on maps and site diagrams. Site lengths and boundaries will be “fixed” the <u>first</u> time they are surveyed and they will not change over time even if future conditions change.

Indicators and protocols are identified in Tables 4.41 and 4.42. The Upper Columbia Basin Monitoring Strategy (Hillman 2004) describes the indicators and protocols in detail. Some indicators are measured along the length of the site (e.g., biological indicators, LWD, number of pools, bank stability, etc.); others are measured along transects placed within the sites. Effectiveness monitoring sites will be divided into 11 evenly-spaced transects by dividing the site into 10 equidistant intervals with "transect 1" at the downstream end of the site and "transect 11" at the upstream end of the site.

The number of sites selected for each action to be monitored (from the list of priorities) will depend on effect size, variability, power, and significance levels. Although there is little to no information on variability for specific indicators, this plan recommends that all analyses achieve a power of 0.80 and a Type I error of 0.05.[43] This plan does not define effect size specifically (because of a lack of information), but does define "practical significance" as the difference between the current condition and properly functioning condition (as defined by the BLM). That is, success is defined as the point when the treated area reaches "properly functioning condition." Thus, properly functioning condition is the benchmark for restoration in the Owyhee Subbasin.

Several different statistical procedures can be used to analyze BACI designs. Manly (1992) identified three methods: (1) a graphical analysis that attempts to allow subjectively for any dependence among successive observations, (2) regression analysis, which assumes that the dependence among successive observations in the regression residuals is small enough to ignore, and (3) an analysis based on a time series model that accounts for dependence among observations. Cook and Campbell (1979) recommend using autoregressive integrated moving average models and the associated techniques developed by Box and Jenkins (1976). Skalski and Robson (1992) introduced the odd's-ratio test, which looks for a significant change in dependent variable proportions in control-treatment sites between pretreatment and post-treatment phases. A common approach, recommended by WSRFB (2003), includes analysis of difference scores. Differences are calculated between paired control and treatment sites. These differences are then analyzed for a before-after treatment effect with a two-sample t-test, Welch modification of the t-test, or with nonparametric tests like the randomization test, Wilcoxon rank sum test, or the Mann-Whitney test (Stewart-Oaten et al. 1992; Smith et al. 1993). Choice of test will depend on the type of data collected and whether those data meet the assumptions of the tests.

Pilot Project

A pilot status/trend and effectiveness monitoring program will be implemented on the Duck Valley Indian Reservation within the Owyhee and Bruneau subbasins. This monitoring program will begin in 2004 and will use the statistical and sampling designs, indicators, and protocols outlined in this plan. Management actions implemented on the

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[43] Power is the probability of correctly rejecting the null hypothesis when it is really false. Type I error is the probability of rejecting the null hypothesis when it is really true.

reservation will be monitored for effectiveness using control-treatment and BACI statistical designs with random sampling. Status/trend monitoring, using the rotating panel design and GRTS, will assess current conditions and changes in biological and physical/environmental conditions over time. In this case, however, only 15 sites per panel will be sampled. In addition, the entire Reservation will be classified according to the Landscape Classification methods described above. Monitoring on the Reservation will tie into the Owyhee Subbasin Plan Monitoring and Evaluation Program. Information collected during the pilot study will be used to modify the Owyhee Subbasin Monitoring and Evaluation Program. A draft plan of the monitoring strategy for the DVIR is included in Appendix 4.

4.6.5 Data and Information Archive

Because the indicators and protocols used in this plan are consistent with the Upper Columbia Basin Monitoring Strategy (Hillman 2004), this plan will incorporate the data dictionary and infrastructure being developed for that program and the other pilot projects. The data dictionary and infrastructure are intended for use throughout the entire Columbia Basin. Subbasin planners in the upper Columbia Basin intend to use this data management program.

The data management program, called the Columbia Basin Coordinated Information System (CBCIS), is being developed by the Bureau of Reclamation, Spatial Dynamics, Inc., and Commonthread, Inc., with consultation from State, Federal, and Tribal agencies and consultants. The data dictionary is a data management tool that provides a comprehensive conceptual framework based on the monitoring indicators and data collection protocols. The data dictionary will also include a geodatabase (incorporating an ArcHydro Geodatabase Model) that will host GIS work (landscape classification information). The data dictionary will be used to develop field forms that crews will complete during data collection.

Currently the vision is that the primary database will be held at the NOAA Fisheries Science Center in Seattle. The primary database will contain summarized data and portals to raw data collected within each subbasin. The goal is that each subbasin will be responsible for managing and maintaining raw data. Thus, all data generated from the Owyhee Monitoring and Evaluation Program will be stored and managed at the BLM office in Idaho and at the Duck Valley Indian Reservation. The data management program will automatically summarize the raw data, thereby reducing processing errors. Data will be uploaded only by authorized personnel, who have user access. Data can be retrieved (downloaded) by anyone, but only authorized individuals can upload data into the database.

Trained field crews will collect and record data onto field forms generated by the data dictionary.[44] A monitoring supervisor will review data forms each day to make sure that

[44] This plan recommends the use of electronic data loggers for recording data in the field. The use of data loggers and electronic data-entry interfaces should minimize data-entry errors.

all required information was collected. In addition, the supervisor will look for outliers and missing data. Data will be entered into the data management program by the authorized user. Compiled data will be double-checked for accuracy by a second person (this will reduce recording errors). Data will be analyzed following the protocols developed in the data dictionary. Each year an annual report describing the results of the past years' work will be made available to technical/scientific staff representing different agencies, decision-makers, stakeholders, and the public.

4.6.6 Evaluation

This plan recognizes three essential elements for evaluation (Figure 4.7):

1. **Scientific Evaluation**—An evaluation of available information by objective and independent scientists to assess the strengths and weaknesses of the program.

2. **Decision-Making Evaluation**—An evaluation of available information by decision makers, who determine what alternatives and management actions are needed when triggers are reached.

3. **Public Evaluation**—An evaluation of available information by the public to assess economic and societal needs.

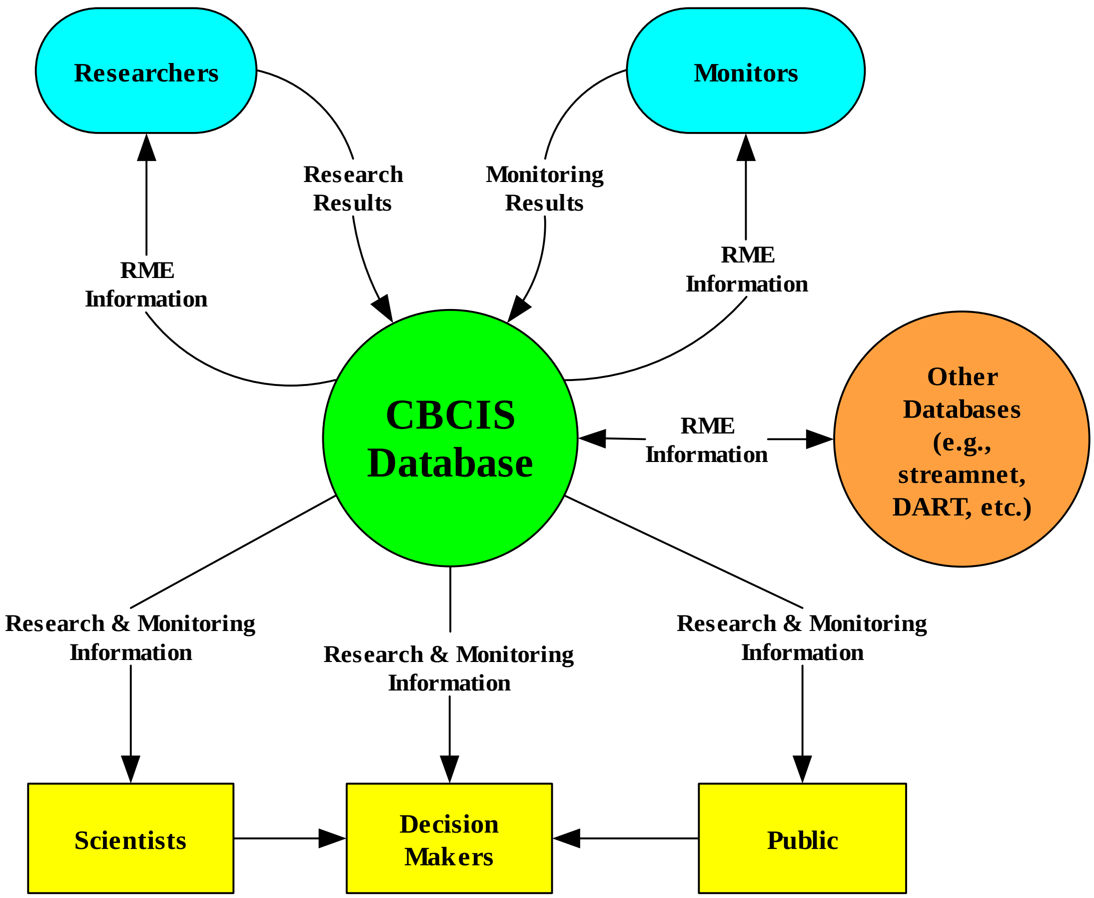

Figure 4.7. Diagram showing the flow of information from researchers and monitors in the Owyhee Subbasin to scientific reviewers, public, and decision makers.

The purpose for evaluation is to interpret information gathered from monitoring, assess deviations from goals or anticipated results, and recommend changes in policies or management actions where appropriate. The Owyhee Subbasin planners believe this requires input from both objective, independent scientists and the general public. Both groups will annually provide feedback to decision makers, who have the responsibility to change policies or management actions.

The following independent scientists[45] have been proposed for evaluating research and monitoring information from the Owyhee Subbasin:

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[45] These scientists have been identified as possible reviewers. They have not been contacted to determine their willingness to act as independent reviewers.

1. Dr. Jack Griffith (retired professor of fish ecology)
2. Dr. Mike Falter (retired professor of stream ecology/limnology/toxicology)
3. Dr. Jonathan Bart (USGS research wildlife biologist)
4. Dr. Lyman McDonald (Statistical Consultant)
5. Dr. Richard Inouye (ISU professor of plant-animal ecology)
6. Dr. James Smith (BSU professor of plant ecology)

The following proposed list of individuals[46] will be responsible for making policy and management decisions:

1. Gayle Batt (Idaho Water Users Association)
2. Jay Chamberlin (Owyhee Irrigation District)
3. Guy Dodson (Shoshone-Paiute Tribes)
4. Carl Hill (Owyhee Watershed Council)
5. Gary Johnson (Nevada Department of Wildlife)
6. Duane LaFayette (Idaho Soil Conservation Commission)
7. Allyn Meuleman (U.S. Bureau of Reclamation)
8. Kevin Meyer (Idaho Department of Fish and Game)
9. Keith Paul (U.S. Fish and Wildlife Service)
10. Ray Perkins (Oregon Department of Fish and Wildlife)
11. Chris Salove (Owyhee County Commissioner)
12. Pamella Smolczynski (Idaho Department of Environmental Quality)
13. Jenna Whitlock (Bureau of Land Management)

Interested individuals and the public will have access to all reports posted on the Owyhee Subbasin website. Draft annual reports will be sent to the independent scientific review panel and posted on the website for public review by mid-February. The comment period will last from mid-February to late-March. Final annual reports will be completed by mid-April. The monitoring coordinator will be responsible for compiling comments and reports and sending them to the panel of decision makers. Any changes in the monitoring program by the decision panel will be made by mid-May.

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[46] These individuals have been identified as possible decision makers. Although they have not been contacted to determine their willingness to act as decision makers, they were heavily involved with the development of the subbasin plan.

Owyhee Subbasin Plan

Appendix 1 – General Supplemental Information

Prepared By:

The Shoshone-Paiute Tribes,

Contract Administrator and Owyhee Coordinating Committee Member

and

The Owyhee Watershed Council,

Owyhee Coordinating Committee Member

Prepared for:

The Northwest Power and Conservation Council

Final Draft May 28, 2004

Steven C. Vigg,

Steven Vigg & Company

Editor and Project Coordinator

Disclaimer:

Final approval by the Northwest Power and Conservation Council is contingent upon a favorable review by the Independent Scientific Review Panel and meeting requirements for adoption as an amendment to the Council's Fish & Wildlife Program.

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Appendix 1.2 Fishing Research for the Shoshone-Paiute of the Duck Valley Indian Reservation Relating to Subbasin Planning (Source: Deward E. Walker, Jr., Ph.D., 2004)

As part of our ongoing research into Shoshone-Paiute reliance on fish and other riparian resources, we have been asked to provide information concerning the Shoshone-Paiute relating to subbasin planning. Since 1958 we have conducted comparative research among various tribes of the Columbia Plateau and Great Basin; this has necessitated specific research with most of the tribes in these regions (Table 1).

Table 1: Principal Tribes Involved in Comparative Research of the Columbia Plateau and Great Basin

Shoshone-Paiute of the Duck Valley Indian Reservation
Nez Perce
Confederated Tribes of the Umatilla Indian Reservation
Yakama Indian Nation
Palus
Confederated Tribes of the Colville Indian Reservation
Coeur d'Alene
Arapahoe
Bitterroot Salish (Flathead)
Kootenai
Ft. Hall Shoshone-Bannock
Lemhi Shoshone-Bannock
Warm Springs Confederated Tribes
Wind River Shoshone and Arapahoe
Ft. McDermitt Shoshone-Paiute
Burns Paiute
Klamath

Methods

Our research methods begin with reviewing relevant archaeological published research of historians, anthropologists, and fish biologists. Because of its importance to tribal leaders and others, we also review the legal foundation for the tribes' fishing rights both on and off-reservation. The most important addition we can make to the existing research is to communicate the detailed knowledge of fishing techniques, reliance, and cultural significance of fishing which the tribes hold. Ethnographic research that draws upon the memories and practices of tribal fishermen form the basis of much of the new information we have been gathering. Field travel to specific fishing sites is an essential part of our research with tribal fishermen and other cultural experts who possess information concerning both past and present aspects of fishing.

Some of our research has been published at various times (Walker 1967, 1992, 1993, 1995, 1999). Much of our data remain unpublished but are the foundation of ongoing research for the Shoshone-Paiute of the Duck Valley Indian Reservation. We have adopted an inclusive geographical setting for our research, spanning portions of Idaho, Oregon, and Nevada – areas known to have been occupied and used by Shoshone-Paiute fishermen. Principal riparian systems we are currently investigating for detailed evidence of traditional Shoshone-Paiute fishing are included in Table 2.

Table 2: Principal Rivers Under Investigation for Shoshone-Paiute Fishery Locations

Snake (Idaho and Oregon)
John Day
Deschutes
Owyhee
Powder
Burnt
Payette
Boise
Bruneau
Jarbridge
Weiser
Salmon

It should be noted that these rivers are not the only rivers on which Shoshone-Paiute fishing traditionally has taken place. We are documenting tribal fishing in a very large region which includes portions of both the Great Basin and the Columbia Plateau.

Because of our long-term research activity in the Columbia Plateau and Great Basin we are able to draw upon the knowledge of many different elders from various tribes. In this project these individuals include members of Shoshone-Paiute families who have traditionally used the fisheries not only in the Duck Valley area but at various locations throughout the Columbia Plateau and Great Basin. In our research we are guided by the customary ethnographic method of asking both detailed as well as open-ended questions of the most knowledgeable tribal members and by field trips and demonstrations of fishing practices. While sociological methods require elaborate preparation of questionnaires producing results that are quantitative in nature, ethnographic inquiry depends much more on the ethnographer's personal knowledge of and familiarity with the culture, language, and history of the carefully selected respondents known to possess expert knowledge of the topics under research. It is also occasionally necessary to conduct research interviews in either the Paiute/Bannock or Shoshone language in order to gain the in-depth understanding we are seeking. There are also various concepts and topics that are best expressed in the native languages, and certain respondents are less comfortable answering questions in English. These questions focus on three types of inquiry:

1. The respondent's personal knowledge of past and present fishing practices;
2. The respondent's knowledge of past and present fishing practices by other tribal members;
3. The respondent's assessment of cultural and other impacts stemming from fishery losses and what coping strategies have been adopted to compensate for such losses.

Our research is particularly valuable for its documentation of the extensive geographic region within which fishing took place as well as the estimates we provide of the size of the annual catch and reliance of the Shoshone-Paiute and other tribes on this valuable resource. In gathering data from Tribal fishermen concerning the tribal catch and the tribes' reliance on aquatic resources, we have employed the following five methods:

1. Use of direct, recorded counts of fish catches.
2. Use of direct, recorded counts of the customary number of peak fishing days.
3. Use of direct, recorded counts of numbers of fishermen for the customary number of days and their productivity.
4. Use of direct, recorded counts of various types of fishing devices, with estimates of their efficiency.
5. Use of direct, recorded counts of the number of fishing locations customarily used, with estimates of their relative productivity.

Once such data have been obtained, we employ tribal fishermen to assist us in their interpretation and explanation considering the following five factors:

1. Nature and efficiency of traditional fishing gear.
2. Size and duration of the accessible fish run.
3. Extent and productivity of spawning habitats.
4. Cultural preferences for fish versus other foods, including the relative contribution of fish to the total tribal diet.
5. Uses of fish for other than dietary purposes (e.g., in trade or ceremonies).

Reliance and Technology

A significant contribution of our ethnographic assessment of Shoshone-Paiute fisheries to the existing body of published research is a description of tribal fishing technology. The fishing techniques employed by the traditional Shoshone-Paiute closely resemble those found among most tribes of the Columbia River and its tributaries. I have prepared a series of illustrations taken from archival photographs, direct observation in the field, ethnographic publications, archaeological publications, as well as information and models provided by knowledgeable tribal fishermen. They are available upon request. They include the following:

- Various types of nets made of wild hemp, including dipnets and various seines.
- Detachable harpoons, leisters, and double-pronged spears in a style somewhat different from the Plateau styles seen among the Nez Perce, Umatilla, Yakama and others. They were made of bone, stone, and horn.
- The spearing or hooking blind in which a fisherman waited in a concealing structure to spear or hook the fish.
- Weirs (fence-like structures) like those first seen by Lewis and Clark on the Lemhi River that were employed on mid-sized streams.
- Traps such as the fall trap for taking fish descending the river.
- Basketry (tubular or conical) traps used independently or in conjunction with weirs.
- Dams built of piled stone so as to permit spearing or harpooning, usually in smaller streams.
- Gorges and hooks of bone and wood used to gaff as well as hook fish (with bait). They ranged in size from the large sturgeon hooks (with or without bait) to the small gorges used with bait. The large sturgeon hooks were used with long ropes that permitted butchering in the water, because the sturgeon were sometimes too large to land while still alive and intact.
- Fishwalls constructed of piled stones and extended out into the larger streams providing both a resting place for salmon moving upstream as well as a dipping and spearing platform for fishermen.
- Various types of stupefacients that temporarily immobilized fish so they could be speared, hand-fished, or dipnetted.

Cooperative fish drives were employed in placid pools in conjunction with spears, harpoons, nets, and fish clubs. Much larger congregations of tribal members, exceeding 1,000, would fish cooperatively using various techniques under the direction of a fishing specialist/leader (sometimes referred to as a fish or salmon chief) in such fisheries as the Hagerman-Shoshone Falls, Boise-Payette-Weiser Valley, and others throughout the Columbia, Snake, Salmon, and Owyhee drainages. Idaho Yesterdays (1974:14-23) presents a description of the Hagerman-Shoshone Falls fisheries. These large fisheries resemble Celilo and Kettle Falls in the Plateau on the mid-Columbia River.

Preservation of fish required little beyond sun drying, but smoke was also used for taste and to protect against insects. There was an extensive Shoshone-Paiute trade in dried fish. Dried fish were readily stored in basketry containers and in several types of underground caches for use during seasons of limited availability. Fish pemmican was prepared and traded as were sturgeon oil and other fish byproducts. Fish skin, bone, vertebrae, and sturgeon scales entered into the manufacture of various products for use and for trade.

Species taken include: Lamprey (Entosphenus tridentatus), sturgeon (Acipenser transmontanus), whitefish (Prosopium williamsoni), trout (Salmo sp.), chub (Gila sp.), Northern Pike minnow (Ptychocheilus oregonensis), suckers (Catostomus platyrhynchus), crayfish (Astacus sp.), and mussels (Mytilidae sp.) were used as a supplement to the supplies of anadromous fish that included chinook (Oncorhynchus tsha-tscha), sockeye (Oncorhynchus nerka), chum (Oncorhynchus keta), coho (Oncorhynchus kisutch), and steelhead (Salmo gairdeneri).

We have discovered that Shoshone-Paiute fishing sites at which the various techniques have been traditionally employed are easily grouped into three broad types: 1) fishing sites at natural falls, cascades, or rapids; 2) sites with construction, such as weirs, traps (shades or blinds), and fish walls; and 3) the simple fishing site commonly utilized without such geographic or constructed distinguishing features. The first two types are by far the most productive sites and are capable of daily harvests in the hundreds and even thousands of fish during certain peak days of anadromous fish runs. The third type is not usually employed during peak days of the anadromous runs and is used in an opportunistic manner for both anadromous and especially resident species. Nets, spears, leisters, basketry traps, and other techniques were employed in various combinations at the first two types of sites to enhance their effectiveness. It is these types of fishing sites that produced the heavy catches described for the Hagerman-Shoshone Falls, Boise-Payette-Weiser Valley fisheries, and others throughout the Columbia, Snake, Salmon, and Owyhee drainages. Fishing at such sites typically required large numbers of Shoshone-Paiute working together to adequately exploit the passage of large runs of fish during the seasons and times of their availability. Fishing extended for as much as sixteen hours on certain days. These large congregations at major fisheries included most of the subgroups of the Shoshone-Paiute confederation (Walker 1993a), but also members of more distant tribes (see Table 1).

As evidence of the importance and significance of the annual fish catch we have reviewed direct historical observations of Shoshone-Paiute fishing in southern Idaho. For example, Robert Stuart, in 1812-1813, a member of the Astoria party, described the fishery on the Boise River system, as:

> . . . the most renowned Fishing place in this Country [southern and central Idaho] It is consequently the resort of the majority of Snakes [Shoshone-Paiute), where Immense numbers of Salmon are taken . . [Stuart 1813, 1935].
>
> . . . Mr. Miller says that he stopped here on his way down – it was in the afternoon, by far the best spearing time, when to his utter astonishment the Indians in a few hours killed some thousands of fish . . . [Stuart 1813, 1935].

Large fish catches in southern Idaho were also noted by Nathaniel J. Wyeth (Young 1899:168-169) as he led an exploring expedition along the Snake River in 1833. On September 9 he recorded the following:

> In [the] morning went to see the Indians catch salmon which is done by entangling them in their passage up the creek among dams [weirs] which they erect and spearing them they catch an immense quantity the operation commences in the morning at a signal given by their Chief. . . The main river here is full of salmon.

On September 12 Wyeth (Young 1899:169) recorded another observation of southern Idaho:

> The river is full of salmon and a plenty of them are to be had of the Indians which we meet every few miles fishing on the banks of the stream.

Craig and Hacker (1940:140) quote Washington Irving in describing Captain Bonneville as follows:

> The early traders report that Indians at Salmon Falls on the Snake River took several thousand salmon in one afternoon by means of spears [for additional details see Idaho Yesterdays (1974:14-23)].

In the October 12, 1871, issue of The Weekly Montanian, Granville Stuart (1871) wrote that the Shoshone were reliant on mountain sheep and salmon:

> . . . of which latter there is an abundance in [the] Salmon River . . .

Several valuable historical notes have also been presented in Madsen (1979). For example, he cites a report in the Commissioner of Indian Affairs Annual Report submitted on 25 September 1872 by J. C. Rainsford (1872:437) to J. A Viall, in which it is noted that a crisis was being created by dams and overfishing by non-Indians. He quotes:

> Sir: I have the honor to submit the following report of this agency:
>
> The salmon, though very abundant in the Columbia River during the past season, has been very scarce at the fishing places of these tribes. . . . This is, in my opinion, owing to the immense quantities caught, and the obstructions erected by the several fisheries on the Columbia River. The failure is of vast importance to these people [emphasis added] as they have been in the habit of curing and storing large quantities for winter use. The entire amount caught by [the tribe] this season does not exceed 10,000 pounds; while in past years the amount has been from 30,000 to 60,000 pounds. [Reference is to one band of Shoshone-Paiute at Lemhi.]

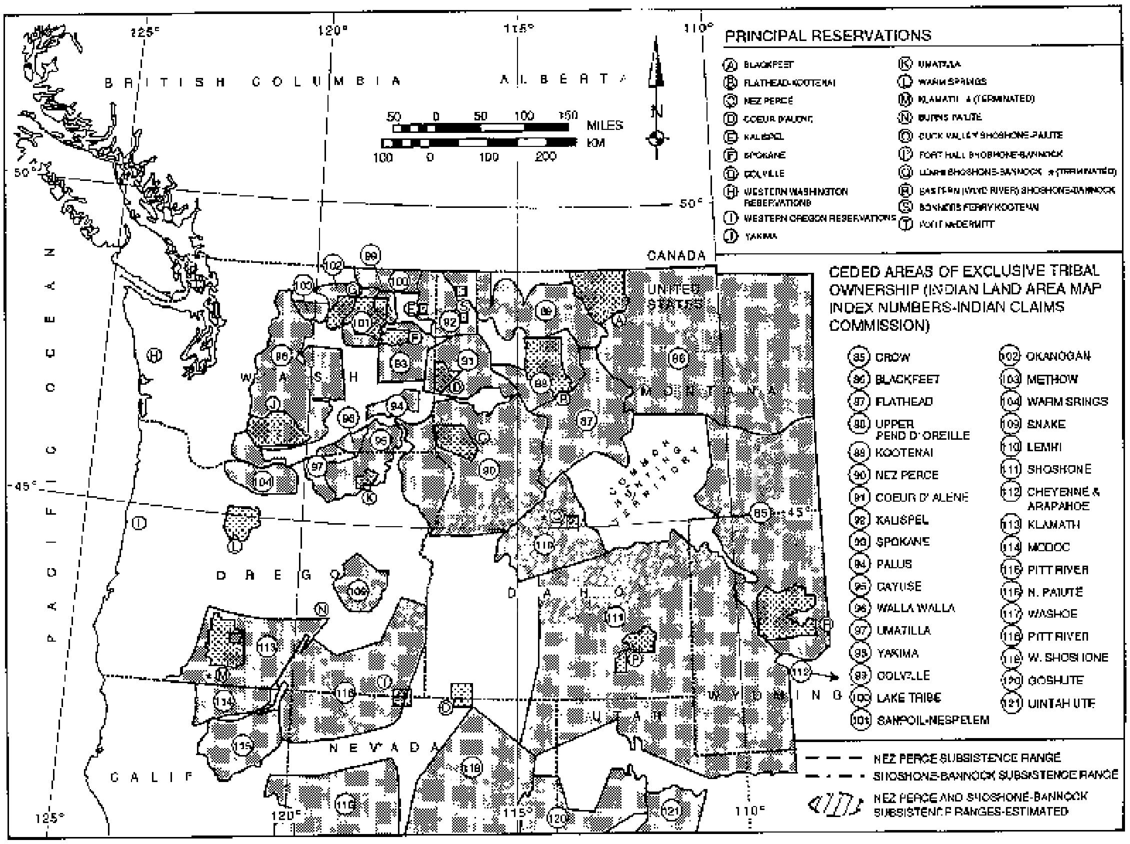
In addition to extensive recorded historical observations of the abundant fish catches customarily taken throughout the region we have employed tribal expertise to locate ten traditional weir sites in the Duck Valley region (Owyhee and Bruneau drainages) that have been blocked by downstream damming of the Owyhee and other Snake River tributaries. We have been able to use this information to estimate the average catch that could be expected in normal years before the blockading of fish passage for the various anadromous species available when the Duck Valley Indian reservation was established. We have determined that before the blockading of the fish passage on the Snake, Owyhee, and Bruneau rivers, the Shoshone-Paiute of the Duck Valley Indian Reservation enjoyed three annual salmon runs of about ten days each. We have determined from interviews of elders as well as recorded interviews of individuals born in the 19th century that there were three annual salmon runs that could be expected, in normal years, to last about ten days. In fact, we have evidence that suggests that the Duck Valley Indian

Reservation location was decided upon in part because of the abundant fisheries available in the region. For example, in an interview with Federal Agent Levi Gheen, the Territorial Enterprise (1-3-1878) quoted him to the effect that, "The country abounds in deer, grouse, prairie chickens and other wild game, while the creeks and river literally swarm with excellent fish. All in all Duck Valley is a veritable Indian paradise." Again, it was at this time that Captain Sam first mentioned Duck Valley to Gheen, a "place . . . about seventy or eighty miles northeast of [Elko] where [the Indians] say there is plenty of game and fish and a good farming country as near as they can judge with plenty of timber (in the mountains) water and grass" (Gheen 1875).

Using information gained from Shoshone-Paiute and other tribal fishermen as well as from comparative tribal catch records (Walker 1967, 1992, 1993b), we estimate their catch to have been about 200 fish per day, averaging 15 pounds each, for each weir, yielding a potential average annual catch of 90,000 pounds, or about 6,000 fish. As part of further comparative verification of these estimated catches, we have also derived estimates for two other important fisheries (the Boise-Payette-Weiser Valley and the Hagerman-Shoshone Falls sites) which the Shoshone-Paiute shared with occupants of the Upper Snake River and Boise Valley. We estimate that the Boise-Payette-Weiser Valley area contained at least 25 traditional weir sites and falls/cascades sites as did the Hagerman-Shoshone Falls area. It is our conclusion that each site could produce an average annual catch for about ten days, three times per year. We estimate this to have been 200 fish per day, per weir, averaging 15 pounds each per weir. Therefore, while the reported 19th century salmon catch estimates are large when compared to contemporary catches in the Columbia-Snake system, they appear to be very supportable by the evidence discovered in our research.

Reserved Fishing Rights

Anthropologists as well as the ICC (see Indian Claims Commission Act of 1946) (NARF 1973) have drawn heavy lines around "exclusively" occupied territorial areas for various tribal groups of the Great Basin and elsewhere (see Map 1). This practice completely ignores the overlapping, intertribal cross-utilization of various economic resources in the large areas lying between the nuclear areas of permanent habitation traditionally occupied by tribes of the Columbia Plateau, Great Basin, and elsewhere. It also ignores the very large subsistence ranges typical of such Tribes of the region. It should be noted that in its decisions, the ICC omitted large areas, to which tribal rights remain unextingquished, of southwest Idaho and adjacent areas that form much of the Shoshone-Paiute homeland. Such judicial territorial designations by the ICC must be regarded as misleading simplifications that ignore the joint, intertribal use of large, overlapping subsistence ranges in the Great Basin and Columbia Plateau. Anthropologists need not allow the administrative and legal needs of the Anglo-American system of law dictate how Shoshone-Paiute or other traditional tribal territorial limits are to be drawn. In fact, such lines may be quite different, depending on whether economic, political, or subsistence subsystems of tribal organization are being considered. In addition, the establishment of the reservation system and the drawing of territorial limitations/boundaries has tended to encourage competition and opposition among reservations that did not previously exist among tribes. As with most other groups, the Shoshone-Paiute traditionally shared their territory with many others, despite frequently exaggerated and relatively rare examples of intertribal hostilities.



Historical evidence largely contradicts the popular picture of intertribal competition and occasional warfare among Columbia Plateau and Great Basin tribes. There is considerable evidence to the contrary that tribes throughout these two large regions traded, intermarried, and otherwise generally acted in a friendly manner toward one another. This foundation of friendship and cooperation has become even more important as the Shoshone-Paiute have attempted to compensate for the blockading of their reservation-based fisheries. With aid from friends and relatives on nearby reservations, public, or privately held lands, the Shoshone-Paiute continue to exercise their reserved rights in many off-reservation areas despite decisions made by the ICC and other federal agencies to deny those rights. These areas, around such rivers as the Snake, John Day, Deschutes, Owyhee, Powder, Burnt, Payette, Boise, Bruneau, Jarbridge, Weiser, and Salmon, contribute to offsetting the tribes' economic, cultural, ceremonial, and subsistence needs, but the loss of their local fisheries in the Duck Valley region has resulted in significant impoverishment, affecting especially the quality of their diet and health.

Establishment of the Duck Valley Indian Reservation began in 1877. A principal consideration in the decision to establish the reservation was its water and abundant fish resources. While the federal actions involved in establishing the Duck Valley Indian Reservation are complex, neither they nor the ICC's deliberations extinguished their customary off-reservation fishing or other rights. In effect, the fishing and hunting rights of the Shoshone-Paiute have continued uninterrupted into the present and have been collectively shared among the other tribal groups with whom they are related. In fact, since 1985 it has been the announced policy of the Bureau of Indian Affairs that tribal off-reservation treaty-reserved rights are potentially exercisable on all federal lands within a tribe's ceded area, as well as on federal lands in other areas traditionally used for those activities, unless applicable treaties/executive orders state otherwise. This policy is based on various legal interpretations by the courts of which I provide the following synopsis.

Some early court cases interpreting the right to fish at usual and accustomed stations indicated that a tribe's exercise of this right was limited to the lands ceded by the tribe to the United States. State v. Meninock, 115 Wash. 528, 529,197 P. 641, 642 (1941). However, it is the ruling of the U.S. Supreme Court that Indian treaties are to be interpreted according to the understanding of the Indians and the intent of the parties. Washington v. Washington State Commercial Passenger Fishing Vessel Association, 443 U.S. 658, 676 (1979). In 1919, the Supreme Court also determined that the Indians signing the Yakima Treaty would have understood their reserved fishing rights to extend to all of their traditional fishing areas, without regard to ceded land boundaries. Seufert Brothers v. United States, 249 U.S. 194, 198-99 (1919). Consequently, their fishing rights could be exercised both inside and outside their ceded lands. This holding has been followed ever since. United States v. Washington, 384 F. Supp. 312, 401-02 (W.D. Wash., 1974), aff'd, 520 F.2d 676, 9th Cir. 1975, cert. denied, 423 U.S. 1085 (1976).

Judicial holdings regarding other off-reservation reserved treaty rights have been less clear. Courts have held that the right to hunt on open and unclaimed lands is limited: 1) to the ceded lands, State v Arthur, 74 Idaho 251, 261, 261 P.2d 135, 141, cert. denied, 347 U.S. 937 (1953); 2) to aboriginal hunting territories, State v. Stasso, 172 Mont. 242, 246, 563 P.2d 562, 564 (1977); or 3) to unoccupied federal lands anywhere, State v. Tinno, 94 Idaho 759, 768, 497 P.2d 1386, 1395 (1972) (concurring opinion). Northwest Indian treaties give more specific direction to resolve these issues. For example, the Fort Bridger Treaty itself refers to "hunting districts," Treaty with the Eastern Band Shoshoni and Bannock, 1868, supra. art. 4, indicating that the signatories expected treaty hunting rights to be exercised within traditional hunting areas that were also unoccupied "public lands" of the United States, without regard to ceded lands. Treaty council minutes for several of the Stevens treaties reveal that the Indians understood that they were reserving their rights to hunt, gather, and pasture in areas traditionally used for those activities. No mention was made of restricting them to ceded lands.

It is the conclusion of the U.S. Supreme Court that Indian treaties are interpreted according to the understanding of the Indians, and in the absence of clear judicial direction, all reserved treaty rights should be exercisable both on ceded lands, where tribal groups were presumed to have exclusive use and occupancy, and in other areas traditionally used (jointly) for those activities at the time of the treaty, unless the treaty clearly states otherwise. This also implies that investigation of tribal understanding of treaties is a part of an agency's official trust responsibilities in their determination and enforcement of tribal treaties and tribal off-reservation treaty-reserved rights.

Conclusions and Recommendations for Additional Research

Our research provides an important enrichment of the depiction of Shoshone-Paiute traditional and contemporary fishing. Based on numerous records the salmon played an important part in Shoshone-Paiute life and culture. We believe, however, that the information we have gathered is only a beginning and that much can be done to further clarify the nature of fishing and the impacts of various historical developments on this important aspect of tribal economy. Previous research is of limited value and must be strengthened by additional research because it has not adequately depicted the reliance, techniques, geographical range, legal foundation for off-reservation fishing, or the effects of fishery losses on the Shoshone-Paiute. A full and accurate picture requires the additional research that we are currently providing and hope to be able to complete in the near future.

Appendix 1.3 Abbreviations and Acronyms for the Owyhee Subbasin Plan

Appendix 1.3.1 Abbreviations and Acronyms from the Northwest Power Planning and Conservation Council's Directory of Organizations, Publication 2004-0x1

A

AFS American Fisheries Society
AIC Association of Idaho Cities
ANSI American National Standards Institute
APAC Association of Public Agency Customers
APPA American Public Power Association
ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
AWC Association of Washington Cities

1 This document is a list of acronyms that may be found in Council-related materials. Please note that Council policy is to avoid the use of acronyms in written materials whenever possible. If an organization's name is long, a key word in that name should be used rather than an acronym. For example, instead of using COE or USACE for the Corps of Engineers, we use the word "Corps."

AWEA	American Wind Energy Association

B

BLM	Bureau of Land Management
BOG	Basin Oversight Group
BOR	Bureau of Reclamation
BPA	Bonneville Power Administration

C

CABO	Council of American Building Officials
CAT Force	Conservation Acquisition Task Force
CBFWA	Columbia Basin Fish and Wildlife Authority
CEC	California Energy Commission
CIS	Coordinated Information System
COE	Corps of Engineers
CPUC	California Public Utilities Commission
CRITFC	Columbia River Inter-Tribal Fish Commission
CSPE	Columbia Storage Power Exchange
CTUIR	Confederated Tribes of the Umatilla Indian Reservation

D

DOE	U.S. Department of Energy
DREW	Drawdown Regional Economic Workgroup
DSIs	Direct service industries (or) Direct Service Industries, Inc.

E

EEI	Edison Electric Institute
EFAC	Economic Forecasting Advisory Committee
EFSC	Oregon Energy Facility Siting Council
EFSEC	Washington Energy Facility Site Evaluation Council
EIS	Environmental impact statement
EPRI	Electric Power Research Institute
EWEB	Eugene Water and Electric Board

F

FCRPS	Federal Columbia River Power System
FERC	Federal Energy Regulatory Commission
FOE	Friends of the Earth
FOEC	Fish Operations Executive Committee
FPC	Fish Passage Center
FPDEP	Fish Passage Development and Evaluation Program

G

GRC	Geothermal Resource Council
GRI	Gas Research Institute

H

HGP	Hanford Generating Project
HUD	U.S. Department of Housing and Urban Development

I

IAC	Idaho Association of Counties
ICBO	International Conference of Building Officials
ICNU	Industrial Customers of Northwest Utilities
ICP	Intercompany Pool
IDFG	Idaho Department of Fish and Game
IDWR	Idaho Department of Water Resources
IHOT	Integrated Hatchery Operations Team
IOU	Investor-owned utility
IndeGO	Independent Grid Operator
IPCo	Idaho Power Company
IPUC	Idaho Public Utilities Commission
ISAB	Independent Scientific Advisory Board
ISRP	Independent Scientific Review Panel

L

LADWP	Los Angeles Department of Water and Power
LOC	League of Oregon Cities

M

MACo	Montana Association of Counties
MAU	Montana Associated Utilities
MCS	Model conservation standards
MDFWP	Montana Department of Fish, Wildlife and Parks
MDNRC	Montana Department of Natural Resources and Conservation
MLGEO	Montana Local Government Energy Office
MPC	Montana Power Company
MPSC	Montana Public Service Commission
MTLCT	Montana League of Cities and Towns

N

NCAC Northwest Conservation Act Coalition
NEDC Northwest Environmental Defense Center
NELPA Northwest Electric Light and Power Association
NEPA National Environmental Protection Act
NERC National Electric Reliability Council
NIU Northwest Irrigation Utilities
NMFS National Marine Fisheries Service
NOAA National Oceanic and Atmospheric Administration
NWPCC Northwest Power Planning Council
NRC U.S. Nuclear Regulatory Commission
NRDC Natural Resources Defense Council
NRECA National Rural Electric Cooperative Association
NREL National Renewable Energy Laboratory (formerly Solar Energy Research Institute, SERI)
NRIC Northwest Resource Information Center
NWEC Northwest Energy Code
NWPP Northwest Power Pool
NWPPA Northwest Public Power Association
NWPPA Northwest Pulp and Paper Association
NWPCC Northwest Power and Conservation Council
NWPCC Northwest Power Planning Council

O

OAC Oregon Association of Counties
ODFW Oregon Department of Fish and Wildlife
OEC Oregon Environmental Council
OMB Office of Management and Budget
ONRC Oregon Natural Resources Council
OPUC Oregon Public Utility Commission
OPUDA Oregon People's Utility District Association
ORC Oregon Rivers Council
ORECA Oregon Rural Electric Cooperative Association
ONRC Oregon Natural Resources Council
OWRD Oregon Water Resources Department

P

PGE Portland General Electric
PG&E Pacific Gas and Electric (California)
PGP Public Generating Pool
PNCA Pacific Northwest Coordination Agreement
PNGC Pacific Northwest Generating Cooperative
PNL Pacific Northwest Laboratory
PNUCC Pacific Northwest Utilities Conference Committee
PPC Public Power Council

PP&L	Pacific Power and Light
PSPL	Puget Sound Power and Light
PUC	Public Utilities Commission or Public Utility Commission
PUD	Public Utility District or, in Oregon, People's Utility District
PURPA	Public Utility Regulatory Policies Act of 1978

R

REA	Rural Electrification Administration
RFF	Resources for the Future
RSDP	Residential Standards Demonstration Program
RTF	Regional Technical Forum

S

SAAC	State Agency Advisory Committee
SAM	System Analysis Model
SCE	Southern California Electric
SCL	Seattle City Light
SDGE	San Diego Gas and Electric
SEAof O	Solar Energy Association of Oregon

U

UCUT	Upper Columbia United Tribes
USBR	U.S. Bureau of Reclamation
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

W

WAC	Wildlife Advisory Committee
WAPA	Western Area Power Administration
WB	Water budget
WDF	Washington Department of Fisheries
WDOE	Washington Department of Ecology
WDW	Washington Department of Wildlife
WEC	Washington Environmental Council
WES	Western Electricity Study
WIEB	Western Interstate Energy Board
WMGT	Western Montana Electric Generating and Transmission Cooperative, Inc.
WNP	Washington Public Power Supply System Nuclear Project
WPPSS	Washington Public Power Supply System
WRDA	Water Resources Development Act of 1986
WREA	Washington Rural Electric Cooperative Association

WSAC	Washington State Association of Counties
WSCC	Western Systems Coordinating Council
WSEO	Washington State Energy Office
WUTC	Washington Utilities and Transportation Commission
WWO	Water Watch of Oregon

Y

YIN	Yakama Indian Nation

Appendix 1.3.2 Abbreviations and Acronyms from Columbia/Snake River Mainstem TMDL web site (USEPA 2004)

BPA	Bonneville Power Administration
CRITFC	Columbia River Inter-Tribal Fish Commission
CWA	Clean Water Act
DEQ	Department of Environmental Quality
DNMP	Dairy Nutrient Management Plan
DOE	Department of Ecology
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
LA	Load allocation (for non-point sources in TMDLs)
NPDES	National Pollutant Discharge Elimination System
NPS	Non-Point Source
NWIC	Northwest Indian College
OSS	On-site Septic System
PS	Point Source
PUD	Public Utility Districts
QA/QC	Quality Assurance/Quality Control
RBM 10	River Basin Model developed in EPA Region 10
RM #	River Mile Number
SIS	Summary Implementation Strategy
TDG	Total Dissolved Gas
TMDL	Total Maximum Daily Load
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WQS	Water Quality Standards
WRIAS	Water Resource Inventory Areas

Appendix 1.3.3 Abbreviations and Acronyms from the Southeast Oregon Resource Management Plan (BLM 2003)

ACEC	area of critical environmental concern
ADC	animal damage control
AML	appropriate management level
AMP	allotment management plan
AMR	appropriate management response
APHIS	Agricultural Plant and Animal Health Inspection Service
ARA	Andrews Resource Area
ATV	all-terrain vehicle
AUM	animal unit month
BA	biological assessment
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	best management practice
BO	biological opinion
BOM	Bureau of Mines
BOR	Bureau of Reclamation
BPA	Bonneville Power Administration
CERCLIS	comprehensive environmental response, Compensation and Liability Information System
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CLCAS	Canada Lynx Conservation Assessment and Strategy
CRMP	Cultural Resources Management Plan
CWA	Clean Water Act
DLCD	Department of Land Conservation and Development
DOD	Department of Defense
DOE	Department of Energy
DOGAMI	Oregon Department of Geology and Mineral Industries
DOI	Department of the Interior
DPC	desired plant community
DRFC	desired range of future conditions
EA	environmental assessment
EIS	environmental impact statement
EPA	Environmental Protection Agency
ER	entrenchment ratio
ERMA	extensive recreation management area
ERU	ecological reporting unit
ESA	Endangered Species Act
ESI	ecological site inventory
E/EIS	Eastside Environmental Impact Statement
FAA	Federal Aviation Administration
FERC	Federal Energy Regulatory Commission
FLPMA	Federal Land Policy and Management Act
FMP	fire management plan
FWFMP	Federal Wildland Fire Management Policy
GIS	geographic information system

GMA	geographic management area
GTR	green tree replacement
HA	herd area
HMA	herd management area
HMP	habitat management plan
HUC	hydrologic unit code
ICBEMP	Interior Columbia Basin Ecosystem Management Plan
IMP	Interim Management Policy
IMPLWR	Interim Management Policy for Land under Wilderness Review
INFISH	Inland Native Fish Strategy
JRA	Jordan Resource Area
KGRA	known geothermic resource area
LCDC	Land Conservation and Development Commission
LGMP	Leslie Gulch ACEC Management Plan
MFP	management framework plan
MOU	memorandum of understanding
MRA	Malheur Resource Area
NCA	national conservation area
NEPA	National Environmental Policy Act
NHOT	National Historic Oregon Trail
NHPA	National Historic Preservation Act
NL	no leasing
NOAA	National Oceanographic and Atmospheric Administration
NPS	National Park Service
NPSP	nonpoint source pollution
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSO	no surface occupancy
NWSR	national wild and scenic river
NWSRA	National Wild and Scenic River Act
NWSRS	National Wild and Scenic River System
OAR	Oregon Administrative Rules
OBSMP	Oregon's Bighorn Sheep Management Plan
ODA	Oregon Department of Agriculture
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
ODPR	Oregon Department of Parks and Recreation
ODSL	Oregon Division of State Lands
OHV	off-highway vehicle
ONA	outstanding natural area
ONHP	Oregon Natural Heritage Program
ONHTMP	Vale District Oregon National Historic Trail Management Plan
ORS	Oregon Revised Statute
ORV	outstandingly remarkable value

OWFEIS Oregon Wilderness Final Environmental Impact Statement
OWS occupancy with stipulations
PFC proper functioning condition
PILT payments in lieu of taxes
PNC potential natural community
PP&L Pacific Power and Light
PSEORMP/FEIS Proposed Southeastern Oregon Resource Management Plan Final Environmental Impact Statement
PRIA Public Rangelands Improvement Act
PUC Public Utilities Commission
RAIDS riparian aquatic information date system
RAWS remote automated weather station
RCA riparian conservation area
RMO riparian management objective
RMP resource management plan
RNA research natural area
ROD record of decision
ROS recreation opportunity spectrum
RPS rangeland program summary
RS Revised Statutes
R&PP recreation and public purpose
SCORP Oregon's Statewide Comprehensive Outdoor Recreation Plan
SEORAC Southeastern Oregon Resource Advisory Council
SEORMP Southeastern Oregon Resource Management Plan
SHPO State Historic Preservation Office
SMA special management area
SMCMPA Steens Mountain Cooperative Management and Protective Area
SRMA special recreation management area
SRP special recreation permit
S&G's Standards of Rangeland Health and Guidelines for Livestock Grazing Management
TGA The Taylor Grazing Act
TMDL total maximum daily load
TNC The Nature Conservancy
TNR temporary nonrenewable grazing
T&E threatened and endangered
USDA U.S. Department of Agriculture
USDI U.S. Department of the Interior
USFS U.S. Forest Service
USFWS U.S. Fish and Wildlife Service
USGS U.S. Geological Survey
VRM visual resource management
WAFWA Western Association of Fish and Wildlife Agencies
WFSA wildland fire situation analysis
WRCS Western Regional Corridor Study
WSA wilderness study area

WSRO	Wilderness Study Report Oregon
WQMP	Water Quality Management Plan
WQRP	water quality restoration plan

Appendix 1.4 Glossary of Technical Terms

1.4.1 Definition of Strategic Planning Terms

Action Plans: Detailed descriptions of how strategies will be implemented on an operational basis (*Manageware*, State of Louisiana 1996).

Biological Objectives (Science Review Team, SRT, August 16, 1996): Measurable objectives that are adopted by the Northwest Power Planning Council and incorporated into its Fish & Wildlife Program -- and thereby constitute legal standards.

Conceptual Foundation (Independent Scientific Group 1996):

> "A conceptual foundation is a set of scientific principles and assumptions that can give direction to management activities, including restoration programs, such as the FWP. A conceptual foundation determines how information is interpreted, determines what problems (e.g., limitations on fish production) are identified, and as a result, establishes the range of appropriate solutions (Lichatowich et al. 1996). Because it influences the interpretation of information, the conceptual foundation can be a powerful element of management and restoration plans and it can determine the success or failure of these plans. ... Unfortunately, salmon management and restoration plans rarely contain an explicitly described conceptual foundation. The Fish and Wildlife Program is no exception."

Ecological objectives[2] for the implementation work plans (Science Review Team, SRT, August 16, 1996):

> Ecological objectives define the type of biological and physical changes or conditions needed to achieve the management objective. Ecological objectives are based on a conceptual foundation that reflects current understanding of the ecology of the Columbia River Basin. The conceptual foundation is subject to modification as knowledge improves. This in turn can result in modification of objectives and actions. Again, this is a hierarchical system that defines ecological objectives at the Basin, subregional and subbasin level ... Ecological objectives should describe an ecosystem that is consistent with the management objectives. This could include habitat characteristics, correction of identified problems, and biological conditions such as survival changes, diversity and productivity. Ideally, ecological objectives should be quantitative indices relating to needed survival changes, return per spawner or other quantitative indices of ecological change. However, it is unlikely in the near term that such quantitative indices will be available. At this point, simply a qualitative assessment of ecological change or condition needed to meet

[2] The term "*Ecological Objective*" was suggested by the SRT rather than "*Biological Objective*" for two reasons. First, it avoids the legal problem of whether these are "Biological Objectives" in the sense of the Northwest Power Act. Second, it shifts the focus from simply getting a number of fish back through mechanistic solutions, to obtaining an ecological condition that is consistent with a certain condition characterized by a salmon, resident fish and wildlife condition defined by the management objective.

specific management objectives may be all that is possible in many cases. These would be sufficient to establish an overall framework with explicit links between objectives, needed change and actions.

Ecosystem: An ecological community, including all organisms and the abiotic environment, considered as a unit (Swartzman and Kaluzny 1987)[3].

Goals: The general end purposes toward which the effort is directed (*Manageware*, State of Louisiana 1996). Goals represent broad policy direction; e.g., improve migration conditions and survival conditions of listed fish (NMFS Draft Recovery Plan).

Management objectives (Science Review Team, SRT, August 16, 1996): "Management objectives should describe the direction and purpose of fish and wildlife recovery efforts. They should address the question of why recovery programs consist of a given set of strategies and actions. They describe the desired biological state for the watershed in regard to ecosystem characteristics, defining species and management actions. Watershed in this context refers to the Columbia River Basin (including the mainstem rivers as a system), subregions of the Basin (e.g. the Snake River Basin, mid-Columbia, lower Columbia) and individual subbasins. These are hierarchically nested such that there should be vertical consistency between individual subbasin objectives, subregional objectives and management objective for the entire Basin. Different management objectives and ecological relationships can be accommodated by simply moving up or down levels from the Basin to the subbasin levels. Development of management objectives will be an iterative process that cycles between what is desired for watersheds and what is possible given ecological, social and economic constraints."

Mission: A broad, comprehensive statement of the management entities' purpose (*Manageware*, State of Louisiana 1996).

Objectives: Specific and measurable targets for accomplishment (*Manageware*, State of Louisiana 1996). Objectives represent a more specific measurable target, and help define the purpose of setting the goal; e.g., achieve a 20% reduction in smolt mortality by year 2000 (NMFS Draft Recovery Plan).

Philosophies: The core values of the co-management entities, i.e., how we carry out the mission (*Manageware*, State of Louisiana 1996).

Strategies: The methods to accomplish goals and objectives (*Manageware*, State of Louisiana 1996). Strategies are ways to achieve goals and objectives, e.g., alter hydropower operations to mimic more natural river flows (NMFS Draft Recovery Plan).

Tasks (see Action Plans): The specific actions that must be done to achieve an objective using the chosen strategy.

Vision: A compelling conceptual image of the desired future (*Manageware*, State of Louisiana 1996). For example, NMFS' Vision for (Snake River salmon) Recovery[4]: "*We envision an ecosystem that functions to sustain naturally reproducing populations of native fish, and provides social, cultural, and economic benefits to the nation*."

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[3] *Ecological Simulation Primer* (p 335).
[4] The vision is not expected to be achievable within a short time period.

1.4.2 Geographic Information System and Hydrology (USGS, Ecotrust, and ESRI web access January 2003).

Information Sources for this Glossary:
USGS: http://water.usgs.gov/wsc/glossary ;
Ecotrust: http://www.inforain.org/about_gis.htm ;
ESRI: http://www.esri.com/library/glossary

Basic hydrologic data. Includes inventories of features of land and water that vary only from place to place (topographic and geologic maps are examples), and records of processes that vary with both place and time. (Records of precipitation, streamflow, ground-water, and quality-of-water analyses are examples.) Basic hydrologic information is a broader term that includes surveys of the water resources of particular areas and a study of their physical and related economic processes, interrelations and mechanisms. (USGS)

Biome: one of several terrestrial environments distinctly defined as a separate class of ecosystem (i.e. desert, tropical forest, temperate rain forest). (Ecotrust)

Bioregion: a territory defined by a combination of biological, social, and geographic criteria, rather than geopolitical considerations; a system of related, interconnected ecosystems. (Ecotrust)

Coverage:
1. A digital version of a map forming the basic unit of vector data storage in ArcInfo. A coverage stores geographic features as primary features (such as arcs, nodes, polygons, and label points) and secondary features (such as tics, map extent, links, and annotation). Associated feature attribute tables describe and store attributes of the geographic features.
2. A set of thematically associated data considered as a unit. A coverage usually represents a single theme such as soils, streams, roads, or land use. a digital map layer that stores vector information. (ESRI)

Database:
A logical collection of interrelated information, managed and stored as a unit, usually on some form of mass-storage system such as magnetic tape or disk. A GIS database includes data about the spatial location and shape of geographic features recorded as points, lines, areas, pixels, grid cells, or tins, as well as their attributes. (ESRI)

Fourth-field Watershed: a standardized hydrological unit – commonly used on Inforain and elsewhere – that splits large drainages into tributary watersheds and considers small, adjoining basins as part of a single unit. (Ecotrust)

GIS:

- Geographic information system. An organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information. (ESRI)
- A computer-based system whereby maps are dynamically tied to and updated through databases. GIS is used to display and analyze spatial data which are tied to a relational database. This connection is what gives GIS its power: maps can be drawn from the database and data can be referenced from the maps. GIS databases include a wide variety of information: geographic, social, political, environmental, and demographic. (Ecotrust)

HUC: (Hydrologic Unit Code) an eight digit code defined by the Bureau of Land Management that represents a specific drainage basin. (Ecotrust)

Hydrology. The science encompassing the behavior of water as it occurs in the atmosphere, on the surface of the ground, and underground. (USGS)

Metadata: documentation explaining the characteristics of a dataset. (Ecotrust)

Raster: A cellular data structure composed of rows and columns for storing images. Groups of cells with the same value represent features. See also grid. (ERSI)

Stream. A general term for a body of flowing water. In hydrology the term is generally applied to the water flowing in a natural *channel* as distinct from a canal. More generally as in the term *stream gaging*, it is applied to the water flowing in any channel, natural or artificial. (USGS)

Streamflow. The discharge that occurs in a natural channel. Although the term discharge can be applied to the flow of a canal, the word streamflow uniquely describes the discharge in a surface stream course. The term "streamflow" is more general than runoff, as streamflow may be applied to discharge whether or not it is affected by diversion or regulation. (USGS)

Spatial Data: geo-referenced data, those which represent features on the ground. (Ecotrust)

Themes: GIS uses layers, called "themes," to overlay different types of information, much as some static maps use mylar overlays to add tiers of information to a geographic background. Each theme represents a category of information, such as roads or forest cover. (Ecotrust)

Watershed:

- An area drained by a single river or river-system, defined by a ridgeline. (Ecotrust)

- The divide separating one *drainage basin* from another and in the past has been generally used to convey this meaning. However, over the years, use of the term to signify drainage basin or catchment area has come to predominate, although drainage basin is preferred. *Drainage divide*, or just divide, is used to denote the boundary between one drainage area and another. Used alone, the term "watershed" is ambiguous and should not be used unless the intended meaning is made clear. (USGS)

1.4.3 EPA Region 7 Definitions from the TMDL Web Page (USEPA Region 7, January 2004).

The Act. The Clean Water Act, as amended, 33 U.S.C. 1251 et seq. The TMDL program deals with Subsection 303(d).

Allocation. A portion that has been designated for a specific purpose or to particular person or things.

Areawide agency. An agency designated under section 208 of the Act, which has responsibilities for water quality management (WQM) planning within a specified area of a State.

Best Management Practice (BMP). Methods, measures or practices selected by an agency to meet its nonpoint source control needs. BMPs include but are not limited to structural and nonstructural controls and operation and maintenance procedures. BMPs can be applied before, during and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters.

Designated management agency (DMA). An agency identified by a WQM plan and designated by the Governor to implement specific control recommendations.

Discharge of a pollutant. (A) Any addition of any pollutant to navigable waters from any point source. (B) Any addition of any pollutant to the waters of the contiguous zone or the ocean from any point source other than a vessel or other floating craft. (FWPCS § 502)

Effluent limitation. Any restriction established by a state or the administrator on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources into navigable waters of the contiguous zone or the ocean including schedules of compliance. (FWPCS § 502)

FWPCA. The legal acronym for the Federal Water Pollution Control Act originally enacted in 1948 and amended on October 18, 1972, becoming known as the Clean Water Act. (FWPCS § 502)

Impaired waterbody. Any waterbody of the United States that does not attain water quality standards (as defined in 40 CFR part 131) due to an individual pollutant, multiple pollutants, pollution, or an unknown cause of impairment. Where a waterbody receives a thermal discharge from one or more point sources, impaired means that the waterbody does not have or maintain a balanced indigenous population of shellfish, fish, and wildlife.

Indian Tribe. Any Indian Tribe, band, group, or community recognized by the Secretary of the Interior and exercising governmental authority over a Federal Indian reservation.

List of Impaired Waterbodies or ``List''. The list of impaired waterbodies that States, Territories and authorized Tribes are required to submit to EPA pursuant to section 303(d) of the CWA.

Load allocation (LA). The portion of a receiving water's loading capacity that is attributed either to one of its existing or future nonpoint sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural and nonpoint source loads should be distinguished.

Loading capacity. The greatest amount of loading that a water can receive without violating water quality standards.

Load or loading. An amount of matter or thermal energy that is introduced into a receiving water; to introduce matter or thermal energy into a receiving water. Loading of pollutants may be either man-caused or natural (natural background loading).

Navigable waters. Waters of the United States, including territorial seas. (FWPCS § 502)

Non-point source. Any source from which pollution is discharged which is not identified as a point source, including, but not limited to urban, agricultural, or silvicultural runoff. Nonpoint source (NPS) pollution occurs when rainfall, snowmelt, or irrigation water runs over land, or through the ground, and picks up pollutants and deposits them into lakes, rivers and groundwater. Nonpoint pollutants and sources that threaten or impair designated uses in waterbodies include:

- Excess fertilizers (nutrients), herbicides, and insecticides from agricultural and residential and urban areas.
- Sediment (siltation, suspended solids), pesticides, pathogens (animal waste), from agricultural, and residential and urban areas.
- Oil, grease, and toxic chemicals from urban runoff and energy production;
- Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks;

- Bacteria and nutrients from livestock operations, pet wastes, and faulty septic systems.
- Atmospheric deposition, hydromodification, and habitat alteration are also sources of NPS pollution.

Point source. Any discernible confined and discrete conveyance including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft from which pollutants are or may be discharged, not including agricultural storm water discharges and return flows from irrigated agriculture. (FWPCS § 502)

Pollutant. Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, celler dirt and industrial, municipal, and agricultural waste discharged into water. (FWPCS § 502)

Pollution. The man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water.

Reasonable assurance. Reasonable assurance means that you demonstrate that each wasteload allocation and load allocation in a TMDL will be implemented. For point sources regulated under section 402 of the Clean Water Act you must demonstrate reasonable assurance by procedures that ensure that enforceable NPDES permits (including coverage to individual sources under a general NPDES permit) will be issued expeditiously to implement applicable wasteload allocations for point sources. For nonpoint sources you must demonstrate reasonable assurance by specific procedures and mechanisms that ensure load allocations for nonpoint sources will be implemented for that waterbody. Specific procedures and mechanisms for nonpoint sources must apply to the pollutant for which the TMDL is being established, must be implemented expeditiously and must be supported by adequate funding. Examples of specific procedures and mechanisms which may provide reasonable assurance for nonpoint sources include State, Territorial, and authorized Tribal regulations, local ordinances, performance bonds, contracts, cost-share agreements, memorandums of understanding, site-specific or watershed-specific voluntary actions, and compliance audits of best management practices.

Source. Any point of origin or beginning.

Thermal discharge. The discharge of the pollutant heat from a point source.

Threatened waterbody. Any waterbody of the United States that currently attains water quality standards, but for which existing and readily available data and information on adverse declining trends indicate that water quality standards will likely be exceeded by the time the next list of impaired or threatened waterbodies is required to be submitted to EPA. Where a waterbody is threatened by a thermal discharge, threatened means that the waterbody has a balanced indigenous population of shellfish, fish, and wildlife, but adverse declining trends indicate that a balanced indigenous population of shellfish, fish, and wildlife will not be maintained by the time the next list of impaired or threatened waterbodies is required to be submitted to EPA.

Total maximum daily load (TMDL). The sum of the individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background. If a receiving water has only one point source discharger, the TMDL is the sum of that point source WLA plus the LAs for any nonpoint sources of pollution and natural background sources, tributaries, or adjacent segments. TMDLs can be expressed in terms or either mass per time, toxicity, or other appropriate measure. Best Management Practices or other nonpoint source pollution controls make more stringent load allocations practicable, then wasteload allocations can be made less stringent. Thus, the TMDL process provides for nonpoint source control tradeoffs.

Wasteload allocation (WLA). The portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation.

Waterbody. A geographically defined portion of navigable waters, waters of the contiguous zone, and ocean waters under the jurisdiction of the United States, including segments of rivers, streams, lakes, wetlands, coastal waters and ocean waters.

Water quality limited segment (WQLS). Any segment where it is known that water quality does not meet applicable water quality standards, and/or is not expected to meet applicable water quality standards, even after the application of the technology-based effluent limitations required by sections 301(b) and 306 of the Act.

Water quality management (WQM) plan. A State or areawide waste treatment management plan developed and updated in accordance with the provisions of sections 205(j), 208 and 303 of the Act and this regulation.

Water Quality Standards (WQS). Provisions of State or Federal law which consist of a designated use or uses for the waters of the United States and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the Act.

1.4.4 Idaho Department of Environmental Quality Glossary for the South Fork Owyhee TMDL (IDEQ 2003).

305(b) Refers to section 305 subsection “b” of the Clean Water Act. 305(b) generally describes a report of each state’s water quality, and is the principle means by which the U.S. Environmental Protection Agency, congress, and the public

	evaluate whether U.S. waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of the remaining problems.
303(d)	Refers to section 303 subsection "d" of the Clean Water Act. 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to U.S. Environmental Protection Agency approval.
Acre-Foot	A volume of water that would cover an acre to a depth of one foot. Often used to quantify reservoir storage and the annual discharge of large rivers.
Adsorption	The adhesion of one substance to the surface of another. Clays, for example, can adsorb phosphorus and organic molecules.
Aeration	A process by which water becomes charged with air directly from the atmosphere. Dissolved gases, such as oxygen, are then available for reactions in water.
Aerobic	Describes life, processes, or conditions that require the presence of oxygen.
Assessment Database	The ADB is a relational database application designed for the U.S. Environmental Protection Agency for tracking water quality assessment data, such as use attainment and causes and sources of impairment. States need to track this information and many other types of assessment data for thousands of water bodies, and integrate it into meaningful reports. The ADB is designed to make this process accurate, straightforward, and user-friendly for participating states, territories, tribes, and basin commissions.
Adfluvial	Describes fish whose life history involves seasonal migration from lakes to streams for spawning.
Adjunct	In the context of water quality, adjunct refers to areas directly adjacent to focal or refuge habitats that have been degraded by human or natural disturbances and do not presently support high diversity or abundance of native species.

Alevin A newly hatched, incompletely developed fish (usually a salmonid) still in nest or inactive on the bottom of a water body, living off stored yolk.

Algae Non-vascular (without water-conducting tissue) aquatic plants that occur as single cells, colonies, or filaments.

Alluvium Unconsolidated recent stream deposition.

Ambient General conditions in the environment. In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations, or specific disturbances such as a wastewater outfall (Armantrout 1998, EPA 1996).

Anadromous Fish, such as salmon and sea-run trout, that live part or the majority of their lives in the salt water but return to fresh water to spawn.

Anaerobic Describes the processes that occur in the absence of molecular oxygen and describes the condition of water that is devoid of molecular oxygen.

Anoxia The condition of oxygen absence or deficiency.

Anthropogenic Relating to, or resulting from, the influence of human beings on nature.

Anti-Degradation Refers to the U.S. Environmental Protection Agency's interpretation of the Clean Water Act goal that states and tribes maintain, as well as restore, water quality. This applies to waters that meet or are of higher water quality than required by state standards. State rules provide that the quality of those high quality waters may be lowered only to allow important social or economic development and only after adequate public participation (IDAPA 58.01.02.051). In all cases, the existing beneficial uses must be maintained. State rules further define lowered water quality to be 1) a measurable change, 2) a change adverse to a use, and 3) a change in a pollutant relevant to the water's uses (IDAPA 58.01.02.003.56).

Aquatic Occurring, growing, or living in water.

Aquifer	An underground, water-bearing layer or stratum of permeable rock, sand, or gravel capable of yielding of water to wells or springs.
Assemblage (aquatic)	An association of interacting populations of organisms in a given water body; for example, a fish assemblage, or a benthic macroinvertebrate assemblage (also see Community) (EPA 1996).
Assimilative Capacity	The ability to process or dissipate pollutants without ill effect to beneficial uses.
Autotrophic	An organism is considered autotrophic if it uses carbon dioxide as its main source of carbon. This most commonly happens through photosynthesis.
Batholith	A large body of intrusive igneous rock that has more than 40 square miles of surface exposure and no known floor. A batholith usually consists of coarse-grained rocks such as granite.
Bedload	Material (generally sand-sized or larger sediment) that is carried along the streambed by rolling or bouncing.
Beneficial Use	Any of the various uses of water, including, but not limited to, aquatic biota, recreation, water supply, wildlife habitat, and aesthetics, which are recognized in water quality standards.
Beneficial Use Reconnaissance Program (BURP)	A program for conducting systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers.
Benthic	Pertaining to or living on or in the bottom sediment of a water body.
Benthic Organic Matter	The organic matter on the bottom of a water body.
Benthos	Organisms living in and on the bottom sediment of lakes and streams. Originally, the term meant the lake bottom, but it is now applied almost uniformly to the animals associated with the lake and stream bottoms.
Best Management	Structural, nonstructural, and managerial techniques that

Practices (BMPs)	are effective and practical means to control nonpoint source pollutants.
Best Professional Judgment	A conclusion and/or interpretation derived by a trained and/or technically competent individual by applying interpretation and synthesizing information.
Biochemical Oxygen Demand (BOD)	The amount of dissolved oxygen used by organisms during the decomposition (respiration) of organic matter, expressed as mass of oxygen per volume of water, over some specified period of time.
Biological Integrity	1) The condition of an aquatic community inhabiting unimpaired water bodies of a specified habitat as measured by an evaluation of multiple attributes of the aquatic biota (EPA 1996). 2) The ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the natural habitats of a region (Karr 1991).
Biomass	The weight of biological matter. Standing crop is the amount of biomass (e.g., fish or algae) in a body of water at a given time. Often expressed as grams per square meter.
Biota	The animal and plant life of a given region.
Biotic	A term applied to the living components of an area.
Clean Water Act (CWA)	The Federal Water Pollution Control Act (PL 92-50), commonly known as the Clean Water Act, as last reauthorized by the Water Quality Act of 1987 (PL 100-4), establishes a process for states to use to develop information on, and control the quality of, the nation's water resources.
Coliform Bacteria	A group of bacteria predominantly inhabiting the intestines of humans and animals but also found in soil. Coliform bacteria are commonly used as indicators of the possible presence of pathogenic organisms (also see Fecal Coliform Bacteria).
Colluvium	Material transported to a site by gravity.
Community	A group of interacting organisms living together in a given place.

Conductivity The ability of an aqueous solution to carry electric current, expressed in micro (μ) mhos/cm at 25 °C. Conductivity is affected by dissolved solids and is used as an indirect measure of total dissolved solids in a water sample.

Cretaceous The final period of the Mesozoic era (after the Jurassic and before the Tertiary period of the Cenozoic era), thought to have covered the span of time between 135 and 65 million years ago.

Criteria In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. EPA develops criteria guidance; states establish criteria.

Cubic Feet per Second A unit of measure for the rate of flow or discharge of water. One cubic foot per second is the rate of flow of a stream with a cross-section of one square foot flowing at a mean velocity of one foot per second. At a steady rate, once cubic foot per second is equal to 448.8 gallons per minute and 10,984 acre-feet per day.

Cultural Eutrophication The process of eutrophication that has been accelerated by human-caused influences. Usually seen as an increase in nutrient loading (also see Eutrophication).

Culturally Induced Erosion Erosion caused by increased runoff or wind action due to the work of humans in deforestation, cultivation of the land, overgrazing, and disturbance of natural drainages; the excess of erosion over the normal for an area (also see Erosion).

Debris Torrent The sudden down slope movement of soil, rock, and vegetation on steep slopes, often caused by saturation from heavy rains.

Decomposition The breakdown of organic molecules (e.g., sugar) to inorganic molecules (e.g., carbon dioxide and water) through biological and nonbiological processes.

Depth Fines Percent by weight of particles of small size within a vertical core of volume of a streambed or lake bottom sediment.

	The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 6.5 mm depending on the observer and methodology used. The depth sampled varies but is typically about one foot (30 cm).
Designated Uses	Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act.
Discharge	The amount of water flowing in the stream channel at the time of measurement. Usually expressed as cubic feet per second (cfs).
Dissolved Oxygen (DO)	The oxygen dissolved in water. Adequate DO is vital to fish and other aquatic life.
Disturbance	Any event or series of events that disrupts ecosystem, community, or population structure and alters the physical environment.
E. coli	Short for *Escherichia Coli*, *E. coli* are a group of bacteria that are a subspecies of coliform bacteria. Most *E. coli* are essential to the healthy life of all warm-blooded animals, including humans. Their presence is often indicative of fecal contamination.
Ecology	The scientific study of relationships between organisms and their environment; also defined as the study of the structure and function of nature.
Ecological Indicator	A characteristic of an ecosystem that is related to, or derived from, a measure of a biotic or abiotic variable that can provide quantitative information on ecological structure and function. An indicator can contribute to a measure of integrity and sustainability. Ecological indicators are often used within the multimetric index framework.
Ecological Integrity	The condition of an unimpaired ecosystem as measured by combined chemical, physical (including habitat), and biological attributes (EPA 1996).
Ecosystem	The interacting system of a biological community and its non-living (abiotic) environmental surroundings.
Effluent	A discharge of untreated, partially treated, or treated wastewater into a receiving water body.

Endangered Species Animals, birds, fish, plants, or other living organisms threatened with imminent extinction. Requirements for declaring a species as endangered are contained in the Endangered Species Act.

Environment The complete range of external conditions, physical and biological, that affect a particular organism or community.

Eocene An epoch of the early Tertiary period, after the Paleocene and before the Oligocene.

Eolian Windblown, referring to the process of erosion, transport, and deposition of material by the wind.

Ephemeral Stream A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long continued supply from melting snow or other sources. Its channel is at all times above the water table. (American Geologic Institute 1962).

Erosion The wearing away of areas of the earth's surface by water, wind, ice, and other forces.

Eutrophic From Greek for "well nourished," this describes a highly productive body of water in which nutrients do not limit algal growth. It is typified by high algal densities and low clarity.

Eutrophication 1) Natural process of maturing (aging) in a body of water. 2) The natural and human-influenced process of enrichment with nutrients, especially nitrogen and phosphorus, leading to an increased production of organic matter.

Exceedence A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.

Existing Beneficial Use or Existing Use A beneficial use actually attained in waters on or after November 28, 1975, whether or not the use is designated for the waters in Idaho's *Water Quality Standards and Wastewater Treatment Requirements* (IDAPA 58.01.02).

Exotic Species A species that is not native (indigenous) to a region.

Extrapolation	Estimation of unknown values by extending or projecting from known values.
Fauna	Animal life, especially the animals characteristic of a region, period, or special environment.
Fecal Coliform Bacteria	Bacteria found in the intestinal tracts of all warm-blooded animals or mammals. Their presence in water is an indicator of pollution and possible contamination by bacteria (also see Coliform Bacteria).
Fecal Streptococci	A species of spherical bacteria including pathogenic strains found in the intestines of warm-blooded animals.
Feedback Loop	In the context of watershed management planning, a feedback loop is a process that provides for tracking progress toward goals and revising actions according to that progress.
Fixed-Location Monitoring	Sampling or measuring environmental conditions continuously or repeatedly at the same location.
Flow	See Discharge.
Fluvial	In fisheries, this describes fish whose life history takes place entirely in streams but migrate to smaller streams for spawning.
Focal	Critical areas supporting a mosaic of high quality habitats that sustain a diverse or unusually productive complement of native species.
Fully Supporting	In compliance with water quality standards and within the range of biological reference conditions for all designated and exiting beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2000).
Fully Supporting Cold Water	Reliable data indicate functioning, sustainable cold water biological assemblages (e.g., fish, macroinvertebrates, or algae), none of which have been modified significantly beyond the natural range of reference conditions (EPA 1997).
Fully Supporting but	An intermediate assessment category describing water

Threatened	bodies that fully support beneficial uses, but have a declining trend in water quality conditions, which if not addressed, will lead to a "not fully supporting" status.
Geographical Information Systems (GIS)	A georeferenced database.
Geometric Mean	A back-transformed mean of the logarithmically transformed numbers often used to describe highly variable, right-skewed data (a few large values), such as bacterial data.
Grab Sample	A single sample collected at a particular time and place. It may represent the composition of the water in that water column.
Gradient	The slope of the land, water, or streambed surface.
Ground Water	Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and usually emerges again as stream flow.
Growth Rate	A measure of how quickly something living will develop and grow, such as the amount of new plant or animal tissue produced per a given unit of time, or number of individuals added to a population.
Habitat	The living place of an organism or community.
Headwater	The origin or beginning of a stream.
Hydrologic Basin	The area of land drained by a river system, a reach of a river and its tributaries in that reach, a closed basin, or a group of streams forming a drainage area (also see Watershed).
Hydrologic Cycle	The cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Atmospheric moisture, clouds, rainfall, runoff, surface water, ground water, and water infiltrated in soils are all part of the hydrologic cycle.
Hydrologic Unit	One of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The initial 1974 effort (USGS 1987) described

four levels (region, subregion, accounting unit, cataloging unit) of watersheds throughout the United States. The fourth level is uniquely identified by an eight-digit code built of two-digit fields for each level in the classification. Originally termed a cataloging unit, fourth field hydrologic units have been more commonly called subbasins. Fifth and sixth field hydrologic units have since been delineated for much of the country and are known as watershed and subwatersheds, respectively.

Hydrologic Unit Code refer **(HUC)**
The number assigned to a hydrologic unit. Often used to to fourth field hydrologic units.

Hydrology
The science dealing with the properties, distribution, and circulation of water.

Impervious
Describes a surface, such as pavement, that water cannot penetrate.

Influent
A tributary stream.

Inorganic
Materials not derived from biological sources.

Instantaneous
A condition or measurement at a moment (instant) in time.

Intergravel Dissolved Oxygen
The concentration of dissolved oxygen within spawning gravel. Consideration for determining spawning gravel includes species, water depth, velocity, and substrate.

Intermittent Stream
1) A stream that flows only part of the year, such as when the ground water table is high or when the stream receives water from springs or from surface sources such as melting snow in mountainous areas. The stream ceases to flow above the streambed when losses from evaporation or seepage exceed the available stream flow. 2) A stream that has a period of zero flow for at least one week during most years.

Interstate Waters
Waters that flow across or form part of state or international boundaries, including boundaries with Indian nations.

Irrigation Return Flow
Surface (and subsurface) water that leaves a field following the application of irrigation water and eventually flows into streams.

Key Watershed — A watershed that has been designated in Idaho Governor Batt's *State of Idaho Bull Trout Conservation Plan* (1996) as critical to the long-term persistence of regionally important trout populations.

Knickpoint — Any interruption or break of slope.

Land Application — A process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of treatment, pollutant removal, or ground water recharge.

Limiting Factor — A chemical or physical condition that determines the growth potential of an organism. This can result in a complete inhibition of growth, but typically results in less than maximum growth rates.

Limnology — The scientific study of fresh water, especially the history, geology, biology, physics, and chemistry of lakes.

Load Allocation (LA) — A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).

Load(ing) — The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.

Loading Capacity (load capacity) — A determination of how much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a total maximum daily load.

Loam — Refers to a soil with a texture resulting from a relative balance of sand, silt, and clay. This balance imparts many desirable characteristics for agricultural use.

Loess — A uniform wind-blown deposit of silty material. Silty soils are among the most highly erodable.

Lotic — An aquatic system with flowing water such as a brook, stream, or river where the net flow of water is from the headwaters to the mouth.

Luxury Consumption A phenomenon in which sufficient nutrients are available in either the sediment or the water column of a water body, such that aquatic plants take up and store an abundance in excess of the plants' current needs.

Macroinvertebrate An invertebrate animal (without a backbone) large enough to be seen without magnification and retained by a 500µm mesh (U.S. #30) screen.

Macrophytes Rooted and floating vascular aquatic plants, commonly referred to as water weeds. These plants usually flower and bear seeds. Some forms, such as duckweed and coontail (*Ceratophyllum sp.*), are free-floating forms not rooted in sediment.

Margin of Safety (MOS) An implicit or explicit portion of a water body's loading capacity set aside to allow the uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.

Mass Wasting A general term for the down slope movement of soil and rock material under the direct influence of gravity.

Mean Describes the central tendency of a set of numbers. The arithmetic mean (calculated by adding all items in a list, then dividing by the number of items) is the statistic most familiar to most people.

Median The middle number in a sequence of numbers. If there are an even number of numbers, the median is the average of the two middle numbers. For example, 4 is the median of 1, 2, 4, 14, 16; and 6 is the median of 1, 2, 5, 7, 9, 11.

Metric 1) A discrete measure of something, such as an ecological indicator (e.g., number of distinct taxon). 2) The metric system of measurement.

Milligrams per Liter (mg/l) A unit of measure for concentration in water, essentially equivalent to parts per million (ppm).

Million gallons per day A unit of measure for the rate of discharge of water, often

(MGD)	used to measure flow at wastewater treatment plants. One MGD is equal to 1.547 cubic feet per second.
Miocene	Of, relating to, or being an epoch of, the Tertiary between the Pliocene and the Oligocene periods, or the corresponding system of rocks.
Monitoring	A periodic or continuous measurement of the properties or conditions of some medium of interest, such as monitoring a water body.
Mouth	The location where flowing water enters into a larger water body.
National Pollution Discharge Elimination System (NPDES)	A national program established by the Clean Water Act for permitting point sources of pollution. Discharge of pollution from point sources is not allowed without a permit.
Natural Condition	A condition indistinguishable from that without human-caused disruptions.
Nitrogen	An element essential to plant growth, and thus is considered a nutrient.
Nodal	Areas that are separated from focal and adjunct habitats, but serve critical life history functions for individual native fish.
Nonpoint Source	A dispersed source of pollutants, generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and non-irrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.
Not Assessed (NA)	A concept and an assessment category describing water bodies that have been studied, but are missing critical information needed to complete an assessment.
Not Attainable	A concept and an assessment category describing water bodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).

Not Fully Supporting	Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2000).
Not Fully Supporting Cold Water	At least one biological assemblage has been significantly modified beyond the natural range of its reference condition (EPA 1997).
Nuisance	Anything which is injurious to the public health or an obstruction to the free use, in the customary manner, of any waters of the state.
Nutrient	Any substance required by living things to grow. An element or its chemical forms essential to life, such as carbon, oxygen, nitrogen, and phosphorus. Commonly refers to those elements in short supply, such as nitrogen and phosphorus, which usually limit growth.
Nutrient Cycling	The flow of nutrients from one component of an ecosystem to another, as when macrophytes die and release nutrients that become available to algae (organic to inorganic phase and return).
Oligotrophic	The Greek term for "poorly nourished." This describes a body of water in which productivity is low and nutrients are limiting to algal growth, as typified by low algal density and high clarity.
Organic Matter	Compounds manufactured by plants and animals that contain principally carbon.
Orthophosphate	A form of soluble inorganic phosphorus most readily used for algal growth.
Oxygen-Demanding Materials	Those materials, mainly organic matter, in a water body which consume oxygen during decomposition.
Parameter	A variable, measurable property whose value is a determinant of the characteristics of a system; e.g., temperature, dissolved oxygen, and fish populations are parameters of a stream or lake.
Partitioning	The sharing of limited resources by different races or species; use of different parts of the habitat, or the same

	habitat at different times. Also the separation of a chemical into two or more phases, such as partitioning of phosphorus between the water column and sediment.
Bacteria	Disease-producing organisms (e.g., bacteria, viruses, parasites).
Perennial Stream	A stream that flows year-around in most years.
Periphyton	Attached microflora (algae and diatoms) growing on the bottom of a water body or on submerged substrates, including larger plants.
Pesticide	Substances or mixtures of substances intended for preventing, destroying, repelling, or mitigating any pest. Also, any substance or mixture intended for use as a plant regulator, defoliant, or desiccant.
pH	The negative $\log_{10}$ of the concentration of hydrogen ions, a measure which in water ranges from very acid (pH=1) to very alkaline (pH=14). A pH of 7 is neutral. Surface waters usually measure between pH 6 and 9.
Phased TMDL	A total maximum daily load (TMDL) that identifies interim load allocations and details further monitoring to gauge the success of management actions in achieving load reduction goals and the effect of actual load reductions on the water quality of a water body. Under a phased TMDL, a refinement of load allocations, wasteload allocations, and the margin of safety is planned at the outset.
Phosphorus	An element essential to plant growth, often in limited supply, and thus considered a nutrient.
Physiochemical	In the context of bioassessment, the term is commonly used to mean the physical and chemical factors of the water column that relate to aquatic biota. Examples in bioassessment usage include saturation of dissolved gases, temperature, pH, conductivity, dissolved or suspended solids, forms of nitrogen, and phosphorus. This term is used interchangeable with the terms “physical/chemical” and “physicochemical.”
Plankton	Microscopic algae (phytoplankton) and animals (zooplankton) that float freely in open water of lakes and oceans.

Point Source A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.

Pollutant Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Pollution A very broad concept that encompasses human-caused changes in the environment which alter the functioning of natural processes and produce undesirable environmental and health effects. This includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.

Population A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area.

Pretreatment The reduction in the amount of pollutants, elimination of certain pollutants, or alteration of the nature of pollutant properties in wastewater prior to, or in lieu of, discharging or otherwise introducing such wastewater into a publicly owned wastewater treatment plant.

Primary Productivity The rate at which algae and macrophytes fix carbon dioxide using light energy. Commonly measured as milligrams of carbon per square meter per hour.

Protocol A series of formal steps for conducting a test or survey.

Qualitative Descriptive of kind, type, or direction.

Quality Assurance (QA) A program organized and designed to provide accurate and precise results. Included are the selection of proper technical methods, tests, or laboratory procedures; sample collection and preservation; the selection of limits; data evaluation; quality control; and personnel qualifications and training. The goal of QA is to assure the data provided are of the quality needed and claimed (Rand 1995, EPA 1996).

Quality Control (QC)	Routine application of specific actions required to provide information for the quality assurance program. Included are standardization, calibration, and replicate samples. QC is implemented at the field or bench level (Rand 1995, EPA 1996).
Quantitative	Descriptive of size, magnitude, or degree.
Reach	A stream section with fairly homogenous physical characteristics.
Reconnaissance	An exploratory or preliminary survey of an area.
Reference	A physical or chemical quantity whose value is known, and thus is used to calibrate or standardize instruments.
Reference Condition	1) A condition that fully supports applicable beneficial uses with little affect from human activity and represents the highest level of support attainable. 2) A benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and acceptable or unacceptable departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and expert judgment (Hughes 1995).
Reference Site	A specific locality on a water body that is minimally impaired and is representative of reference conditions for similar water bodies.
Representative Sample	A portion of material or water that is as similar in content and consistency as possible to that in the larger body of material or water being sampled.
Resident	A term that describes fish that do not migrate.
Respiration	A process by which organic matter is oxidized by organisms, including plants, animals, and bacteria. The process converts organic matter to energy, carbon dioxide, water, and lesser constituents.
Riffle	A relatively shallow, gravelly area of a streambed with a locally fast current, recognized by surface choppiness. Also an area of higher streambed gradient and roughness.

Riparian Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a water body.

Riparian Habitat Conservation Area (RHCA) A U.S. Forest Service description of land within the following number of feet up-slope of each of the banks of streams:
- 300 feet from perennial fish-bearing streams
- 150 feet from perennial non-fish-bearing streams
- 100 feet from intermittent streams, wetlands, and ponds in priority watersheds.

River A large, natural, or human-modified stream that flows in a defined course or channel, or a series of diverging and converging channels.

Runoff The portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through ground water to creates streams.

Sediment Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air.

Settleable Solids The volume of material that settles out of one liter of water in one hour.

Species 1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.

Spring Ground water seeping out of the earth where the water table intersects the ground surface.

Stagnation The absence of mixing in a water body.

Stenothermal Unable to tolerate a wide temperature range.

Stratification An Idaho Department of Environmental Quality classification method used to characterize comparable units (also called classes or strata).

Stream A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.

Stream Order Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher order streams result from the joining of two streams of the same order.

Storm Water Runoff Rainfall that quickly runs off the land after a storm. In developed watersheds the water flows off roofs and pavement into storm drains that may feed quickly and directly into the stream. The water often carries pollutants picked up from these surfaces.

Stressors Physical, chemical, or biological entities that can induce adverse effects on ecosystems or human health.

Subbasin A large watershed of several hundred thousand acres. This is the name commonly given to 4th field hydrologic units (also see Hydrologic Unit).

Subbasin Assessment (SBA) A watershed-based problem assessment that is the first step in developing a total maximum daily load in Idaho.

Subwatershed A smaller watershed area delineated within a larger watershed, often for purposes of describing and managing localized conditions. Also proposed for adoption as the formal name for 6th field hydrologic units.

Surface Fines Sediment of small size deposited on the surface of a streambed or lake bottom. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 605 mm depending on the observer and methodology used. Results are typically expressed as a percentage of observation points with fine sediment.

Surface Runoff Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants in rivers, streams, and lakes. Surface runoff is also called overland flow.

Surface Water All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.)

	and all springs, wells, or other collectors that are directly influenced by surface water.
Suspended Sediment	Fine material (usually sand size or smaller) that remains suspended by turbulence in the water column until deposited in areas of weaker current. These sediment cause turbidity and, when deposited, reduce living space within streambed gravels and can cover fish eggs or alevins.
Taxon	Any formal taxonomic unit or category of organisms (e.g., species, genus, family, order). The plural of taxon is taxa (Armantrout 1998).
Tertiary	An interval of geologic time lasting from 66.4 to 1.6 million years ago. It constitutes the first of two periods of the Cenozoic Era, the second being the Quaternary. The Tertiary has five subdivisions, which from oldest to youngest are the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs.
Thalweg	The center of a stream's current, where most of the water flows.
Threatened Species	Species, determined by the U.S. Fish and Wildlife Service, which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
Total Maximum Daily Load (TMDL)	A TMDL is a water body's loading capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual bases. TMDL = Loading Capacity = Load Allocation + Wasteload Allocation + Margin of Safety. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.
Total Dissolved Solids	Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.
Total Suspended	The dry weight of material retained on a filter after filtration.

Solids (TSS)	Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (Greenborg, Clescevi, and Eaton 1995) call for using a filter of 2.0 micron or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.
Toxic Pollutants	Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely.
Tributary	A stream feeding into a larger stream or lake.
Trophic State	The level of growth or productivity of a lake as measured by phosphorus content, chlorophyll *a* concentrations, amount (biomass) of aquatic vegetation, algal abundance, and water clarity.
Turbidity	A measure of the extent to which light passing through water is scattered by fine suspended materials. The effect of turbidity depends on the size of the particles (the finer the particles, the greater the effect per unit weight) and the color of the particles.
Vadose Zone	The unsaturated region from the soil surface to the ground water table.
Wasteload Allocation (WLA)	The portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a water body.
Water Body	A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.
Water Column	Water between the interface with the air at the surface and the interface with the sediment layer at the bottom. The idea derives from a vertical series of measurements (oxygen, temperature, phosphorus) used to characterize water.
Water Pollution	Any alteration of the physical, thermal, chemical, biological, or radioactive properties of any waters of the state, or the discharge of any pollutant into the waters of the state, which will or is likely to create a nuisance or to render such waters harmful, detrimental, or injurious to

	public health, safety, or welfare; to fish and wildlife; or to domestic, commercial, industrial, recreational, aesthetic, or other beneficial uses.
Water Quality	A term used to describe the biological, chemical, and physical characteristics of water with respect to its suitability for a beneficial use.
Water Quality Criteria	Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, or industrial processes.
Water Quality Limited	A label that describes water bodies for which one or more water quality criterion is not met or beneficial uses are not fully supported. Water quality limited segments may or may not be on a 303(d) list.
Water Quality Limited Segment (WQLS)	Any segment placed on a state's 303(d) list for failure to meet applicable water quality standards, and/or is not expected to meet applicable water quality standards in the period prior to the next list. These segments are also referred to as "303(d) listed."
Water Quality Management Plan	A state or area-wide waste treatment management plan developed and updated in accordance with the provisions of the Clean Water Act.
Water Quality Modeling	The prediction of the response of some characteristics of lake or stream water based on mathematical relations of input variables such as climate, stream flow, and inflow water quality.
Water Quality Standards	State-adopted and EPA-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.
Water Table	The upper surface of ground water; below this point, the soil is saturated with water.
Watershed	1) All the land which contributes runoff to a common point in a drainage network, or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller "subwatersheds." 2) The whole geographic region

	which contributes water to a point of interest in a water body.
Water Body Identification Number (WBID)	A number that uniquely identifies a water body in Idaho ties in to the Idaho Water Quality Standards and GIS information.
Wetland	An area that is at least some of the time saturated by surface or ground water so as to support with vegetation adapted to saturated soil conditions. Examples include swamps, bogs, fens, and marshes.
Young of the Year	Young fish born the year captured, evidence of spawning activity.

1.4.5 Definitions of Terms from the Southeastern Oregon Resource Management Plan (BLM 2003).

Acquired lands ~ Lands acquired for BLM administration in various ways, such as but not limited to: (1) any lands purchased by congressionally appropriated funds, (2) land donations, (3) land exchanges, (4) Land and Water Conservation Fund acquisitions, (5) land withdrawals returned to public land status through withdrawal revocations and/or relinquishments, etc., (6) split-estate acquisitions, (7) Federal agency jurisdictional transfers, (8) easement acquisitions, and/or (9) lands acquired by any other means.

Activity occasion ~ A standard unit of recreation use consisting of one individual participating in one recreation activity during any reasonable portion of any one day.

Actual use data ~ The number of livestock, kind or class of those livestock, and time period those livestock actually grazed a specific allotment or pasture.

Agate ~ A variety of chalcedony that exhibits several different color patterns (such as flat and/or concentric bands, swirls and loops) usually caused by mineral impurities. It is generally used as an ornamental or gem stone. Moss, lace, and plume agate are notable varieties.

Allotment management plan (AMP) ~ A plan for managing livestock grazing on specified public land.

Allowable sale quantity ~ The quantity of timber that may be sold from suitable land and that has been included in the yield projections for the timber period specified by the land use plan. Usually expressed on an annual basis as the average annual allowable sale quantity.

Alluvium ~ Material deposited on the land by water, such as sand, silt, or clay.

All-terrain vehicle (ATV) ~ Small, 3-wheel and 4-wheel recreational vehicles capable of operating in rugged terrain.

Andesite ~ A fine-grained igneous rock of intermediate composition composed of about equal amounts of iron and magnesium minerals and plagioclase feldspars.

Animal unit ~ One cow, one cow/calf pair, one horse, or five sheep.

Animal unit month (AUM) ~ The forage needed to support one cow, one cow/calf pair, one horse, or five sheep for one month. Approximately 800 pounds of forage.

Appropriate management level (AML) ~ The optimum number of wild horses that provides a thriving natural ecological balance on the public range.

Appropriate management response (AMR) ~ Specific actions taken in response to a wildland fire to implement protection and fire use objectives.

Area of critical environmental concern (ACEC) ~ Area where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect humans from natural hazards.

Argillite ~ A weakly metamorphosed clay-rich sedimentary rock.

Asbestos ~ A group of fibrous silicate minerals, generally used in the manufacture of heat and fire resistant materials (such as cloth, yarn, paint, paper, brake-linings, and tile).

Attribute ~ A discreet feature or characteristic of biotic or physical resources that can be measured (example: plant density, which is the number of individuals or stems per unit area).

Badlands ~ Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels, most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Band ~ A group of wild horses running together or a lone wild horse.

Basalt ~ A dark, heavy, fine-grained silica-poor igneous rock composed largely of iron and magnesium minerals and calcium-rich plagioclase feldspars.

Beneficial use ~ Any of various uses of water in an area. Water may be for agricultural, domestic, or industrial use, salmonid spawning, recreation, wildlife habitat, or other uses.

Bentonite ~ A soft, plastic, porous, light-colored rock composed essentially of clay of the smectite group, plus colloidal silica, and produced by the devitrification and accompanying chemical alteration of rhyolitic tuffs or volcanic ash. It has the ability to absorb large quantities of water and expand several times its original volume. It is used as a sealant on dams and reservoirs, in drilling mud, and pet litter, and as a binder.

Best management practices (BMP's) ~ A set of practices which, when applied during implementation of management actions, ensures that negative impacts to natural resources are minimized. BMP's are applied based on site-specific evaluation and represent the most effective and practical means to achieve management goals for a given site.

Black acres ~ Actual burned area or actual acres treated for mechanical.

BLM assessment species ~ Plant and animal species on List 2 of the "Oregon Natural Heritage Data Base," or those species on the "Oregon List of Sensitive Wildlife Species"(OAR 635-100-040) that are identified in BLM Instruction Memo OR-91-57 and are not included as Federal candidate, State listed, or BLM sensitive species.

BLM sensitive species ~ Plant or animal species eligible for Federal listed, Federal candidate, State listed, or State candidate (plant) status, or on List 1 in the "Oregon Natural Heritage Data Base," or approved for this category by the BLM State Director.

BLM tracking species ~ Plant and animal species on List 3 and 4 of the "Oregon Natural Heritage Data Base," or those species on the "Oregon List of Sensitive Wildlife Species"(OAR 635-100-040) that are identified in BLM Instruction Memo OR-91-57 and are not included as Federal candidate, State listed, BLM sensitive, or BLM assessment species.

Board foot ~ A unit of measure of the wood in lumber, logs, or trees. The amount of wood in a board 1-foot wide, 1-foot long, and 1-inch thick before finishing.

Borax ~ An evaporite mineral (Na2B4O7. 10H2O). It is the major source of boron and is generally found in alkali lake deposits. It has a variety of uses (including glass and ceramics manufacturing, agricultural chemicals, chemical fluxes, fire retardant and preservative).

Brine ~ Subsurface water with a high concentration of dissolved salts, usually sodium, potassium and/or calcium, and lesser concentrations of other salts (such as boron).

Buffer strip ~ A protective area adjacent to an area of concern requiring special attention or protection. In contrast to riparian zones, which are ecological units, buffer strips can be designed to meet varying management concerns.

Burning period ~ That part of each 24-hour period when fires spread most rapidly, typically from 10 a.m. to sundown.

Calcareous soil ~ A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caldera ~ A volcanic depression much larger than the original crater and generally formed by the violent eruption of rhyolitic magma (examples: Crater Lake, and Mahogany Mountain Caldera).

Cave ~ See Chapter 2, Caves, for definition.

Chalcedony ~ A cryptocrystalline variety of quartz (SiO2) consisting of microscopic fibers**.** It exhibits a myriad of colors and patterns, and is used primarily as an ornamental or gemstone. Agate, jasper and thunder eggs are varieties.

Channeled ~ Refers to a drainage area in which natural meandering or repeated branching and convergence of a streambed have created deeply incised cuts, either active or abandoned, in alluvial material.

Chert ~ A hard, very dense, fine-grained sedimentary rock composed largely of microscopic quartz (SiO2) crystals; synonymous with *flint*.

Clastic ~ A rock composed of broken pieces of preexisting rock.

Clay ~ As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt. *Geology*: A rock or mineral fragment of any composition finer than 0.00016 inches in diameter. *Mineral:* A hydrous aluminum-silicate that occurs as microscopic plates, and commonly has the ability to absorb substantial quantities of water on the surface of the plates.

Clayey soil ~ Silty clay, sandy clay, or clay.

Climax vegetation ~ The stabilized plant community on a particular site. The plant cover reproduces itself and does not change as long as the environment remains the same.

Coarse textured soil ~ Sand or loamy sand.

Colluvium ~ Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Commercial forestland ~ Forestland that can produce 20 cubic feet of timber per acre per year and that is not withdrawn from timber production.

Commercial thinning ~ A cutting made in a forest stand to remove excess merchantable timber in order to accelerate growth or improve the health of the remaining trees.

Commodities ~ Goods and services produced by industries.

Complex, soil ~ A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Corrective maintenance ~ Maintenance performed on a nonroutine basis and considered to be a one-time only cost.

Craton ~ A portion of a continent that has been structurally stable for a prolonged period of time.

Crown ~ The upper part of a tree or shrub, including the living branches and their foliage.

Cryptogamic crust ~ See microbiotic crust.

Custodial management ~ Management of a group of similar allotments with minimal expenditure of appropriated funds to continue protecting existing resource values.

Deep soil ~ A soil that is 40 to 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Diameter at breast height (DBH) ~ The diameter of a tree measured 4.5 feet above the ground.

Diatomite ~ A soft, crumbly, lightweight, highly porous sedimentary rock consisting mainly of microscopic siliceous skeletons of diatoms (single-celled aquatic plants related to algae). It is used for filter aids, paint filler, abrasives, anti-caking agents, insecticide carriers, and insulation.

Drainage, surface ~ Runoff, or surface flow of water, from an area.

Duff ~ A generally firm organic layer on the surface of mineral soils consisting of fallen, decaying plant material including everything from the litter on the surface to underlying pure humus.

Earnings ~ Wages and salaries, other labor income, and proprietor's income (including inventory valuation and capital consumption adjustments).

Ecological site condition ~ See ecological status.

Ecological site inventory (ESI) ~ The basic inventory of present and potential vegetation on BLM rangelands. Ecological sites are differentiated on the basis of the kind, proportion, or amount of plant species.

Ecological status ~ The present state of vegetation of a range site in relation to the potential natural community for that site. Four classes (see below) are used to express the degree to which the production or composition of the present plant community reflects that of the potential natural community (climax):

Ecological status (seral	Percent of community in climax

stage)	condition
Potential natural community	76–100
Late seral	51–75
Mid seral	26–50
Early seral	0–25

Ecosystem-based management ~ (1) management driven by explicit goals, executed by policies, protocols, and practices, and made adaptable by monitoring and research based on our best understanding of the ecological interactions and processes necessary to sustain ecosystem composition, structure, and function; (2) any land management system that seeks to protect viable populations of all native species, perpetuate natural-disturbance regimes on

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the regional scale, adopt a planning timeline of centuries, and allow human use at levels that do not result in long-term ecological degradation.

Employee compensation ~ Wages and salaries paid to employees by industries, plus the value of benefits and any contributions to Social Security and pension funds by the employee and employer.

Enhancement of habitat for special status animal and plant species ~ Taking deliberate, proactive measures that are expected to make habitat conditions more productive, diverse, or resilient to disturbances for the benefit of special status animal and plant species.

Enhancement of populations of special status animal and plant species ~ Taking deliberate, proactive measures in cooperation with the Oregon Department of Fish and Wildlife or

U.S. Fish and Wildlife Service to meet their respective species management goals. For animal species, enhancement means allowing supplemental releases of fish or wildlife into existing populations to increase overall numbers of animals or to improve their genetic health. For plants, enhancement means transplanting or seeding species to supplement existing populations.

Ephemeral stream ~ A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no continuous supply from melting snow or other source, and its channel is above the water table at all times.

Epithermal deposit ~ A type of hydrothermal deposit that occurs mainly as veins formed within 1,600 feet of the surface and with temperatures ranging from 122–392 F.

Erosion ~ The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (accelerated) ~ Erosion much more rapid than geologic erosion, occurring mainly as a result of human or animal activities or of a catastrophe in nature, such as with fire, that exposes the surface.

Erosion (geologic) ~ Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains; synonymous with *natural erosion*.

Escaped fire ~ A fire that has exceeded initial attack capabilities.

Evaporite mineral ~ A mineral precipitated as a result of evaporation (example: halite).

Extended attack situation ~ The situation when a fire cannot be suppressed with initial attack forces within a reasonable period of time. This type fire can usually be suppressed by additional forces from within the geographic area of the district and usually within 24 hours after suppression action has started.

Extensive recreation management area (ERMA) ~ Area where recreation management is less structured (than within an SRMA) and recreation use more dispersed with minimal regulatory constraints and where minimal recreation-related investments are required.

Feldspar ~ The most abundant minerals of the Earth’s crust. The two groups are Alkali and Plagioclase.

Fertility, soil ~ The quality that enables a soil to provide plant nutrients in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fuel type ~ An identification association of fuel elements of distinctive species, form, size, arrangement or other characteristics that will cause a predictable rate of spread or resistance to control under specific weather conditions.

Fine textured soil ~ Sandy clay, silty clay, or clay.

Fire effects ~ The physical, biological, and ecological impact of fire on the environment.

Fire intensity ~ The product of the available heat of combustion per unit area of ground and the rate of spread of the fire.

Fire management area ~ One or more parcels of land having a common set of fire management objectives.

Fire regime ~ Periodicity and pattern of naturally occurring fire in a particular area or vegetative type, described in terms of frequency, biological severity, and area extent (Society of American Foresters, 1996).

Fire return interval ~ The number of years between two successive fires documented in a designated area (such as the interval between two successive fire occurrences).

Fire strategy ~ An overall plan of action for fighting a fire that gives regard to the most cost-efficient use of personnel and equipment in consideration of values threatened, fire behavior, legal constraints, and objectives established for resource management. Leaves decisions on the tactical use of personnel and equipment to line commanders in the suppression function.

Fire suppression ~ All the work activities connected with fire-extinguishing operations, beginning with the discovery and continuing until the fire is completely extinguished.

Flood plain ~ A nearly level alluvial plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the stream.

Fluorite ~ Fluorospar (CaF2). A halide mineral-related to table salt (Na2Cl), and the principal ore of fluorine gas. Fluorite is used as a flux in the manufacture of glass, in the manufacturing of hydrofluoric acid (HF), and as a source of carved ornamental stones.

Fluvial (Fluviatile) deposit ~ A sedimentary deposit laid down, transported by, or suspended in, a stream.

Forb ~ Any herbaceous plant not a grass or a grasslike species.

Forest health ~ The condition in which forest ecosystems sustain their complexity, diversity, resiliency and productivity while providing for human needs and values.

Forestland ~ Land that is now, or is capable of being, at least 10 percent stocked by forest tree species such as ponderosa pine, Douglas fir, western larch, white fir, or lodgepole pine.

Fuels ~ Includes living and dead plant materials that are capable of burning.

Fuel type ~ An identification association of fuel elements of distinctive species, form, size, arrangement or other characteristics that will cause a predictable rate of spread or resistance to control under specific weather conditions.

Graben ~ A fault-bounded down-dropped portion of the Earth's crust.

Gravel ~ Rounded or angular fragments of rock as much as 3 inches (2 millimeters–7.6 centimeters) in diameter. An individual piece is a pebble.

Gravel ~ (Geology) Unconsolidated, rounded rock fragments greater than 0.08 inches in diameter. Sizes range from pebbles (.008–2.5 inches) to cobbles (2.5–10 inches) to boulders (greater than 10 inches).

Greenstripping ~ The practice of establishing or using patterns of fire-resilient vegetation and/or material to reduce wildfire occurrence and size. Examples are establishing fire-resilient vegetation adjacent to roads or railways, around or interspersed in valuable shrub stands, or within large blocks of flash fuels.

Ground water (geology) ~ Water filling all the unblocked pores of the material below the water table.

Ground yarding ~ Use of tracked or wheeled equipment to transport logs from where they are cut to a landing.

Gully ~ A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Harvest unit ~ An area from which trees are harvested. Harvest method can range from clearcutting to individual tree selection.

Herd ~ One or more wild horse bands using the same general area.

Herd Area (HA) ~ A geographic area identified as having provided habitat for a wild horse herd in 1971.

Herd management area (HMA) ~ A geographic area identified in a management framework plan or resource management plan for the long-term management of a wild horse herd.

Herd management area plan ~ A plan that prescribes measures for the protection, management, and control of wild horses and their habitat on one or more HMA's, in conformance with decisions made in approved management framework or resource management plans.

High resource values ~ Lands with high resource values are considered to be public lands that have the caliber of resources to qualify them for inclusion in SMA's such as ACEC's, NWSR's, WSA's, and high resource areas such as critical wildlife habitat areas, wild horse herd areas, critical fish habitat areas, cultural site areas, threatened and endangered species habitats, etc. Long-term retention of public lands in these SMA's is either required by law through congressional action or identified through the land use planning process.

Horizon, soil ~ A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes.

Horst ~ A fault-bounded uplifted portion of the Earth's crust.

Hot-springs deposit ~ A type of hydrothermal deposit formed in a hot-springs environment.

Hydrothermal deposit ~ A mineral deposit formed by hot, mineral-laden fluids.

Igneous rock ~ Rock that solidified from a molten or semimolten state. The major varieties include intrusive (solidified beneath the surface of the Earth) and volcanic (solidified on or very near the surface of the Earth).

Incident commander ~ Individual responsible for the management of all incident (fire) operations.

Initial attack ~ First action taken to suppress a fire, via ground and/or air. An aggressive suppression action consistent with firefighter and public safety and values to be protected.

Individual tree selection cutting ~ A cutting method in which selected trees are removed throughout a harvest unit to meet a specific goal. Goals can range from harvest of a specific volume to improving the health of the remaining trees.

Infiltration rate ~ The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Initial attack ~ First action taken to suppress a fire, via ground and/or air.

Interim management policy (IMP) ~ Policy for managing public lands under wilderness review. Section 603 (c) of FLPMA states: "During the period of review of such areas and until Congress has determined otherwise, the Secretary shall continue to manage such lands according to his authority under this Act and other applicable law in a manner so as not to impair the suitability of such areas for preservation as wilderness, subject, however, to the continuation of existing mining and grazing uses and mineral leasing in the manner and degree in which the same was being conducted on the date of approval of this Act: Provided, that, in managing the public lands the Secretary shall by regulation or otherwise take any action required to prevent unnecessary or undue degradation of the lands and their resources or to afford environmental protection."

Intermittent stream ~ A stream, or reach of a stream, that flows for prolonged periods only when it receives groundwater discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Interior drainage ~ Streams with no outlet to the sea.

Known geothermal resource area (KGRA) ~ "An area in which the geology, nearby discoveries, competitive interest, or other indicia would, in the opinion of the Secretary, engender the belief in men who are experienced in the subject matter that the prospect for extraction of geothermal stream or associated geothermal resources are good enough to warrant expenditures or money for that purpose" [43 CFR 3200.0-5(k)].

Lacustrine deposit (geology) ~ Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landing ~ A location where timber is gathered for further transport.

Limestone ~ A sedimentary rock consisting chiefly of calcium carbonate.

Limits of acceptable change ~ For recreation management, a nine-step process used to define the desired resource conditions for an area and to determine acceptable levels of resource change due to recreation use. The process helps to develop management actions to avoid exceeding standards.

Loam ~ Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Magma ~ Molten rock from within the Earth capable of flowing like liquid.

Maintenance of habitat for special status animal and plant species ~ Avoidance or mitigation of projects and land uses so that they cause no new significant adverse impacts on habitats of special status animal and plant species. The quality of the habitat to be maintained is probably variable and may range from poor to excellent. The amount of habitat may be below its potential. Under maintenance management options, especially where habitat quality is low, there is some risk that species may eventually need to be listed under the authority of the ESA.

Maintenance of populations of special status animal and plant species ~ Avoidance or mitigation of projects and land uses so that they have no new significant adverse impacts on populations of special status animal and plant species. Populations to be maintained may range from low to high over time and may be below their potential level. Under maintenance management options, especially where populations are small, there is some risk that species may eventually need to be listed under the authority of the ESA.

Management framework plan (MFP) ~ BLM land use plan, predecessor to the RMP.

Map unit ~ The basic system of description in a soil survey and delineation on a soil map. Can vary in level of detail.

Mature timber ~ Trees that have passed their maximum rate of growth in terms of physiological processes, height, diameter or volume.

MBF ~ Thousand board feet.

Mechanical treatment ~ Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil ~ Very fine sandy loam, loam, silt loam, or silt.

Merchantable trees ~ Trees that are of sufficient size to be economically processed into wood products.

Metamorphosed ~ Rock that has been altered in composition, texture or structure by heat and/or pressure.

Microbiotic crust ~ Lichens, mosses, green algae, fungi, cyanobacteria, and bacteria growing on or just below the surface of soils.

MMBF ~ Million board feet.

Monitoring ~ The periodic and systematic collection of resource data to measure progress toward achieving objectives.

Multiple use management ~ Management of public land and resource values to best meet various present and future needs of the American people. This means coordinated management of resources and uses to assure the long-term health of the ecosystem.

Multiplier ~ A change in an economic measure resulting from a specified change in some other economic measure.

Naturalness (a primary wilderness value) ~ An area that generally appears to have been affected primarily by the forces of nature with the imprint of people's work substantially unnoticeable.

Near natural rate of recovery ~ Synonymous with the PACFISH requirement not to "retard" or "measurably slow" recovery of degraded riparian features. Further defined in these recommendations within the context of effects that "carry over to the next year." Any effect that carries over to the next year is likely to result in cumulative negative effects and measurably slow recovery of degraded riparian features.

Net value change ~ The sum of the changes resulting from increases (benefits) and decreases (damages) in the value of outputs from the land area affected as the consequences of fire. An average dollar value per acre is assigned based on the change to all resources including range, watershed, wildlife, soils, and recreation.

Nutrient, plant ~ Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil, and carbon, hydrogen, and oxygen obtained from the air and water.

Off-highway vehicle (OHV) ~ A vehicle that can be operated off of improved and regularly maintained roads with hardened or gravel surfaces.

Old growth forest ~ Dry site pine stands meeting the following criteria: At least 10 trees/ acre that are at least 150 years of age and/or 21 inches dbh, and have a basal area of 24 square foot/acre at least 10 acres in size; or, in very late-seral stands, at least 2 trees/acre that are at least 200 years of age and/or 31 inches dbh, and have a basal area of 11 square foot/ acre.

Organic matter~ Plant and animal residue in the soil in various stages of decomposition.

Overstory ~ The trees in a forest that form the upper crown cover.

Percolation ~ The downward movement of water through the soil.

Perennial stream ~ A stream in which water is present during all seasons of the year.

Perlite ~ A rhyolite volcanic glass that contains more water than ordinary obsidian. It commonly contains a cracked texture caused by contraction during cooling. The material is used primarily as lightweight aggregate and as an insulator.

Permeability ~ The quality of the soil that enables water to move downward through the profile, measured as the number of inches per hour that water moves downward through the saturated soil.

Personal income ~ Employee compensation plus property income.

Phase 1 fire planning ~ The first phase of a two-stage fire management planning process that identifies desired resource conditions and fire management direction, including fire management strategies, which will promote achievement of resource objectives

pH value ~ A numerical designation of acidity and alkalinity in soil (see "reaction, soil").

Physiographic province ~ A geographic region with similar climatic, land form, and geologic features, and which is significantly different from adjacent regions.

Picture rock ~ (Also known as picture jasper, scenic jasper.) A variety of chalcedony with fanciful patterns that often resemble scenery. Varieties are found in southeastern Oregon (examples: Owyhee jasper and McDermitt jasper).

Pluton ~ An igneous rock that crystallized deep underground.

Pluvial ~ Referring to a period of greater rainfall.

Pluvial Lake ~ A lake formed during a period of exceptionally high rainfall (such as during a time of glacial advance during the Pleistocene epoch) and now either extinct or existing as a remnant, such as Lake Bonneville.

Porphyry deposit ~ A large, low-grade metallic mineral deposit containing disseminated sulfide minerals (examples: copper, gold, molybdenum, or tin).

Prescribed burning ~ Controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions that allow the fire to be confined to a predetermined area and at the same time to produce the fire line intensity and rate of spread required to attain planned resource management objectives.

Prescribed fire ~ Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition.

Prescription ~ Written statement defining objectives to be attained, as well as measurable criteria, which guide the selection of appropriate management actions. Prescription criteria may include safety, economic, public health, environmental, geographic, administrative, social, and legal considerations under which the fire will be allowed to burn.

Preventative maintenance ~ Scheduled servicing, repairs, inspections, adjustments, and replacement of parts that result in fewer breakdowns and fewer premature replacements, and achieve the expected life of facilities and equipment.

Primary wilderness values ~ The primary or key wilderness values described in the "Wilderness Act" by which WSA's and designated wilderness are managed to protect and enhance the wilderness resource. Values include roadlessness, naturalness, solitude, primitive and unconfined recreation, and size.

Primitive and unconfined recreation (a primary wilderness value) ~Nnonmotorized and undeveloped types of outdoor recreation activities. Refers to wilderness recreation opportunities, such as nature study, hiking, photography, backpacking, fishing, hunting, and other related activities. Does not include the use of motorized vehicles, bicycles, or other mechanized means of travel.

Productivity ~ (1) *Soil productivity*: the capacity of a soil to produce plant growth, due to the soil's chemical, physical, and biological properties (such as depth, temperature, water-holding capacity, and mineral, nutrient, and organic matter content). (2) *Vegetative productivity*: the rate of production of vegetation within a given period. (3) *General*: the innate capacity of an environment to support plant and animal life over time.

Project acres ~ (fire) Total project size.

Public land ~ Any land or interest in land owned by the United States and administered by the Secretary of the Interior through the BLM.

Public resource values ~ Lands with public resource values are considered to be any public lands located outside SMA's, and high resource areas that do not have the caliber of resources to qualify them for inclusion in SMA's and high resource areas. For these types of lands BLM would maintain its land tenure adjustments options within Zone 1, 2, and 3 areas. Any land tenure adjustments involving public lands having "public resource values" must be determined to be in the public interest and must meet the requirements of NEPA and the General Management Criteria of Appendix L.

Pumice ~ A glassy, rhyolitic rock exhibiting a vesicular, or frothy texture. It is generally used as a light weight aggregate and an abrasive.

Pyroclastic debris ~ Rock fragments produced by a volcanic explosion.

Range site ~ An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Rangeland ~ Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Rangeland health ~ The degree to which the integrity of the soil and the ecological processes of rangeland ecosystems are sustained.

Reaction, soil ~ A measure of acidity or alkalinity of a soil, expressed in pH values. Soils with pH values less than 7 are acidic and those with pH greater than 7 are alkaline.

Recreation opportunity spectrum (ROS) ~ A means of characterizing recreation opportunities in terms of setting, activity, and experience opportunities.

Recreation site ~ An area where management actions are required to provide a specific recreation setting and activity opportunities, to protect resource values, provide public visitor safety and health, and/or to meet public recreational use demands and recreation partnership commitments. A site may or may not have permanent facilities.

Recreational river ~ A river or section of a river that is readily accessible by road or railroad; it may have had some development along the shorelines and may have undergone some impoundments or diversions in the past.

Regeneration ~ The new growth of a natural plant community that develops from seed.

Rehabilitation ~ The activities necessary to repair damage or disturbance caused by wildfire or the fire suppression activity.

Research natural area (RNA) ~ An area where natural processes predominate and which is preserved for research and education. Under current BLM policy, these areas must meet the relevance and importance criteria of ACEC's and are designated as ACEC's.

Resource advisor ~ Resource specialist responsible to the incident commander for gathering and analyzing information concerning values-at-risk that may be impacted by the fire or fire suppression activities.

Resource management plan (RMP) ~ A land use plan as described by the FLPMA.

Restoration ~ Holistic actions taken to modify an ecosystem to achieve desired, healthy, and functioning conditions and processes.

Restoration of habitat for special status animal and plant species ~ Taking deliberate, proactive measures to reestablish habitat suitable for supporting special status animal and plant species.

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Restoration of populations of special status animal and plant species ~ Taking deliberate, proactive measures in cooperation with the ODFW or USFWS to meet their respective species management goals. Restoration means reestablishing a species into a currently unoccupied suitable area.

Rhyolite ~ A fine-grained light-colored silica-rich igneous rock composed largely of potash feldspars and quartz.

Rift ~ A graben of regional extent; it marks a zone where the entire crust is ruptured under tension.

Right-of-way ~ A permit or an easement authorizing the use of public land for certain specified purposes, commonly for pipelines, roads, telephone lines, electric lines, reservoirs, etc. Also, the reference to the land covered by such an easement or permit.

Right-of-way corridor ~ A parcel of land identified by law, Secretarial order, through a land use plan or by other management decision as being the preferred location for existing and future right-of-way grants and suitable to accommodate one type of right-of-way or one or more rights-of-way that are similar, identical or compatible.

Rill ~ A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Riparian/wetland areas ~ See Chapter 2, Water Resources and Riparian/Wetland Areas section, Riparian and Wetland Definitions, Processes, Functions, and Patterns.

Risk assessment ~ Assessing the chance of fire starting, natural or human-caused, and its potential risk to life, resources and property.

Rock fragments ~ Rock or mineral fragments having a diameter of 2 millimeters or more (examples: pebbles, cobbles, stones, and boulders).

Runoff ~ The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground water runoff or seepage flow from ground water.

Saline soil ~ A soil containing soluble salts in an amount that impairs the growth of plants. A saline soil does not contain excess exchangeable sodium.

Salvage cutting ~ Removal of trees that are dead or in imminent danger of being killed by injurious agents.

Sand ~ (geology) A rock fragment or detrital particle between 0.0025 and 0.08 inches in diameter.

Scenic river ~ A river or section of a river that is free of impoundments and whose shorelines are largely undeveloped but accessible in places by roads.

Schist ~ A metamorphic rock characterized by coarse-grained minerals oriented approximately parallel.

Section 202 lands ~ Lands being considered for wilderness designation under section 202 of FLPMA.

Sediment ~ Soil, rock particles and organic or other debris carried from one place to another by wind, water or gravity.

Selection cutting ~ Removal of individual or small groups of trees to meet predetermined goals for the remaining stand.

Seral stage ~ See ecological status.

Series, soil ~ A nationally-defined soil type set apart on distinct soil properties that affect use and management. In a soil survey, this includes a group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shallow soil ~ A soil that is 10 to 20 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Sheet erosion ~ The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Silica ~ Silicon dioxide ($SiO2$), occurring in both crystalline (such as quartz, cristobalite, and chalcedony) and amorphous (such as opal) form, as well as impure (such as diatomite, and chert) forms, and combined as silicates for numerous significant minerals (such as feldspars or amphiboles).

Silt ~ *Geology*: A rock fragment or detrital particle smaller than very fine sand and larger then coarse clay, ranging from 0.0024 to 0.00016 inches in diameter and commonly having a high content of clay minerals. *As a soil separate:* Individual mineral particles ranging in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand

(0.05 millimeter). *As a soil textural class:* Soil that is 80 percent or more silt and less than 12 percent clay.

Simple approach smoke estimation model ~ A straight-line Gaussian plume dispersion model designed as a screening tool to predict maximum particulate concentrations and visual impacts from prescribed fire. The model simulates emissions, transport, dispersion, and optical effects of any inert pollutant over flat terrain.

Skid trails ~ Pathways along which logs are dragged to a landing for further transportation.

Skidding ~ A commonly used term for the yarding of logs to a landing.

Slash ~ The branches, bark, treetops, reject logs, and broken or uprooted trees left on the ground after logging.

Slate ~ A compact, fine-grained, platy metamorphic rock formed from shale or claystone.

Slope ~ The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. For example, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Smectite ~ A group of clay minerals, characterized by a three-layer crystal lattice, that is capable of absorbing water molecules between the layers of the crystal lattice allowing it to expand several times its original volume. Montmorillonite and Hectorite smectites are the major constituents of the bentonites found the planning area.

Sodic (alkali) soil ~ A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Soil ~ A natural, three-dimensional body at the Earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil association ~ A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single soil map unit.

Soil classification ~ The systematic arrangement of soils into groups or categories on the basis of their characteristics.

Soil compaction ~ An increase in soil bulk density of 15 percent or more from the undisturbed level.

Soil complex ~ A map unit of two or more kinds of soils in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping.

Soil productivity ~ The capacity of a soil for producing a specified plant or sequence of plants under specific management.

Soil profile ~ A vertical section of the soil extending through all its horizons and into the parent material.

Soil survey ~ A field investigation resulting in a soil map showing the geographic distribution of various kinds of soil and an accompanying report that describes the soil types and interprets the findings.

Soil texture ~ The relative proportions of sand, silt, and clay particles in a mass of soil.

Solitude (a primary wilderness value) ~ The state of being alone or remote from habitations; a lonely, unfrequented, or secluded place. The intent is to evaluate the opportunity for solitude in comparison to habitations of people.

Special recreation management area (SRMA) ~ An area where recreation is one of the principal management objectives, where intensive recreation management is needed, and where more than minimal recreation-related investments are required.

Special status species ~ Plant or animal species known or suspected to be limited in distribution, rare or uncommon within a specific area, and/or vulnerable to activities that may affect their survival. Lists of special status species are prepared by knowledgeable specialists throughout the State of Oregon; BLM prepares a list of State sensitive species predominantly based on the lists prepared biennially by ONHP.

Special stipulation ~ A specific operating condition or limitation added to a mineral lease to protect sensitive resources. It modifies the original terms and conditions of that lease.

Stand ~ A community of trees occupying a specific area and sufficiently uniform in species, age, spacial arrangement and condition as to be distinguishable from trees on surrounding lands.

Stream channel ~ The hollow bed where a natural stream of surface water flows or may flow; the deepest or central part of the bed, formed by the main current and covered more or less continuously by water.

Structure, soil ~ The arrangement of primary soil particles into compound particles or aggregates.

Sunstone ~ A calcium-rich variety of plagioclase feldspar that exhibits a pink to red metallic shimmer when viewed perpendicular to the surface. The shimmer is caused by light reflecting off the surface of minute parallel platelets of native copper suspended in the stone.

Supplemental wilderness values ~ Includes ecological (such as vegetation, wildlife, and overall biological/botanical processes and values associated with the natural environment), geological, scientific, educational, scenic, and historic values. When present they can enhance primary wilderness values, but are not mandated by Congress.

Sustained yield ~ Maintenance of an annual or regular periodic output of a renewable resource from public land consistent with the principles of multiple use.

Talc ~ A very soft, light green mineral (Mg3Si4O10 (OH2)), found in basic igneous rocks and metamorphosed dolomites (CaMg (CO3)2). It is used in a wide variety of applications (such as filler, cosmetics, lubricants and as a source of ornamental stone).

Talus ~ Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

Terrace (geologic) ~ An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Terrane ~ A suite of similar rocks transported by crustal movements into a position where they are separated from dissimilar rocks by faults.

Thinning ~ A cutting made in a forest stand to remove or kill excess timber in order to accelerate growth or improve the health of the trees that remain.

Thriving natural ecological balance ~ The condition of the public range when resource objectives related to wild horses in approved land use and/or activity plans have been achieved.

Thunderegg ~ An agate, opal, or chalcedony-filled nodule deposit formed in rhyolitic lavas or tuffs.

Trend ~ The direction of change in ecological status observed over time. Trend is described as toward or away from the potential natural community, or as not apparent.

Tuff ~ Volcanic ash or rock composed of compacted ash.

Upland (geology) ~ Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Utilization ~ The proportion or degree of the current year's forage production that is consumed or destroyed by animals (including insects); may refer either to a single plant species, a group of species, or to the vegetation as a whole; synonymous with *use.*

Values-at-risk ~ Any or all natural resources, improvements or other values that may be jeopardized if a fire occurs (value-at-risk, risk of resource values).

Vegetation manipulation ~ Alteration of present vegetation by using fire, plowing, or other means to manipulate natural succession trends.

Visit –A unit of measure for evaluating the amount of recreational activity on public land; equivalent to one person spending any part of a day recreating on public land.

Visual resource classes ~ Refer to Chapter 2.

Volcanic arc ~ A curved, linear belt of volcanoes.

Volcaniclastic ~ A sedimentary rock consisting largely of lava fragments, volcanic glass, and crystals.

Wild horses ~ Unbranded and unclaimed horses that use public land as all or part of their habitat, or that have been removed from such land by an authorized officer but have not lost their status under section 3 of the "Wild Free-Roaming Horse and Burro Act."

Wild river ~ A river or section of a river that is free of impoundments and generally inaccessible except by trail, with watersheds and shorelines essentially primitive and waters unpolluted.

Wilderness inventory ~ A written description of resource information and data, and a map of those public lands that meet the wilderness criteria as established under Section 603 (a) of FLPMA and Section 2 (c) of "The Wilderness Act."

Wilderness study area (WSA) ~ A roadless area or island that has been inventoried and found to have wilderness characteristics as described in section 603 of FLPMA and section 2 (c) of "The Wilderness Act." WSA's were administratively designated by BLM following evaluation of wilderness inventories.

Wildfire ~ Any fire occurring on wildland that is not meeting management objectives and thus requires a suppression response. An unwanted wildland fire.

Wildland fire ~ Any nonstructure fire, other than prescribed fire, that occurs in the wildland.

Wildland fire situation analysis (WFSA) ~ A decision-making process that evaluates alternative management strategies against selected safety, environmental, social, economical, political, and resource management objectives as selection criteria.

Woodland ~ A forest community occupied primarily by noncommercial species such as juniper, mountain mahogany or aspen.

Xenolith ~ A fragment of rock distinctly different from the igneous rock in which it is enclosed; a foreign intrusion into rock.

Yarding ~ The moving of logs from the stump to a landing for further transportation.

Zeolite ~ A group of hydrated silicates of aluminum with alkali metals. They contain a porous molecular structure that allows them to selectively trap individual molecules within that structure. Zeolites are used in water purification and decontamination systems, animal feed supplements, drying agents, and for soil improvement.

1.4.6 Cultural Anthropology-related terms (Source UCSB Anthropology Web Site, http://www.anth.ucsb.edu/netinfo.html), unless otherwise noted.

acculturation: cultural change that occurs in response to extended firsthand contacts between two or more previously autonomous groups.

achieved status: social standing and prestige reflecting the ability of an individual to acquire an established position in society as a result of individual accomplishments (cf. ascribed status).

adaptation: changes in gene frequencies resulting from selective pressures being placed upon a population by environmental factors; results in a greater fitness of the population to its ecological niche.

administrative system: a twentieth-century system of ownership in which land is owned and managed by the state; found in China, the Soviet Union, and some parts of Africa and Latin America.

affinal kin: persons related by marriage.

alienation: the fragmentation of individuals' relations to their work, the things they produce, and the resources with which they produce them.

altruistic act: a behavior characterized by self-sacrifice that benefits others.

ambilocality: residence of a married couple with or near the kin of either husband or wife, as they choose.

animatism: belief in an impersonal supernatural force.

animism: belief in a soul, a spiritual essence that differs from the tangible, physical body.

anthropological linguistics: the scientific study of human communication within its sociocultural context and the origin and evolution of language.

anthropology: the study of humanity - our physical characteristics as animals, and our unique non-biological characteristics we call culture. The subject is generally broken down into three subdisciplines: biological (physical) anthropology, cultural (social) anthropology, and archaeology.

applied anthropology: the activity of professional anthropologists in programs that have as primary goals changes in human behavior believed to ameliorate contemporary social, economic, and technological problems.

archaeology: a subdiscipline of anthropology involving the study of the human past through its material remains.

arranged marriage: any marriage in which the selection of a spouse is outside the control of the bride and groom. art the process and products of applying skills to any activity that transforms matter, sound, or motion into forms considered aesthetically pleasing to people in a society.

ascribed status: social standing or prestige which is the result of inheritance or hereditary factors (cf. achieved status).

authority: the ability to exert influence because of one's personal prestige or the status of one's office.

autonomy: taking commands from only one authoritative source, oneself, and rejecting all attempts to override one's autonomy. Moral autonomy entails making the final decisions about what one should do. Political autonomy entails having the liberty to act upon the decision one has made.

band: a small territorially-based social group consisting of 2 or more nuclear families. A loosely integrated population sharing a sense of common identity but few specialized institutions.

Bands: A small units within the tribe are termed **"bands"** because of their political autonomy, small population, and simple, informal social organization. (Stewart 1939).

bifurcation: a basis of kin classification that distinguishes the mother's side of the family from the father's side.

bilateral descent: a descent ideology in which individuals define themselves as being at the center of a group of kin composed more or less equally of kin from both paternal and maternal lines.

bilocal residence: regular alternation of a married couple's residence between the household or vicinity of the wife's kin and of the husband's kin.

biological imperatives: the basic human drives for food, rest, sexual satisfaction, and social contact.

biological species: a group of interbreeding populations that is reproductively isolated from other such groups.

bride price: payment made by a man to the family from whom he takes a daughter in marriage.

bride service: service rendered by a man as payment to a family from whom he takes a daughter in marriage.

bride wealth: property given by the family of the groom to the family of the bride to compensate them for the loss of their daughter's services.

call system: a repertoire of sounds, each of which is produced in response to a particular situation.

carrying capacity: the point at or below which a population tends to stabilize.

caste: a social category in which membership is fixed at birth and usually unchangeable.

cattle complex: an East African socioeconomic system in which cattle represent social status as well as wealth.

census: a comprehensive survey of a population designed to reveal its basic demographic characteristics.

centralization: concentration of political and economic decisions in the hands of a few individuals or institutions.

ceremonial fund: the portion of the peasant budget allocated to religious and social activities.

chiefdom: a term used to describe a society that operates on the principle of ranking, i.e. differential social status. Different lineages are graded on a scale of prestige, calculated by how closely related one is to the chief. The chiefdom generally has a permanent ritual and ceremonial center, as well as being characterized by local specialization in crafts.

civilization: a term used by anthropologists to describe any society that has cities.

clan: a unilineal descent group usually comprising more than ten generations consisting of members who claim a common ancestry even though they cannot trace step-by-step their exact connection to a common ancestor.

class: a ranked group within a stratified society characterized by achieved status and considerable social mobility.

cognates: words so similar from one language to the next as to suggest that both are variants of a single ancestral prototype.

cognitive anthropology: the study of how peoples of different cultures acquire information about the world (cultural transmission), how they process that information and reach decisions, and how they act on that information in ways that other members of their cultures consider appropriate.

cognitive processes: ways of perceiving and ordering the world.

collateral relatives: people to whom one is related through a connecting person.

communal cult: a society with groups of ordinary people who conduct religious ceremonies for the well-being of the total community.

community identity: an effort by speakers to identify themselves with a specific locality and to distinguish themselves from outsiders.

conflict: in its political manifestation, conflict exacts an ever-increasing toll in human lives and misery.

conjugal relationship: the relationship between spouses.

consanguineal kin: persons related by birth.

conversion: the use of a sphere of exchange for a transaction with which it is not generally associated.

corporate ownership control: of land and other productive resources by a group rather than by individuals.

creation-science: the idea that scientific evidence can be and has been gathered for creation as depicted in the Bible. Mainstream scientists and the Supreme Court discount any scientific value of creation-science statements.

cross-cultural research: (holocultural research) a method that uses a global sample of societies in order to test hypotheses.

cultural anthropology: a subdiscipline of anthropology concerned with the non-biological, behavioral aspects of society; i.e. the social, linguistic, and technological components underlying human behavior. Two important branches of cultural anthropology are ethnography (the study of living cultures) and ethnology (which attempts to compare cultures using ethnographic evidence). In Europe, it is referred to as social anthropology.

cultural determinism: the idea that except for reflexes all behavior is the result of learning.

cultural diffusion: the spreading of a cultural trait (e.g., material object, idea, or behavior pattern) from one society to another.

cultural ecology: a term devised by Julian Steward to account for the dynamic relationship between human society and its environment, in which culture is viewed as the primary adaptive mechanism.

cultural environment: the complex of products of human endeavor, including technology and social institutions.

cultural evolution: the theory that societal change can be understood by analogy with the processes underlying the biological evolution of species.

cultural materialism: the theory, espoused by Marvin Harris, that ideas, values, and religious beliefs are the means or products of adaptation to environmental conditions ("material constraints").

cultural relativism: the ability to view the beliefs and customs of other peoples within the context of their culture rather than one's own.

cultural universal: those general cultural traits found in all societies of the world. culture shock a psychological disorientation experienced when attempting to operate in a radically different cultural environment.

culture area: a region in which several groups have similar culture complexes.

culture of poverty: a self-perpetuating complex of escapism, impulse gratification, despair, and resignation; an adaptation and reaction of the poor to the marginal position in a class-stratified, highly individuated, capitalistic society.

culture: learned, nonrandom, systematic behavior and knowledge that can be transmitted from generation to generation.

demographic transition: a rapid increase in a society's population with the onset of industrialization, followed by a leveling off of the growth rate due to reduced fertility.

demography: the study of the processes which contribute to population structure and their temporal and spatial dynamics..

dependent variable: a variable that is affected by the independent variable.

descent group: a group of consanguineal kin united by presumed lineal descent from a common ancestor.

descent relationship: the ties between mother and child and between father and child.

descent tracing: one's kinship connections back through a number of generations.

descriptive linguistics: that branch of anthropological linguistics that studies how languages are structured.

differentiation: organization in separate units for various activities and purposes.

diffusion: when elements of one culture spread to another without wholesale dislocation or migration.

divination: a practice in which an element of nature acts as a sign to provide supernatural information to the diviner.

division of labor: the set of rules found in all societies dictating how the day to day tasks are assigned to the various members of a society.

domestic cycle: the changes in household organization that result from a series of demographic events.

domestication: the process by which people try to control the reproductive rates of animals and plants by ordering the environment in such a way as to favor certain species.

double descent: a system of descent in which individuals receive some rights and obligations from the father's side of the family and others from the mother's side.

dowry: payment made by the bride's family to the groom or to the groom's family.

dysfunction: the notion that some cultural traits can cause stress or imbalance within a cultural system.

ecological determinism: a form of explanation in which it is implicit that changes in the environment determine changes in human society.

ecology: the study of the dynamic relationships of organisms to each other and the total environment.

economic class: a group that is defined by the economic position of its members in relation to the means of production in the society--the wealth and relative eocnomic control they may command.

economic system: the ideas and institutions that people draw upon and the behaviors in which they engage in order to secure resources to satisfy their needs and desires.

ecosystem: a group of organisms with specific relationships between themselves and a particular environment.

egalitarian society: a society that recognizes few differences in wealth, power, prestige, or status.

emic: a perspective in ethnography that uses the concepts and categories that are relevant and meaningful to the culture under analysis.

empirical: received through the senses (sight, touch, smell, hearing, taste), either directly or through extensions.

empiricism: reliance on observable and quantifiable data.

environment: everything external to the organism.

equilibrium: a balance among the components of an ecosystem.

ethnicity: a basis for social categories that are rooted in socially perceived differences in national origin, language, and/or religion.

ethnobotany: a subdiscipline of anthropology that explores how societies perceive and categorize plants in their environment and how they use these plants for food, medicine, ritual, etc.

ethnocentrism: the tendency to judge the customs of other societies by the standards of one's own ethnographic present: describes the point in time at which a society or culture is frozen when ethnographic data collected in the field are published in a report.

ethnography: that aspect of cultural anthropology concerned with the descriptive documentation of living cultures.

ethnohistory: the study of ethnographic cultures through historical records.

ethnology: a subset of cultural anthropology concerned with the comparative study of contemporary cultures, with a view to deriving general principles about human society.

evolution: the process by which small but cumulative changes in a species can, over time, lead to its transformation; may be divided into two categories: physical evolution (adaptive changes in biological makeup) and cultural evolution (adaptive changes in thought and behavior).

evolutionary ecology: the study of living organisms within the context of their total environment, with the aim of discovering how they have adapted.

exchange: the distribution of goods and services among members of a society.

exogamy: marriage outside a particular group with which one is identified.

extended family household: a multiple-family unit incorporating adults of two or more generations.

family household: a household formed on the basis of kinship and marriage.

folktales: traditional stories found in a culture (generally transmitted orally) that may or may not be based on fact.

foraging: collecting wild plants and hunting wild animals for subsistence.

formal interview: an interview that consists of questions designed to elicit specific facts, attitudes, and opinions.

formal organization: a group that restricts membership and makes use of officially designated positions and roles, formal rules and regulations, and a bureaucratic structure.

fossil: the remains or traces of any ancient organism.

fraternal polyandry: marriage of one woman with a set of brothers.

freehold: private ownership of property.

function: the contribution that a particular cultural trait makes to the longevity of the total culture.

gender: a cultural construct consisting of the set of distinguishable characteristics associated with each sex.

genetic determinism: the idea that all behavior, including very specific behavior, is biologically based, in contrast to cultural determinism.

genetics: the study of the mechanisms of heredity and biological variation.

grammar: the formal structure of a language, comprising phonology, morphology, and syntax.

grammatical structure: the rules for organizing elements of a language into meaningful utterances.

graphic arts: those forms of art such as painting and drawing.

group: a number of individuals who interact on a regular basis and have a sense of collective identity.

habitat: the specific area where a species lives.

historical linguistics: the study of how languages change over time.

holism: the philosophical view that no complex entity can be considered to be only the sum of its parts; as a principle of anthropology, the assumption that any given aspect of human life is to be studied with an eye to its relation to other aspects of human life.

Homo sapiens: the human species.

horizontal migration: a nomadic pattern characterized by regular movement over a large area in search of grass; also called plains migration.

horticulture: a simple form of agriculture based on the working of small plots of land without draft animals, plows, or irrigation; also called extensive agriculture.

household: a domestic residential group whose members live together in intimate contact, rear children, share the proceeds of labor and other resources held in common, and in general cooperate on a day-to-day basis.

hunter-gatherers: a collective term for the members of small-scale mobile or semi-sedentary societies, whose subsistence is mainly focused on hunting game and gathering wild plants and fruits; organizational structure is based on bands with strong kinship ties.

hunting and gathering: involves the systematic collection of vegetable foods, hunting of game, and fishing.

hypothesis: a statement that stipulates a relationship between a phenomenon for which the researcher seeks to account and one or more other phenomena.

hypothetico-deductive explanation: a form of explanation based on the formulation of hypotheses and the establishment from them by deduction of consequences which can then be tested against the archaeological data.

incest taboo: the prohibition of sexual intimacy between people defined as close relatives.

incest: sexual intercourse between closely related persons.

inclusive fitness: an individual's own fitness plus his or her effect on the fitness of any relative.

independent family household: a single-family unit that resides by itself, apart from relatives or adults of other generations.

independent variable: the variable that can cause change in other variables.

induction: a method of reasoning in which one proceeds by generalization from a series of specific observations so as to derive general conclusions (cf. deduction).

Industrial Age: a cultural stage characterized by the first use of complex machinery, factories, urbanization, and other economic and general social changes from strictly agricultural societies.

industrial society: a society consisting of largely urban populations that engage in manufacturing, commerce, and services.

industrialism: a form of social organization in which the population's needs for food, manufactured products, transportation, and many services are met through the use of machines powered largely by fossil fuel.

informant: a person who provides information about his or her culture to the ethnographic fieldworker.

innovation: the process of adopting a new thing, idea, or behavior pattern into a culture.

instinct: a genetically-determined pattern of behavior that is characteristic of a species and is often a response to specific internal or environmental stimuli.

institutions: a society's recurrent patterns of activity, such as religion, art, a kinship system, law, and family life.

intensive agriculture: a form of agriculture that involves the use of draft animals or tractors, plows, and often some form of irrigation.

invention: any new thing, idea, or way of behaving that emerges from within a society.

inventory of resources: a catalogue of the kinds of materials the people under investigation take from their environment in order to clothe, house, and feed themselves; the amount of time they spend procuring these materials; the quantity of food they collect or produce; and the distribution of the research population per unit of land.

in selection: the process whereby an individual's genes are selected by virtue of that individual's increasing the chances that his or her kin's genes will be propagated into the next generation.

kindred: a collection of bilateral kin.

language: a highly flexible and complex system of communication that allows for the exchange of detailed information about both interior and exterior conditions. As a creative and open system, new signals may be added and new ideas transmitted.

law: a rule of social conduct enforced by sanctions administered by a particular source of legitimate power.

legitimacy: the right to rule on the basis of recognized principles.

lexicon: in linguistics, the total number of meaningful units {such as words and affixes) of a language.

lexigram: a symbol that represents a word.

life expectancy: the length of time that a person can, on the average, expect to live.

lineage: a unilineal descent group composed of people who trace their genealogies through specified links to a common ancestor.

lineal relatives: direct ascendants and descendants.

linguistic anthropology: a subdivision of anthropology that is concerned primarily with unwritten languages (both prehistoric and modern), with variation within languages, and with the social uses of language; traditionally divided into three branches: descriptive linguistics, the systematic study of the way language is constructed and used; historical linguistics, the study of the origin of language in general and of the evolution of the languages people speak today; and sociolinguistics, the study of the relationship between language and social relations.

linguistics: the scientific study of language.

linked changes: those changes brought about in a culture when other (interconnected) parts of that same culture undergo change.

local races: subdivisions of geographical races. One type consists of partially isolated groups, usually remnants of once larger units. The second type includes fairly large subdivisions that contain a degree of variation within them.

low energy budget: an adaptive strategy by which a minimum of energy is used to extract sufficient resources from the environment for survival.

marginal people: those individuals who are not in the mainstream of their society.

market exchange: a mode of exchange which implies both a specific location for transactions and the sort of social relations where bargaining can occur. It usually involves a system of price-making through negotiation.

material culture: the buildings, tools, and other artifacts that includes any material item that has had cultural meaning ascribed to it, past and present.

matriarchy: a society ruled by females.

matrifocal: centered on the mother; said of a family situation common to the urban poor worldwide in which the woman and her relationships with her children and her female kin form the core of family life.

matrilineage: a lineage whose members trace their genealogies through specified female links to a common female ancestor.

matrilineal descent: descent traced through the female line.

matrilocal residence: residence of a married couple with or near the wife's kin.

mechanization: the replacement of human and animal labor by mechanical devices.

mercantile system: a system of ownership common in Europe and elsewhere after the eighteenth century in which land became the private property of individual owners.

model: a system of hypothetical principles that represents the characters of a phenomenon and from which predictions can be made.

monogamy: an exclusive union of one man and one woman.

monotheism: belief in one god.

morphemes: the smallest units of speech that convey meaning.

morphology: the study of structure, including the system by which speech units are combined to form meaningful words.

natural selection: the process whereby members of a species who have more surviving offspring than others pass their traits on to the next generation, whereas the less favored do not do so to the same degree.

Neolithic: an Old World chronological period characterized by the development of agriculture and, hence, an increasing emphasis on sedentism.

neolocal residence: residence of a married couple in a new household established apart from both the husband's and the wife's kin.

network: a web of social ties of various kinds.

niche: the environmental requirements and tolerances of a species; sometimes seen as a species' "profession" or what it does to survive.

nomadic pastoralism: the strategy of moving the herds that are one's livelihood from pasture to pasture as the seasons and circumstances require.

nonunilineal descent group: a kin group in which descent may be traced through either parent or through both.

nonverbal communication: the various means by which humans send and receive messages without using words (e.g., gestures, facial expressions, touching).

norm: the most frequent behavior that the members of a group will show in a specific situation.

Northern Paiute Groups – Bands versus Tribes versus Nations: Since no political authority bound the whole group together, it might have been equally correct to have called the inclusive unit a "**nation**" and each of the smaller units "**tribes**". However, since Powell, Kroeber, Steward, and others have already referred to the subdivisions of the Northern Paiute as **bands**, it seemed preferable to retain that designation (Stewart 1939).

nuclear family household: an independent family unit formed by a monogamous union.

nucleation: the tendency of populations to cluster in settlements of increasing size and density.

Paiute: The history of the name Paiute (Pah Ute, Piute) for the Indians of west central Nevada has been explained as a combination of the Paiute words pa ("water") and ute ("direction"). The Indians spoke themselves as nömönömönömö (people), but probably travelers who had had previous experience with the Ute used **ute** to form the last part of the named for this new Shoshonean group, but added **pa** to indicate observable differences between the two groups. Certain it is that the same Indians are known as Snake by some writers and Paiute by others. Fremont, for example, made no distinction between the Indians he met in southern Oregon and those near Pyramid Lake (Stewart 1939).

paleontologists: experts on animal life of the distant past.

paleontology: that specialized branch of physical anthropology that analyzes the emergence and subsequent evolution of human physiology.

pastoralism: a form of social organization based on herding.

patrilineage: a lineage whose members brace their genealogies through specified male links to a common male ancestor.

patrilineal descent group: a unilineal descent group in which membership is inherited through the paternal line.

patrilineal descent: descent traced through the male line.

patrilocal postmarital residence: a custom where by a married couple resides in the household or vicinity of the husband's parents.

patrilocal residence: residence of a married couple with or near the husband's kin.

patrimonial system: a system of ownership, followed in northern and central Europe during the Middle Ages, in which land was controlled by feudal lords who held their domains by hereditary right.

peasants: farmers who lack control over the means of their production--the land, the other resources, and the capital they need to grow their crops, and the labor they contribute to the process.

phoneme: a class of sounds that differ slightly from one another but that may be substituted for one another without any change of meaning.

phonology: the sound system of a language.

physical anthropology: the scientific study of the physical characteristics, variability, and evolution of the human organism.

physical environment: the complex of inanimate elements that surround an organism.

politics: the process by which a community's decisions are made, rules for group behavior are established, competition for positions of leadership is regulated, and the disruptive effects of disputes are minimized.

polyandry: marriage between one woman and two or more men simultaneously.

polygamy: plural marriage.

polygyny: marriage between one man and two or more women simultaneously.

polytheism: belief in many gods.

positive eugenics: a method of increasing the frequency of desirable traits by encouraging reproduction by individuals with these traits.

potlatch: a form of competitive giveaway found among the Northwest Coast American Indians that serves as a mechanism for both achieving social status and distributing goods.

power: the ability to exert influence because one's directives are backed by negative sanctions of some sort.

prehistoric: the period prior to written records for any given area. In North America synonymous with

prehistory: the period of human history before the advent of writing.

primitive: a derogatory term used to describe small-scale, preliterate, and technologically simple societies.

processors: hunter-gatherers who occupy one permanent settlement, from which they move to temporary camps to exploit seasonally available resources (a foraging pattern).

production: the conversion of natural resources to usable forms.

productive life span: the period bounded by the culturally established ages at which a person ideally enters and retires from the work force.

productivity: the amount of work a person accomplishes in a given period of time.

profane: the sphere of the ordinary and routine; the everyday, natural world.

psychological anthropology: the study of the relationship between culture and individual personality.

race: a subgroup of human population that shares a greater number of physical traits with one another than they do with those of other subgroups.

regulation of access to resources: control over the use of land, water, and raw materials.

religion: a framework of beliefs relating to supernatural or superhuman beings or forces that transcend the everyday material world.

research design: systematic planning of research, usually including (1) the formulation of a strategy to resolve a particular question; (2) the collection and recording of the evidence; (3) the processing and analysis of these data and their interpretation; and (4) the publication of results.

resilience: the ability of an ecosystem to undergo change while still maintaining its basic elements or relationships.

revolution: an attempt to overthrow the existing form of political organization, the principles of economic production and distribution, and the allocation of social status.

rites of passage: rituals that mark a person's transition from one set of socially identified circumstances to another.

ritual: behavior that has become highly formalized and stereotyped.

role: a set of behavioral expectations appropriate to an individual's social position.

sacred: the sphere of extraordinary phenomena associated with awesome supernatural forces.

sampling: the probabilistic, systematic, or judgmental selection of a sub-element from a larger population, with the aim of approximating a representative picture of the whole.

sanction: any means used to enforce compliance with the rules and norms of a society.

scarce resources: a central concept of Western economics which assumes that people have more wants than they have resources to satisfy them.

science: a method of reaming about the world by applying the principles of the scientific method, which includes making empirical observations, proposing hypotheses to explain those observations, and testing those hypotheses in valid and reliable ways; also refers to the organized body of knowledge that results from scientific study.

scientific theory: a statement that postulates ordered relationships among natural phenomena.

sedentism: the practice of establishing a permanent, year-round settlement.

semantic domains: groups of related categories of meaning in a language.

semantics: the study of the larger system of meaning created by words.

senescence: old age.

serial monogamy: an exclusive union followed by divorce and remarriage, perhaps many times.

settlement pattern: the spatial distribution of cultural activities across a landscape at a given moment in time.

sexual division of labor: the situation in which males and females in a society perform different tasks. In hunting-gathering societies males usually hunt while females usually gather wild vegetable food.

sexual stratification: the ranking of people in a society according to sex.

shaman: a medium of the supernatural who acts as a person in possession of unique curing, divining, or witchcraft capabilities.

shamanistic cult: that form of religion in which part-time religious specialists called shamans intervene with the deities on behalf of their clients.

slavery: a practice that permits some people within a society to own other persons and to claim the right to their labor.

social anthropology: see cultural anthropology.<> **social category:** a category composed of all people who share certain culturally identified characteristics.

social class: a category of people who have generally similar educational histories, job opportunities, and social standing and who are conscious of their membership in a social group that is ranked in relation to others and is replicated over generations.

social division of labor: the process by which a society is formed by the integration of its smaller groups or subsets.

social norm: an expected form of behavior.

social pressure: a means of social control in which people who venture over the boundaries of society's rules are brought back into line.

social stratification: the ranking of subgroups in a society according to wealth, power, and prestige..

socialization: the process by which a person acquires the technical skills of his or her society, the knowledge of the kinds of behavior that are understood and acceptable in that society, and the attitudes and values that make conformity with social rules personally meaningful, even gratifying; also termed enculturation.

society: a group of interacting people who share a geographical region, a sense of common identity, and a common culture.

sociobiology: the study of the biological control of social behavior.

sociocultural anthropology: a branch of anthropology that deals with variations in patterns of social interaction and differences in cultural behavior.

sociolinguistics: a branch of anthropological linguistics that studies how language and culture are related and how language is used in different social contexts.

sorcery: the performance of certain magical rites for the purpose of harming other people.

specialization: the limited range of activities in which a single individual is likely to be engaged.

specialized pastoralism: the adaptive strategy of exclusive reliance on animal husbandry.

speech community: a socially distinct group that develops a dialect; a variety of language that diverges from the national language in vocabulary, pronunciation, and grammar.

spheres of exchange: the modes of exchange-- reciprocity, redistribution, and market exchange-- that apply to particular goods or in particular situations.

spirit possession: the supposed control of a person's behavior by a supernatural spirit that has entered the body.

stability: the ability of an ecosystem to return to equilibrium after disturbances.

state: a term used to describe a social formation defined by distinct territorial boundedness, and characterized by strong central government in which the operation of political power is sanctioned by legitimate force. In cultural evolutionist models, it ranks second only to the empire as the most complex societal development stage.

statistical analysis: the application of probability theory to quantified descriptive data.

status: a position in a pattern of reciprocal behavior.

stratification: the division of a society into groups that have varying degrees of access to resources and power.

supernatural beliefs: a set of beliefs found in all societies that transcend the natural, observable world.

symbol: something that can represent something distant from it in time and space.

syntax: the arrangement of words into meaningful utterances.

system: a series of interrelated parts wherein a change in one part brings about changes in all parts.

terms of reference: the terms by which people refer to their kin when they speak about them in the third person.

territory: an area that a group defends against other members of its own species.

theism: belief in one or more gods of extrahuman origin.

theory: a step in the scientific method in which a statement is generated on the basis of highly confirmed hypotheses and is used to generalize about conditions not yet tested.

totem: a plant or animal whose name is adopted by a clan and that holds a special significance for its members, usually related to their mythical ancestry.

transhumance: seasonal movement of livestock between upland and lowland pastures.

travelers: hunter-gatherers who follow a regular yearly round, occupying a series of campsites for brief periods when a valued resource is available in the vicinity of each site (a logistical pattern).

tribe: a descent and kinship-based group in which subgroups are clearly linked to one another, with the potential of uniting a large number of local groups for common defense or warfare. Unlike bands, tribes are usually settled farmers, though they also include nomadic pastoral groups whose economy is based on exploitation of livestock. Individual communities tend to be integrated into the larger society through kinship ties.

Tribes: Certainly, if we have units to set apart, the basis for the formation of those units must be clearly defined. The larger unit I have called **"tribe"** because it is a group of Indians linguistically, culturally, and territorially united. (Stewart 1939).

unilineal descent group: a kin group in which membership is inherited only through either the paternal or the maternal line, as the society dictates.

unilineal evolution: a pattern of cultural progress through a sequence of evolutionary stages; the basic premise of the early cultural evolutionists.

unstructured interview: an ethnographic data-gathering technique usually used in the early stages of one's fieldwork in which interviewees are asked to respond to broad, open-ended questions.

urbanization: the proportionate rise in the number of people living in cities in comparison to the number living in rural areas.

urbanized society: a society in which a majority of people live in cities.

variable: any property that may be displayed in different forms.

wealth: the accumulation of material objects that have value within a society.

Appendix 1.5.

Appendix 1.5 Specific stakeholder comments at the Owyhee Subbasin Public Outreach meetings and response letters written by Steven C. Vigg and reviewed by the Owyhee Technical/Planning team.

Appendix 1.5.1 Comments at the Owyhee, Nevada Meeting on April 1, 2004 – listed by stakeholder.

Herman Atkinis' Comments

Comment #1: There are three parts to the assessment, where are you at with those three steps?

Comment #2: Sounds like changes to the final plan could be made by people outside of the subbasin. Who will have the last say? In effect, local people have comment, but the NWPCC will ultimately have the last say.

Guy Dodson's Comments

Comment #1:
Guy Dodson noted that there was an incorrect entry on Indian Creek as there are no pollutant sources within this area.

John Jackson's Comments

Comment #1:
John Jackson commented that on the QHA spreadsheet, Indian Creek on p.6 says that the limiting factor is obstruction and on the limiting factors page it says that the limiting factor for this reach is pollutants. John Jackson noted that a black and white copy of a color-coded spreadsheet made things a little bit difficult to review.

Comment #2:
John also questioned the entry on Sheep Creek – S.F. Owyhee to Sheep Cr. Reservoir stating that this reach is listed as a 1.0, but below the reservoir there are no pollutants identified and they are listed as a 4.0.

Comment #3:
John Jackson asked whether or not the website had a PowerPoint showing where the different reaches are since several of the creeks had different names. John Jackson asked

Guy Dodson, which Juniper Creek was referred to on the spreadsheet. John Jackson questioned whether or not livestock grazing can be listed as a pollutant.

John Sellman's Comments

Comment #1:
He asked how information has been collected from year to year for these different reaches. Tim Dykstra explained that on the Nevada side they met with BLM Fisheries Biologist, Pat Coffman and NDOW, Gary Johnson. Jake Sellman asked if they were going to update this spreadsheet once a year. The NWPCC requires a 5-year review of each subbasin plan, but a more frequent review may be conducted locally.

Appendix 1.5.2 Letters responding to the comments at the Owyhee, Nevada Meeting on April 1, 2004 – listed by stakeholder.

Response to Herman Atkinis' Comments
May 17, 2004

Herman Atkinis, Administration
Shoshone Paiute Tribes of the Duck Valley Indian Reservation
Highway 51 Stateline
P.O. Box 219
Owyhee, Nevada 89832

Dear Herman Atkinis:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) have been posted on the www.Owyhee.us web site:

- Comment #1: There are three parts to the assessment, where are you at with those three steps?
- Comment #2: Sounds like changes to the final plan could be made by people outside of the subbasin. Who will have the last say? In effect, local people have comment, but the NWPCC will ultimately have the last say.

Your comments have been reviewed by the Owyhee Planning and Technical teams and we provide the following responses:

- Response to comment #1

During the public meeting, I explained that all three parts of the Owyhee Subbasin Plan were in progress – the first draft of the technical assessment, first draft of inventory of restoration activities were available, and the management plan was in development and first draft would be available by the middle of April. At this time (May 17th) we have completed several revisions on each of the Owyhee Subbasin Plan Chapters and Appendices. The latest versions of all Owyhee Subbasin Plan documents are available for review at any time on www.Owyhee.US – just click the "Deliverables" navigation button on the front page. All contract deliverables will be due COB May 28, 2004 to the Northwest Power and Conservation Council (NWPCC), Portland, Oregon.

- Response to comment #2

During the public meeting, Tom Dayley gave an in-depth description of the subbasin plan review process. The NWPCC expects to have a final document for amendment into the Program by January 2005. Tom Dayley affirmed that changes to the plan could be made by people outside of this Subbasin via the official F&W Program amendment public comment process, but that the NWPCC would not give equal weight to all of the comments received – with more weight given to comments from local stakeholders. Steve explained that the local support for the plan is extremely important to the entire process. Tom Dayley confirmed that it is the responsibility of the NWPCC to make the final determinations on the subbasin plan revision and Fish & Wildlife Program Amendment process.

42418 East Larch Mountain Road, Corbett, OR, 97019 ● vigg@earthlink.net ● (503) 695-3433

Owyhee Subbasin Plan

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg

Steven C. Vigg
Principal
Steven Vigg & Company

SCV

42418 East Larch Mountain Road, Corbett, OR, 97019 ● vigg@earthlink.net ● (503) 695-3433

Response to Guy Dodson's Comments
May 17, 2004
Guy Dodson Sr., Director
Habitat, Fish, Wildlife & Parks Department
Shoshone Paiute Tribes of the Duck Valley Indian Reservation
Highway 51 Stateline
P.O. Box 219
Owyhee, Nevada 89832

Dear Guy Dodson:

We thank you for attending the Owyhee Subbasin public outreach meeting. Your comment has been posted on the www.Owyhee.us web site:

- Comment #1: Guy Dodson noted that there was an incorrect entry on Indian Creek as there are no pollutant sources within this area.

Your comment has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1:

During the meeting John Jackson, from Petan Ranch, also stated that this rating was apparently a mistake since there is no mining, milling, housing, development, or other sources of pollution on Indian Creek. I checked with Gary Johnson, Nevada Department of Wildlife, and he agreed that the rating of 1.0 for "pollutants" was in error. We discussed the ratings for the tributaries flowing into Indian Creek (Winters, Mitchell and Wall) that all had been rated 4.0 for "pollutants". Based on Mr. Johnson's personal observations and the ratings of the tributaries, we decided that Indian Creek should be rated 4.0 for the "pollutants" attribute. We will correct this datum in the QHA data files. To further clarify the matter, Gary Johnson also informed me that there are two "Indian Creeks" in the Nevada portion of the Owyhee. The one under discussion provides habitat for redband trout; it is near the south end of the Duck Valley Indian Reservation – emanating from the Bull Run Mountains and flowing into the S. Fork of the Owyhee River. Prior to entering the Owyhee, some of the water is diverted into Dry Creek Reservoir on the Petan Ranch. The other "Indian Creek" is in Independence Valley and is a tributary to the headwaters of the S.F. Owyhee River; it does not contain redband trout or any other salmonid species.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

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Thank you,

Steven C. Vigg

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Response to John Jackson's Comments:
May 16, 2004

John Jackson
Owyhee, NV 89832

Dear John Jackson:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) have been posted on the www.Owyhee.us web site:

- Comment #1: John Jackson commented that on the QHA spreadsheet, Indian Creek on p.6 says that the limiting factor is obstruction and on the limiting factors page it says that the limiting factor for this reach is pollutants. John Jackson noted that a black and white copy of a color-coded spreadsheet made things a little bit difficult to review.
- Comment #2: John also questioned the entry on Sheep Creek – S.F. Owyhee to Sheep Cr. Reservoir stating that this reach is listed as a 1.0, but below the reservoir there are no pollutants identified and they are listed as a 4.0.
- Comment #3: John Jackson asked whether or not the website had a PowerPoint showing where the different reaches are since several of the creeks had different names. John Jackson asked Guy Dodson, which Juniper Creek was referred to on the spreadsheet. John Jackson questioned whether or not livestock grazing can be listed as a pollutant.

Your comment(s) have been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1:

You are right, the photocopy of a color-coded spreadsheet made it difficult to read some numbers. For HUC 17050105, Indian Creek on p.6 of the Limiting Factors Handout #3b actually lists pollutants as the limiting factor. This is consistent with the minimum score of 1.0 for Pollutants (Attribute #10) on Handout 3a QHA Ratings – for the Indian Creek reach.

- Response to comment #2:
- For HUC 17050105, the Sheep Creek reach – S.F. Owyhee to Sheep Cr. Reservoir -- is rated as a 1.0 for Pollutants and 0.5 for Obstructions. The reach below the reservoir is intermittent/dry and therefore contains no redband trout – so the dam (#11 Obstruction) is the limiting factor with a score of 0.5 because it eliminates the flow below the reservoir. Thus intermittent flow/dessication is the overwhelming problem below the dam and the "pollutants" attribute is rated at a 4.0 because it is not a factor when the stream is dry.

- Response to comment #3:

We used the BLM GIS data bases as the definitive tool to locate specific reaches and identify streams by name. Livestock grazing is not listed as a pollutant; however, livestock feces on the stream banks may result in high coliform bacteria (*E. coli*) counts or other factors such as increased sedimentation in the stream.

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Response to John Sellman's Comments
May 17, 2004

John Sellman, Biologist
Habitat, Fish, Wildlife & Parks Department
Shoshone-Paiute Tribes of the Duck Valley Indian Reservation
Highway 51 Stateline
P.O. Box 219
Owyhee, Nevada 89832

Dear John Sellman:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) has been posted on the www.Owyhee.us web site:

- Comment #1: He asked how information has been collected from year to year for these different reaches. Jake Sellman also asked if they were going to update this spreadsheet once a year.

Your comment(s) has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

During the public meeting, Tim Dykstra explained that on the Nevada portion of the Owyhee, we met with BLM Fisheries Biologist, Pat Coffin and NDOW Fisheries biologist, Gary Johnson to review information collected by their agencies over the past two decades and to get their expert judgments on the QHA evaluation. The Northwest Power and Conservation Council requires a 5-year review of each of the 62 subbasin plans as part of the Council's Fish & Wildlife Program Amendment process. However, a more frequent review will be conducted as part of the Provincial Review (every three years) as part of the BPA funding process for Fish & Wildlife enhancement projects. Furthermore, the Tribes' Habitat, Fish, Wildlife and Parks Department will be updating relevant information annually as part of the Monitoring & Evaluation (M&E) Plan that is being initiated this year (spring of 2004).

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

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Appendix 1.5.3 Comments at the Grand View, Idaho Meeting on April 2, 2004 – listed by stakeholder.

Craig Baker's Comments

Comment #1:
Craig Baker of the Sierra Del Rio Ranch noted that Pole Creek and Deep Creek reaches listed within the Idaho QHA spreadsheet pool only where they flow through in the spring. The predominant fish in these creeks are bass, not redband trout.

Comment #2:
Craig Baker stated that if you killed 1 juniper tree per year for every cow out on the range (which would be the slow approach), the trees would eventually be gone and the water would be ten-fold.

Donna Bennett's Comments

Comment #1:
Donna Bennett explained that the studies that this assessment is based upon were primarily done in the 1980s. She explained that the area has been in a drought since the 1970s, but none of the studies take this fact into account.

Comment #2:
Donna Bennett commented that juniper burning needs to be a part of the land management in the subbasin. She explained that on her place in the fall, the Indians used to come: the men would hunt and the women gathered camas roots. When they moved out they would burn the entire area. She explained that one 50 year old juniper tree will transpire 80 gallons of water per day. She noted that they have started burning on their place and they are starting to get springs coming back, even on dry years.

George Bennett's Comments

Comment #1:
George Bennett stated that the water in some locations is coming out of the ground a good 2 degrees higher than the current temperature standard.

Brian Collett's Comments

Comment #1:
Brian Collett stated that the reach labeled Rock Creek-6 is entirely on private ground. He questioned when a study on this reach was done and by whom, stating that there are trespass issues associated with this sort of thing. The confidence rating for this reach is a

0.5, and should be a zero. He requested that this reach be eliminated from the assessment as his family is the only people with knowledge of this reach and they do not want this section ranked.

Comment #2:
Brian Collett stated that in order to have better water quality in this area we will have to address the juniper invasion problem.

Comment #3:
Brian Collett stated that the use of agenda-driven science in these assessments is not acceptable.

Chris Collett's Comments

Comment #1:
Chris Collett noted that Bruce Zoellick, the leading scientist in the QHA assessment for the Idaho stream reaches, has a personal agenda for this area and his data is biased.

Comment #2:
Chris Collett stated that the terms "restoration and protection" are worrisome to her – protection from what? She commented that money used should focus on restoration not protection. She stated her concern that fences will be built where they are not needed, and ranchers that are doing a good job currently will be punished for their caretaking of the land.

Comment #3:
Chris Collett stated that the use of agenda-driven science in these assessments is not acceptable.

Gene Davis' Comments

Comment #1:
Gene Davis noted that the reach entitled 'Battle Creek #2' should not be rated at all because of the zero confidence. He questioned why 'Shoofly Creek' was ranked with zero confidence as well. He also noted that 'Dry Creek #1 and #2' are reaches that are dry seven out of ten years, with no water running in them at all. He explained that there is some riparian vegetation, but the reaches shouldn't be considered for red band trout habitat due to the lack of water.

Derron Fredrick's Comments

Comment #1:

Derron Frederick noted that Bruce Zoellick, the leading scientist in the QHA assessment for the Idaho stream reaches, has a personal agenda for this area and his data is biased.

Comment #2:
Derron Frederick commented that Rock Creek only has water in the spring and there are no fish within this stream.

Comment #3:
Derron Frederick stated that Dry Creek (reach 1 and 2 on page 9 of the handout) are always dry. He stated that the lack of existing water is such that they have to have a pipeline to water cattle in that area. He also noted that Shoofly Creek #3 is on private land and the only time there is water there is when there is flood water. He explained that the water down below in this reach is only wastewater from the canal. In fact, he stated that several people farm through what they are calling a creek.

Comment #4:
Derron Frederick stated that in the Owyhee River Basin, most of the Red Band Trout exist on private ground or in areas that are only accessed through private ground. He stated that if the process continues to proceed with unfair assessments that use agenda-based science that the local landowners will lock up there lands and will no longer provide access through their lands to these areas.

Jeanette Hemenway's Comments

Comment #1:
Jeanette Hemenway commented that she had come to the meeting because she had seen a program on television where the Indians claimed to have owned the Snake River. She said she was 86 years old, had lived here all her life, and has had established water rights. She explained that she has always respected the Indians, but can't understand why fish are more important than her and her descendants. Steve Vigg commented that he was not aware of this television program. Guy Dodson noted that she was most likely referring to a program that ran on Idaho Public Television (Channel 4).

Comment #2:
Jeanette Hemenway noted that her grandparents were here in 1904, and that there was not the amount of salmon present in the Snake River that people were claiming.

Dana Rutan's Comments

Comment #1:
Dana Rutan expressed his concerns about the redband trout habitat designation in many of the stream reaches as they are not naturally cool enough to sustain redband trout populations. He further explained his concern that such an inaccurate designation will be used to justify the removal of cattle from these areas in the future, as this will be seen by land managers as the only solution.

Comment #2:
Dana Rutan stated that the bottom line solution will be to kick cattle off of the range. He questioned why we should get money to protect fish that have obviously adapted to existing habitat conditions.

Comment #3:
Dana Rutan stated that while the Owyhee Dam may have blocked some fish migration, it multiplied the amount of food produced within the area by more than fifty times.

Comment #4:
Dana Rutan commented that it is not right to rank streams with a zero confidence rating. Giving an area a low score without any data is not fair.

Comment # 5:
Dana Rutan noted that Combination Creek dries up. He also explained that Boulder Creek has lots of willows and is in very good riparian condition.

John Urquidi's Comments

Comment #1:
John Urquidi asked if there were two Shoofly Creeks because he was only familiar with the Shoofly Creek that was located in the Bruneau drainage. Pam Smolczynski noted later that there is a Shoofly Creek in the Owyhee Subbasin. It is possible that the agency personnel and local landowners use different names for this stream reach.

Comment #2:
John Urquidi asked how Steve Vigg had documented that pre-1933 salmon runs existed in the Owyhee River Basin. He wondered where he had documented that these supposed salmon runs were eliminated by the construction of the Owyhee Dam.

Comment #3:
John Urquidi commented regarding the attribute rating and definition of normative used in the QHA models. He stated that normal conditions in the Owyhee drainage have unique variances from other areas. For example, spring temperatures are hotter in the Owyhees than in other areas, and juniper invasions cause dewatering of the drainages. These are just two of the many variances occurring within the Owyhee Subbasin. He stated his opinions that more work needs to be done to establish baseline data and the definition of normal.

Comment #4:
John Urquidi noted that a confidence rating of 0 is confusing. He stated that it should not have been ranked in all columns as 0 indicated no factual knowledge. He suggested that areas with 0 confidences should state not/rated in the notes of the model and only includes numbers to meet the computer models requirements.

Appendix 1.5.4 Letters responding to the comments at the Grand View, Idaho Meeting on April 2, 2004 – listed by stakeholder.

Response to Craig Baker's Comments
May 16, 2004

Craig Baker
17351 Murphy Flat Rd.
Murphy, ID 83650

Dear Craig Baker:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) have been posted on the www.Owyhee.us web site:

- Comment #1: Craig Baker of the Sierra Del Rio Ranch noted that Pole Creek and Deep Creek reaches listed within the Idaho QHA spreadsheet pool only where they flow through in the spring. The predominant fish in these creeks are bass, not redband trout.
- Comment #2: Craig Baker stated that if you killed 1 juniper tree per year for every cow out on the range (which would be the slow approach), the trees would eventually be gone and the water would be ten-fold.

Your comments have been reviewed by the Owyhee Planning and Technical teams and we provide the following responses:

- Response to comment #1

Your specific information regarding the Pole Creek and Deep Creek reaches is noted. Members of the technical team have observed good populations of redband trout in the upper reaches of Deep Creek that have spring-fed perennial flow. Apparently, the flow in Pole Creek and the lower reaches of Deep Creek may be intermittent or interrupted – dependant upon terrain – and may have more of the warm water species such as smallmouth bass.

- Response to comment #2

The issue of increased water consumption (evapotranspiration) by increased Juniper encroachment has been noted. By inspection of the current versus historic maps of the distribution of old growth western Juniper and Mountain Mahogany Woodlands habitat (Source: www.nwhi.org/ibis) – it is apparent that this habitat type has increased in the Owyhee Subbasin. This habitat is dominated by fire-sensitive species, and therefore, the range of western juniper and mountain mahogany has expanded because of federal fire suppression policies (Crawford and Kagan 2004; Wayne Burkhart cited by Jerry Hoagland, Personal Correspondence, April 2004). Quigley and Arbelbide concluded that in the Inland Pacific Northwest, Juniper/Sagebrush, Juniper Woodlands, and Mountain Mahogany cover types now are significantly greater in extent than before 1900; however, this habitat is generally in degraded condition because of increased exotic plants and decreased native bunchgrasses. As far as I am aware, no scientific studies have been conducted to estimate temporal changes in water loss by Junipers in the Owyhee Subbasin (mid-1800's to present). However, I understand that cooperative research has been initiated by USDA, University of Idaho, Oregon State University, and

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BLM – to study the effects of Juniper woodlands on stream flow in the Owyhee Subbasin and the Burns, Oregon area.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

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Response to Donna Bennett's Comments
May 16, 2004

Donna Bennett
Grand View, ID 83624

Dear Donna Bennett:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) have been posted on the www.Owyhee.us web site:

- Comment #1: Donna Bennett explained that the studies that this assessment is based upon were primarily done in the 1980s. She explained that the area has been in a drought since the 1970s, but none of the studies take this fact into account.
- Comment #2: Donna Bennett commented that juniper burning needs to be a part of the land management in the subbasin. She explained that on her place in the fall, the Indians used to come: the men would hunt and the women gathered camas roots. When they moved out they would burn the entire area. She explained that one 50 year old juniper tree will transpire 80 gallons of water per day. She noted that they have started burning on their place and they are starting to get springs coming back, even on dry years.

Your comment(s) have been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1:

A substantial amount of habitat and water quality monitoring and fish population surveys have been conducted during the past 3-5 years – during drought conditions. We agree that it is important to take climatic conditions into account, including recent drought conditions.

- Response to comment #2:

The need to manage Juniper encroachment has been noted by many landowners providing comments. However, old growth Juniper would not be categorized as recent encroachment. As far as I am aware, no scientific studies have been conducted to estimate temporal changes in water loss by Junipers (recent versus old growth) in the Owyhee Subbasin. However, I understand that cooperative research has recently been initiated by USDA, University of Idaho, Oregon State University, and BLM – to study the effects of Juniper woodlands on stream flow in the Owyhee Subbasin and the Burns, Oregon area. Perhaps additional studies are needed to estimate the magnitude of water loss due to increased biomass of Juniper trees in the Owyhee over time.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

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Response to George Bennett's Comments
May 16, 2004

George Bennett
Grand View, ID 83624

Dear George Bennett:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) has been posted on the www.Owyhee.us web site:

- Comment #1: George Bennett stated that the water in some locations is coming out of the ground a good 2 degrees higher than the current temperature standard.

Your comment(s) has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

We understand that warm springs occur throughout the Owyhee Subbasin – and some springs have water temperatures at the source that are above the DEQ standards for cool water fisheries and/or the thermal tolerance of redband trout. We have noted your comment, we are interested in specific temperature data in specific stream reaches, if you have that available, please sent it to us.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

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Response to Brian Collett's Comments

May 16, 2004

Brian Collett
Oreana, ID 83650

Dear Brian Collett:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) have been posted on the www.Owyhee.us web site:

- Comment #1: Brian Collett stated that the reach labeled Rock Creek-6 is entirely on private ground. He questioned when a study on this reach was done and by whom, stating that there are trespass issues associated with this sort of thing. The confidence rating for this reach is a 0.5, and should be a zero. He requested that this reach be eliminated from the assessment as his family is the only people with knowledge of this reach and they do not want this section ranked.
- Comment #2: Brian Collett stated that in order to have better water quality in this area we will have to address the juniper invasion problem.
- Comment #3: Brian Collett stated that the use of agenda-driven science in these assessments is not acceptable.

Your comment(s) have been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

Our Technical team members checked the reach labeled "Rock Creek-6" and found it included a small overlap of federal land and that the headwaters area included about 110 acres of state ground that has developed springs and has been leased out to private landowners in the past. For clarification, we could change the description on our tables to incorporate the phrase "excluding private ground and including state and federal lands". The Qualitative Habitat Assessment tool was designed to incorporate various levels of information – "hard" (quantitative) scientific data, expert opinion of professionals, and inferences based on best available information and reasonable hypotheses. In cases where a quantitative assessment of habitat condition and/or redband trout population sampling had not been conducted on a specific reach – it is reasonable for fishery and habitat experts to make inferences from adjacent or nearby reaches that have similar characteristics. On a scale of 0 to 2, a confidence rating of 0.5 was generally assigned to reaches without site-specific quantitative data, that could be qualitatively assessed via expert opinion and inferences based the condition of upstream or downstream reaches in the same proximity.

Even if the stream reaches had a confidence ratings of "0" (zero) it should not be eliminated from the QHA analysis and results according to Jeff Fryer (Oregon Technical Team). Dr. Fryer stated: "Biologists doing the rating who know the area can do a good job of inferring from other data how a reach should rate. If the biologist knows the land

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use, has data from upstream and/or downstream of the reach in question, or has knowledge of other similar reaches in the area, the rating given has a good chance of being accurate. Low confidence should be taken into account when looking at the results and coming up with a subbasin plan. For example, if a reach has high current or restoration value, but low confidence, filling in this data gap could well be one of the priorities of the subbasin plan."

- Response to comment #2

The issue of increased water consumption (evapotranspiration) by increased Juniper encroachment has been noted. By inspection of the current versus historic maps of the distribution of old growth western Juniper and Mountain Mahogany Woodlands habitat (Source: www.nwhi.org/ibis) – it is apparent that this habitat type has increased in the Owyhee Subbasin. This habitat is dominated by fire-sensitive species, and therefore, the range of western juniper and mountain mahogany has expanded because of federal fire suppression policies (Crawford and Kagan 2004; Wayne Burkhart cited by Jerry Hoagland, Personal Correspondence, April 2004). Quigley and Arbelbide concluded that in the Inland Pacific Northwest, Juniper/Sagebrush, Juniper Woodlands, and Mountain Mahogany cover types now are significantly greater in extent than before 1900; however, this habitat is generally in degraded condition because of increased exotic plants and decreased native bunchgrasses. As far as I am aware, no scientific studies have been conducted to estimate temporal changes in water loss by Junipers in the Owyhee Subbasin (mid-1800's to present). However, I understand that cooperative research has been initiated by USDA, University of Idaho, Oregon State University, and BLM – to study the effects of Juniper woodlands on stream flow in the Owyhee Subbasin and the Burns, Oregon area.

- Response to comment #3

"Science" is the result of valid application of the scientific method which includes hypothesis testing, data collection according to standard protocols, data analysis according to standard methods, and interpretation according to sound logic. Natural Resources biologists and managers utilize data derived from research based on the scientific method – to compile a valid knowledge base. The Owyhee Subbasin Plan relies on data bases developed by resource management entities, best available information derived from relevant scientific studies and publications, and direct observation from professionals and other reliable sources that can be documented.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

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Response to Chris Collett's Comments

May 16, 2004

Chris Collett
Oreana, ID 83650

Dear Chris Collett:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) have been posted on the www.Owyhee.us web site:

- Comment #1: Chris Collett noted that Bruce Zoellick, the leading scientist in the QHA assessment for the Idaho stream reaches, has a personal agenda for this area and his data is biased.
- Comment #2: Chris Collett stated that the terms "restoration and protection" are worrisome to her – protection from what? She commented that money used should focus on restoration not protection. She stated her concern that fences will be built where they are not needed, and ranchers that are doing a good job currently will be punished for their caretaking of the land.
- Comment #3: Chris Collett stated that the use of agenda-driven science in these assessments is not acceptable.

Your comments have been reviewed by the Owyhee Planning and Technical teams and we provide the following responses:

- Response to comment #1

The Owyhee Technical Team includes Bruce Zoellick as a representative of the Bureau of Land Management, Bruneau Resource Area. I consider Bruce Zoellick to be to be a qualified and knowledgeable biologist with significant experience in field research related to Owyhee River habitats and fish ecology. Several other professional biologists provided input to the Idaho QHA workshops, including Pam Druliner, Bonnie Hunt, Eric Lietzinger, Keith Meyer, Tim Dykstra, and myself – none of these biologists have indicated that Bruce Zoellick presented biased data in the QHA process.

- Response to comment #2

Restoration and protection are common terms in Fish & Wildlife Management. Protection simply means taking management actions to prevent properly functioning habitat from being degraded; and "restoration" means conducting actions that bring degraded habitat back to a properly functioning state.

- Response to comment #3

"Science" is the result of valid application of the scientific method which includes hypothesis testing, data collection according to standard protocols, data analysis according to standard methods, and interpretation according to sound logic. In the

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Owyhee Subbasin Plan, we make every attempt to incorporate best available information based on scientific research.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

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Response to Gene Davis' Comments
May 16, 2004

Gene Davis
790 E. 11 North
Mountain Home, ID 83647

Dear Gene Davis:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) has been posted on the www.Owyhee.us web site:

- Comment #1: Gene Davis noted that the reach entitled 'Battle Creek #2' should not be rated at all because of the zero confidence. He questioned why 'Shoofly Creek' was ranked with zero confidence as well. He also noted that 'Dry Creek #1 and #2' are reaches that are dry seven out of ten years, with no water running in them at all. He explained that there is some riparian vegetation, but the reaches shouldn't be considered for red band trout habitat due to the lack of water.

Your comment has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

The Qualitative Habitat Assessment tool was designed to incorporate various levels of information – "hard" (quantitative) scientific data, expert opinion of professionals, and inferences based on best available information and reasonable hypotheses. In cases where a quantitative assessment of habitat condition and/or redband trout population sampling had not been conducted on a specific reach – it is reasonable for fishery and habitat experts to make inferences from adjacent or nearby reaches that have similar characteristics. Even if the stream reaches had a confidence ratings of "0" (zero) it should not be eliminated from the QHA analysis and results according to Jeff Fryer (Oregon Technical Team). Dr. Fryer stated: "Biologists doing the rating who know the area can do a good job of inferring from other data how a reach should rate. If the biologist knows the land use, has data from upstream and/or downstream of the reach in question, or has knowledge of other similar reaches in the area, the rating given has a good chance of being accurate. Low confidence should be taken into account when looking at the results and coming up with a subbasin plan. For example, if a reach has high current or restoration value, but low confidence, filling in this data gap could well be one of the priorities of the subbasin plan." We will utilize the low confidence ratings (<1.0) to point out areas where additional research is needed.

We noted your information about 'Dry Creek #1 and #2 relative to water flow and redband riparian conditions and habitat. Derron Frederick also commented that these stream segments are usually dry. We will consult with the biologists who rated those reaches regarding specific scores and flow regimes; if we find any conflicting information we will contact you to help resolve the issues.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg

Steven C. Vigg
Principal
Steven Vigg & Company

SCV

42418 East Larch Mountain Road, Corbett, OR, 97019 ● vigg@earthlink.net ● (503) 695-3433

Response to Derron Fredrick's Comments

May 16, 2004

Derron Frederick
Grand View, ID 83624

Dear Derron Frederick:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) have been posted on the www.Owyhee.us web site:

- Comment #1: Derron Frederick noted that Bruce Zoellick, the leading scientist in the QHA assessment for the Idaho stream reaches, has a personal agenda for this area and his data is biased.
- Comment #2: Derron Frederick commented that Rock Creek only has water in the spring and there are no fish within this stream.
- Comment #3: Derron Frederick stated that Dry Creek (reach 1 and 2 on page 9 of the handout) are always dry. He stated that the lack of existing water is such that they have to have a pipeline to water cattle in that area. He also noted that Shoofly Creek #3 is on private land and the only time there is water there is when there is flood water. He explained that the water down below in this reach is only wastewater from the canal. In fact, he stated that several people farm through what they are calling a creek.
- Comment #4: Derron Frederick stated that in the Owyhee River Basin, most of the Red Band Trout exist on private ground or in areas that are only accessed through private ground. He stated that if the process continues to proceed with unfair assessments that use agenda-based science that the local landowners will lock up there lands and will no longer provide access through their lands to these areas.

Your comments have been reviewed by the Owyhee Planning and Technical teams and we provide the following responses:

- Response to comment #1

The Owyhee Technical Team includes Bruce Zoellick as a representative of the Bureau of Land Management, Bruneau Resource Area. I consider Bruce Zoellick to be to be a qualified and knowledgeable biologist with significant experience in field research related to Owyhee River habitats and fish ecology. Several other professional biologists provided input to the Idaho QHA workshops, including Pam Druliner, Bonnie Hunt, Eric Lietzinger, Keith Meyer, Tim Dykstra, and me – none of these biologists have indicated that Bruce Zoellick presented biased data in the QHA process.

- Response to comment #2

Thank you for the information on Rock Creek seasonal flows and lack of fish life.

- Response to comment #3

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We have taken note of your comments on Dry Creek (reach 1 and 2 on page 9 of the handout) and Shoofly Creek reach 3. We will consult with biologists that are familiar with these reaches and post any additional information or follow-up responses to your observations on the Owyhee.us web site.

- Response to comment #4

We agree that private land has important redband trout habitat, and encourage your participation in future restoration efforts.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

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Response to Jeanette Hemenway's Comments
May 16, 2004

Jeanette Hemenway
Grand View, ID 83624

Dear Jeanette Hemenway:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comments have been posted on the www.Owyhee.us web site:

- Comment #1: Jeanette Hemenway commented that she had come to the meeting because she had seen a program on television where the Indians claimed to have owned the Snake River. She said she was 86 years old, had lived here all her life, and has had established water rights. She explained that she has always respected the Indians, but can't understand why fish are more important than her and her descendants. Steve Vigg commented that he was not aware of this television program. Guy Dodson noted that she was most likely referring to a program that ran on Idaho Public Television (Channel 4).
- Comment #2: Jeanette Hemenway noted that her grandparents were here in 1904, and that there was not the amount of salmon present in the Snake River that people were claiming.

Your comments have been reviewed by the Owyhee Planning and Technical teams and we provide the following responses:

- Response to comment #1

I cannot foresee any circumstance in which the Owyhee Subbasin planning process will affect your established water right. Furthermore, the Owyhee Subbasin plan is not related to any Indian water rights litigation.

- Response to comment #2

We note your historical information based on your grandparents observation. Quantitative monitoring of anadromous salmon and steelhead spawning runs began with the construction of mainstem Columbia River system dams and ladders – for example, Bonneville Dam on the lower Columbia River in 1938. Data on numbers of salmon and steelhead entering the lower Snake River has been monitored by U.S. Army Corps of Engineers at mainstem dams since 1961. Since the Owyhee Dam (completed in 1933) did not have any functional passage facilities for adult or juvenile salmonids, the salmon runs ascending the Owyhee River could not be directly counted. Idaho Power Company has made estimates of pre-impact anadromous salmonid production in the Mid-Snake reach above Hells Canyon Dam (information is available on the IPC web site).

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation

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for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

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Response to Dana Rutan's Comments

May 16, 2004
Dana Rutan
Grand View, ID 83624

Dear Dana Rutan:
Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) have been posted on the www.Owyhee.us web site:

- Comment #1: Dana Rutan expressed his concerns about the redband trout habitat designation in many of the stream reaches as they are not naturally cool enough to sustain redband trout populations. He further explained his concern that such an inaccurate designation will be used to justify the removal of cattle from these areas in the future, as this will be seen by land managers as the only solution.
- Comment #2: Dana Rutan stated that the bottom line solution will be to kick cattle off of the range. He questioned why we should get money to protect fish that have obviously adapted to existing habitat conditions.
- Comment #3: Dana Rutan stated that while the Owyhee Dam may have blocked some fish migration, it multiplied the amount of food produced within the area by more than fifty times.
- Comment #4: Dana Rutan commented that it is not right to rank streams with a zero confidence rating. Giving an area a low score without any data is not fair.
- Comment # 5: Dana Rutan noted that Combination Creek dries up. He also explained that Boulder Creek has lots of willows and is in very good riparian condition.

Your comments have been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

Redband trout presence has been verified in many of the habitats listed in the QHA analysis and water temperatures have been monitored in many more of the habitats. Any habitats that were known to have naturally occurring temperatures that are too high to sustain redband trout populations were deleted from the analysis.

- Response to comment #2

No one is proposing to eliminate cattle from the Owyhee range. Some habitats have changed for redband trout due to anthropogenic impacts, and in some cases measures are needed to protect and restore fish. As you noted in comment #1, redband trout can be excluded from some stream habitats if conditions are not suitable.

- Response to comment #3

We agree that irrigated agriculture in the Owyhee Subbasin currently provides significant amounts of human food production. We would be interested in scientific data that showed the relative biomass production from irrigated crops (currently) and pre-impact production of anadromous salmonids in the Owyhee River system.

- Response to comment #4

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The Qualitative Habitat Assessment tool was designed to incorporate various levels of information – “hard” (quantitative) scientific data, expert opinion of professionals, and inferences based on best available information and reasonable hypotheses. In cases where a quantitative assessment of habitat condition and/or redband trout population sampling had not been conducted on a specific reach – it is reasonable for fishery and habitat experts to make inferences from adjacent or nearby reaches that have similar characteristics. Stream reaches had a confidence ratings of "0" (zero) should not be eliminated from the QHA analysis and results according to Jeff Fryer (Oregon Technical Team). Dr. Fryer stated: “Biologists doing the rating who know the area can do a good job of inferring from other data how a reach should rate. If the biologist knows the land use, has data from upstream and/or downstream of the reach in question, or has knowledge of other similar reaches in the area, the rating given has a good chance of being accurate. Low confidence should be taken into account when looking at the results and coming up with a subbasin plan. For example, if a reach has high current or restoration value, but low confidence, filling in this data gap could well be one of the priorities of the subbasin plan.”

- Response to comment #5

We note your specific information on Combination Creek and Boulder Creek. It is our understanding that, although Combination Creek is dry during part of the year, it supports relatively high numbers of redband trout on a seasonal basis. Boulder Creek was given a fairly good rating on riparian condition in the QHA analysis., i.e. 2.0-2.5 for reaches of South Boulder Creek and 3.0-3.5 for North Boulder Creek.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

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Thank you,

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Response to John Urquidi's Comments
May 16, 2004

John Urquidi
34276 Hotcreek Rd.
Bruneau, ID 83604

Dear John Urquidi:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) have been posted on the www.Owyhee.us web site:

- Comment #1: John Urquidi asked if there were two Shoofly Creeks because he was only familiar with the Shoofly Creek that was located in the Bruneau drainage. Pam Smolczynski noted later that there is a Shoofly Creek in the Owyhee Subbasin. It is possible that the agency personnel and local landowners use different names for this stream reach.
- Comment #2: John Urquidi asked how Steve Vigg had documented that pre-1933 salmon runs existed in the Owyhee River Basin. He wondered where he had documented that these supposed salmon runs were eliminated by the construction of the Owyhee Dam.
- Comment #3: John Urquidi commented regarding the attribute rating and definition of normative used in the QHA models. He stated that normal conditions in the Owyhee drainage have unique variances from other areas. For example, spring temperatures are hotter in the Owyhees than in other areas, and juniper invasions cause dewatering of the drainages. These are just two of the many variances occurring within the Owyhee Subbasin. He stated his opinion that more work needs to be done to establish baseline data and the definition of normal.
- Comment #4: John Urquidi noted that a confidence rating of 0 is confusing. He stated that it should not have been ranked in all columns as 0 indicated no factual knowledge. He suggested that areas with 0 confidence should state not/rated in the notes of the model and only include numbers to meet the computer models requirements.

Your comments have been reviewed by the Owyhee Planning and Technical teams and we provide the following responses:

- Response to comment #1

Pam Smolczynski answered this question during the meeting — and replied that there is a Shoofly Creek in the Owyhee Subbasin.

- Response to comment #2

The Idaho Power Company has made estimates of pre-impact anadromous salmonid production in the reach above Hells Canyon Dam – refer to their web site for documentation. We understand that the Shoshone-Paiute Tribe is currently making estimates of pre-impact anadromous salmonid abundance {contact Guy Dodson (208-

759-3246) for more information}. Refer to §4.2.1 of the Owyhee Subbasin Management Plan for historical data on salmon distribution in the Owyhee.

- Response to comment #3

We agree more baseline data on existing habitat conditions would be useful. The QHA does not use "normal" conditions as a reference point (which has a statistical definition); instead it uses a "normative" condition which is defined as: "ideal conditions for similar stream in this ecological province".

- Response to comment #4

The Qualitative Habitat Assessment tool was designed to incorporate various levels of information – "hard" (quantitative) scientific data, expert opinion of professionals, and inferences based on best available information and reasonable hypotheses. In cases where a quantitative assessment of habitat condition and/or redband trout population sampling had not been conducted on a specific reach – it is reasonable for fishery and habitat experts to make inferences from adjacent or nearby reaches that have similar characteristics. Even if the stream reaches had a confidence ratings of "0" (zero) it should not be eliminated from the QHA analysis and results according to Jeff Fryer (Oregon Technical Team). Dr. Fryer stated: "Biologists doing the rating who know the area can do a good job of inferring from other data how a reach should rate. If the biologist knows the land use, has data from upstream and/or downstream of the reach in question, or has knowledge of other similar reaches in the area, the rating given has a good chance of being accurate. Low confidence should be taken into account when looking at the results and coming up with a subbasin plan. For example, if a reach has high current or restoration value, but low confidence, filling in this data gap could well be one of the priorities of the subbasin plan." We will utilize the confidence ratings (<1.0) to point out areas where additional research is needed.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

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Thank you,

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Appendix 1.5.5 Comments at the Nyssa, Oregon Meeting on April 6, 2004 – listed by stakeholder.

Dave Bunker's Comments

Comment #1:
Did quite a bit of research in the past couple of weeks before this meeting; BPA has approximately 154 million for 2004; In the past, most money was used to purchase land. There is a ranch in Malheur County that was purchased using BPA funds, and then the water was turned back to the Malheur River to increase in-stream flows for fish. This is not the best us of $1.7 million. It would be better to provide smaller amounts to ranchers and other landowners to make management improvements. BPA spent 3.2 million dollars on a ranch in Grant County. He proposed that there is a better use of 3.2 million dollars. It would have been better to give this money to irrigation districts – would have saved more water while maintaining economic production.

Comment #2:
What are some of the innovative projects being completed with the Council's money? Discussion followed.

Comment #3:
Asked if woody debris improved channel stability; Ray Perkins explained that it depends; discussion followed regarding historic practices.

Comment #4:
For the focal species – high temperature is virtually unimportant at all times; Ray explained that temperature during summer rearing is the most important (ranking of 0-2 instead of 1-4).

Comment #5:
What is the date that the plan is supposed to be completed – May 28, 2004? Is there any between the spill and the management plan? Tom Dayley stated that yes spill is part of the management plan. Discussion followed. Restore fish where habitat exists and where habitats can be reasonably restored. Do you have any projects that will affect water flows for irrigation?

Comment #6:
Asked if there is a change in the NWPCC policy in getting more of the money on the land that is not currently tribal. Tom explained that one of the legal requirements is to give deference to the State Fish & Game Departments, Federal Fish & Game Departments, and the Tribes.

Jay Chamberlin's Comment

Comment #1:
Explained that irrigation diversion makes a difference early in the season, but return flows increase flow later in the season.

Carl Hill's Comment

Comment #1:
Can Tom Dayley verify that this money will be allocated based on priorities? Tom explained that this planning process is suppose to level the playing field as project priorities will be established from the bottom up rather than the top down.

Jennifer Martin's Comment

Comment #1:
How does normative conditions take into account the current existence of dams such as the Owyhee; Ray explained that the process used a reference approach; point of process is to provide justification for projects within the Subbasin.

Ray Perkins' Comments

Comment #1:
We tried not to use the concept of 'pristine' in the ranking process. Everything was ranked a 4 historically and lowered if there was an anthropogenic effect causing degraded habitat conditions.

Comment #2:
BLM would not rank private lands, so he got stuck with it – did the best he could and guessed.

Ed Petersen's Comments

Comment #1:
OSU did a study on surface water temperature a little while back that found that the surface water temperature will move to the ambient air temperature; If this is true, the water is going to track to the higher temperature.

Comment #2:

Noted that everything presented tonight was BPA funding – most of this money goes to Tribes. There has been input about other restoration projects using other funding given to you – will this be included?

Harry Smith's Comments

Comment #1:
Number 5 (High Flow): does 1 mean high flow?

Paul Skeen's Comments

Comment #1:
Isn't there more woody debris since settlement? Early pictures do not show woody vegetation.

Comment #2:
Did you take into account all of the discharge going back into the river from irrigation? Ray explained that you have to look at how this relates to normative. Paul wondered how any of this relates back to anything.

Lou Wettstein's Comments

Comment #1:
What is a geomorphic perspective?

Darrell Williams' Comments

Comment #1:
Wondered what can be done about beavers. Discussion followed. Ray Perkins explained that reservoirs were thrown out and tried to only rank live streams.

Lawrence Ziemer's Comments

Comment #1:
Has there been any thought given to the aquifer that local irrigation creates? DEQ has some information on this. Tom Dayley suggested that this could be part of future strategies.

Comment #2:
Asked if they took temperature readings of the lower reaches of Cow Hollow Creek before it entered the Owyhee River?

Comment #3:
Why is the Indian Tribe the leader in improving habitat for Redband Trout. Why isn't ODFW stepping up and making the improvements? Ray Perkins explained that they have limited staff – him. What is the end result of this plan – are they going to put fish ladders in, take the dams out? Ray explained that this plan will be used to prioritize money for projects within the subbasin.

Appendix 1.5.6 Letters responding to the comments at the Nyssa, Oregon Meeting on April 6, 2004 – listed by stakeholder.

Response to Dave Bunker's Comments

May 23, 2004

Dave Bunker
2705 Heritage Dr.
Nyssa, OR 97913

Dear Dave Bunker:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) have been posted on the www.Owyhee.us web site:

- Comment #1: Did quite a bit of research in the past couple of weeks before this meeting; BPA has approximately $154 million for 2004; In the past, most money was used to purchase land. There is a ranch in Malheur County that was purchased using BPA funds, and then the water was turned back to the Malheur River to increase in-stream flows for fish. This is not the best use of $1.7 million. It would be better to provide smaller amounts to ranchers and other landowners to make management improvements. BPA spent 3.2 million dollars on a ranch in Grant County. He proposed that there is a better use of 3.2 million dollars. It would have been better to give this money to irrigation districts – would have saved more water while maintaining economic production.
- Comment #2: What are some of the innovative projects being completed with the Council's money? Discussion followed.
- Comment #3: Does woody debris improved channel stability?
- Comment #4: For the focal species – high temperature is virtually unimportant at all times.
- Comment #5: What is the date that the plan is supposed to be completed? Is there any connection between the spill and the management plan? Discussion followed. Restore fish where habitat exists and where habitats can be reasonably restored. Do you have any projects that will affect water flows for irrigation?
- Comment #6: Asked if there is a change in the NWPCC policy in getting more of the money on the land that is not currently tribal.
-

Your comments have been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1:

The total BPA Fish & Wildlife budget for FY2004 is approximately $154 million (http://www.nwcouncil.org/fw/0405/soy.htm); based on general guidelines, it will be probably be distributed approximately 70% for anadromous fish, 15% for resident fish and 15% for wildlife. Land purchases or conservation easements are usually derived from the 15% allocated to wildlife mitigation and enhancement.

- Response to comment #2:

A summary of nine “innovative projects” funded in 2002 at a total cost of about $2 million is found at the following link on the Northwest Power and Conservation Council’s web site http://www.nwcouncil.org/library/releases/2002/0814.htm .

Columbia River systemwide:
Project No. 34008, compile and compare data from habitat restoration projects in multiple watersheds to enhance the rate of learning about effects of restoration actions on fish populations, optimize the design of future restoration programs and improve monitoring.
Project 34002, develop better protocols for spawning salmon in Columbia River Basin hatcheries and assess reproductive success of individual fish in hatcheries.
Project 34005, use recent advances in DNA microarray technology to address genetic issues underlying questions related to hatchery management and interactions of wild and hatchery fish populations.
Idaho:
Project 34019, evaluate the relationships among river discharge, subsurface (hyporheic) zone characteristics, and egg pocket water temperature in Snake River fall chinook salmon spawning areas and evaluate the potential for improving Snake River fall chinook salmon smolt survival.
Project 34022, identify population structure of indigenous chinook salmon in the Middle Fork Salmon River of Idaho from patterns of genetic variation.
Project 34036, develop a calibration tool to enable analysis of biological productivity for streams and rivers throughout the Columbia River Basin, to be demonstrated on a subbasin of the Salmon River in Idaho (yet to be determined).
Washington:
Project 34001, monitor the occurrence of salmon pathogens and assess sources, fate and transport of pathogens in the upper middle Columbia River.
Project 34030, increase water infiltration during high precipitation periods by adopting proper agriculture practices, and use land and aquifers to temporarily store water for subsequent release into streams for flow enhancement and temperature control. The project would take place in Asotin Creek.
Oregon:
Project 34023, test hydraulics and biological safety (injury and mortality) of a new design for fish screens. The design in question is called an undershot horizontal flat plate screen, in which water flows under the screen rather than over the top of it. The project would test the ability of the undershot design to pass fish, sediment and debris as compared to an overshot screen. The screen would be tested in Elliot Creek, a tributary of the Hood River.
Lower Columbia River, Oregon and Washington:
Project 34021, explore the role of American shad in Columbia River food webs to better understand shad and fall chinook salmon feeding ecology in the Columbia River. The study would take place in the lower Columbia River of Oregon and Washington.

- Response to comment #3:

During the meeting, Ray Perkins explained that it depends on the specific situation; discussion followed regarding historic practices.

- Response to comment #4:

Water temperature is a very important habitat attribute for redband trout in the Owyhee Subbasin – especially maximum temperatures during the summer. During the meeting, Ray Perkins explained that temperature during summer rearing stage was rated the highest; i.e., a rating of 2.0 – on a scale of zero to 2.0 – in the QHA Species Hypothesis.

- Response to comment #5:

The draft Subbasin Plan is scheduled for completion on May 28, 2004. During the public outreach meeting, Tom Dayley stated that yes spill is part of the management plan (referring to the Columbia Basin, not the Owyhee Subbasin). The Subbasin Plan outlines Objectives and Strategies – it doesn't propose specific projects. In the past, a water rental strategy has been employed by BPA to provide more instream flows in some other subbasins. The Owyhee Subbasin Plan does not include any specific objectives or strategies to reduce water flows for irrigation.

- Response to comment #6:

Tom Dayley explained that one of the legal requirements is to give deference to the State Fish & Game Departments, Federal Fish & Game Departments, and the Tribes.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg

Steven C. Vigg
Principal
Steven Vigg & Company

SCV

Response to Jay Chamberlin's Comment

May 23, 2004

Jay Chamberlin
Owyhee Irrigation District
17 S. 1st Street
Nyssa, OR 97913

Dear Jay Chamberlin:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) has been posted on the www.Owyhee.us web site:

- Comment #1: Explained that irrigation diversion makes a difference early in the season, but return flows increase flow later in the season.

Your comment(s) has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

I wish to thank you for the information you provided at the Nyssa Public meeting regarding irrigation return flows. I also appreciate your response to my additional request regarding water distribution and use for irrigated agriculture in the Owyhee Subbasin, and other statistics pertaining to the operation of the Owyhee Irrigation District. The information you provided has been incorporated into Sections "4.2.2.1 Water Use", and "4.2.2.2 Current Land Use" – of the Owyhee Subbasin Management Plan (Chapter 4).

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven Vigg
Principal
Steven Vigg & Company

SCV

Response to Carl Hill's Comment
May 22, 2004

Carl Hill
2221 Locust Rd.
Nyssa, OR 97913

Dear Carl Hill:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment has been posted on the www.Owyhee.us web site:

- Comment #1: Can Tom Dayley verify that the money will be allocated based on priorities?

Your comment(s) has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

During the public meeting, Tom explained that this planning process is supposed to level the playing field as project priorities will be established from the bottom up rather than the top down. The Council's ISRP has stated that the Subbasin plans should prioritize objectives and strategies – and this prioritization will be the basis for funding projects in the future.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg
Principal
Steven Vigg & Company

SCV

Response to Jennifer Martin's Comment
May 22, 2004

Jennifer Martin
Owyhee Watershed Council
2925 SW 6th Ave. Suite 2
Ontario, OR 97914

Dear Jennifer Martin:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) has been posted on the www.Owyhee.us web site:

- Comment #1: How does normative conditions take into account the current existence of dams such as the Owyhee; Ray explained that the process used a reference approach; point of process is to provide justification for projects within the Subbasin.

Your comment has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

In order for a specific Owyhee stream reach to be "normative" within the context of the QHA model, it would have to be "Ideal conditions for similar stream in this ecological province" -- and it therefore could not be impacted by a dam, for example the Owyhee Dam. To check on my interpretation of this issue, I consulted Jeff Fryer -- the TOAST expert on QHA who has advised us all through this process. The following are the questions I asked Jeff and the responses that he provided. 1) Regarding the definition of "normative". Within the QHA model that was used how do normative conditions take into account the current existence of dams such as the Owyhee? Jeff Fryer's Answer: Normative, the way it was used in the Owyhee, does not take into account the current existence of dams. This is quite similar to the way most of the rest of the subbasins are handling this issue; the reference condition is assumed to be circa 1840 or so conditions. If one of the reaches dominated by a dam were to rate highly for restoration, I suspect that at that point they would say for economic and social reasons we can't restore this reach. Or perhaps they might propose some way to manage the dam to provide some of those potential restoration benefits by, for example, proposing a fish ladder be built. (2) Would the 100% normative condition (rating of 4) include the existence of dams such as the Owyhee? Jeff Fryer's Answer: A rating of 4 would preclude the existence of dams, which I think is the correct way to rate dams as I mentioned in (1).

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg
Principal
Steven Vigg & Company

SCV

Response to Ray Perkins' Comments
May 23, 2004

Ray Perkins
Oregon Department of Fish & Wildlife
3814 Clark Blvd.
Ontario, OR 97914

Dear Ray Perkins:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comments, recorded by Jennifer Martin at the meeting, have been posted on the www.Owyhee.us web site:

- Comment #1: We tried not to use the concept of 'pristine' in the ranking process. Everything was ranked a 4 historically and lowered if there was an anthropogenic effect causing degraded habitat conditions.
- Comment #2: BLM would not rank private lands, so he got stuck with it – did the best he could and guessed.

Your comment(s) have been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

Ray, we thank you for your clarification of this issue at the public meeting. Your response was consistent with the following definition of "normative" that we used in the QHA workshops: In order for a specific Owyhee stream reach to be "normative" within the context of the QHA model, it would have to be "Ideal conditions for similar stream in this ecological province" -- and it therefore could not be impacted by a dam, for example the Owyhee Dam. Your response was also consistent with the interpretation of "normative" provided by Dr. Jeff Fryer, of the Oregon technical team. The following are two questions I asked Jeff and the responses that he provided. 1) Regarding the definition of "normative". Within the QHA model that was used how do normative conditions take into account the current existence of dams such as the Owyhee? Jeff Fryer's Answer: Normative, the way it was used in the Owyhee, does not take into account the current existence of dams. This is quite similar to the way most of the rest of the subbasins are handling this issue; the reference condition is assumed to be circa 1840 or so conditions. If one of the reaches dominated by a dam were to rate highly for restoration, I suspect that at that point they would say for economic and social reasons we can't restore this reach. Or perhaps they might propose some way to manage the dam to provide some of those potential restoration benefits by, for example, proposing a fish ladder be built. (2) Would the 100% normative condition (rating of 4) include the existence of dams such as the Owyhee? Jeff Fryer's Answer: A rating of 4 would preclude the existence of dams, which I think is the correct way to rate dams as I mentioned in (1).

- Response to comment #2

Ray, we thank you for your professional judgment on the ranking of streams on private lands. Dr. Jeff Fryer (Oregon Technical Team) made the following statement about the inferences made by local fish & wildlife experts: “Biologists doing the rating who know the area can do a good job of inferring from other data how a reach should rate. If the biologist knows the land use, has data from upstream and/or downstream of the reach in question, or has knowledge of other similar reaches in the area, the rating given has a good chance of being accurate.”

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg
Principal
Steven Vigg & Company

SCV

Response to Ed Petersen's Comments

May 23, 2004

Ed Petersen
NRCS
2925 S.W. 6th Ave., Ste. 2
Ontario, OR 97914

Dear Ed Petersen:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) have been posted on the www.Owyhee.us web site:

- Comment #1: OSU did a study on surface water temperature a little while back that found that the surface water temperature will move to the ambient air temperature; If this is true, the water is going to track to the higher temperature.
- Comment #2: Noted that everything presented tonight was BPA funding – most of this money goes to Tribes. There has been input about other restoration projects using other funding given to you – will this be included?

Your comments have been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1:

A large body of research data and models exist related to factors affecting water temperature in streams – air temperature is one important contributing factor. Streams in arid country may have relatively deep pools that stratify during low flow conditions allowing for warm temperatures at the surface, while relatively cool water temperatures persist at the bottom. Furthermore, subterranean flow may connect stream reaches that are interrupted at the surface, i.e., exhibit alternating dry versus watered segments. The Corps of Engineers has developed a temperature model and study proposal for the Snake River mainstem reservoirs:
http://www.nwd-wc.usace.army.mil/TMT/2000/agendas/NMFStempmonitorproposal.htm
.

- Response to comment #2:

Yes, the Owyhee Subbasin Plan includes an "Inventory of Existing Restoration Activities" (Chapter 3) that summarizes available information on both BPA-funded projects and restoration projects from other sources. The information compiled by Jennifer Martin – from the Malheur County Soil & Water Conservation District, the Oregon Natural Resources Conservation Service, and questionnaire responses – will be included in the inventory.

Owyhee Subbasin Plan

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg
Principal
Steven Vigg & Company

SCV

Response to Harry Smith's Comment

May 23, 2004

Harry Smith
3631 Lincoln Dr.
Ontario, OR 97914

Dear Harry Smith:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) has been posted on the www.Owyhee.us web site:

- Comment #1: Number 5 (High Flow): does 1 mean high flow?

Your comment(s) has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1:

The definition of Number 5 – High flow is "Frequency and amount of high flow events". In the QHA analysis, each attribute was rated on a scale of 0 to 4, according to the following key:

Score	Attribute Rating	Normative (definition)
0	0% of normative	Ideal conditions for similar stream in this ecological province. Note that this is more from a geomorphic perspective than a biological perspective.
1	25% of normative	
2	50% of normative	
3	75% of normative	
4	100% of normative	

Therefore, a rating of "1" for high flow indicates that the frequency and amount of high flow events was at 25% of the "normative" – i.e., 25% of the ideal conditions for similar streams in the Owyhee System and Mid-Snake Province. Thus, "1" means a relatively low frequency and low magnitude of high flow events.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg

Steven C. Vigg
Principal
Steven Vigg & Company

SCV

Owyhee Subbasin Plan

Response to Paul Skeen's Comments

May 23, 2004

Paul Skeen
2871 Clark Blvd.
Nyssa, OR 97913

Dear Paul Skeen:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) have been posted on the www.Owyhee.us web site:

- Comment #1: Isn't there more woody debris since settlement? Early pictures do not show woody vegetation.
- Comment #2: Did you take into account all of the discharge going back into the river from irrigation? Paul wondered how any of this relates back to anything.

Your comment(s) have been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1:

Riparian and wetland habitats dominated by woody plants are scarce but important habitats found throughout the Owyhee Subbasin of southeast Oregon, southwest Idaho, and north-central Nevada. Mountain alder-willow riparian shrublands are major habitats in the forested zones of eastern Oregon. Eastside lowland willow and other riparian shrublands are the major riparian types throughout eastern Oregon at lower elevations. Black cottonwood riparian habitats occur throughout eastern Oregon, at low to middle elevations. White alder riparian habitats are restricted to perennial streams at low elevations, in drier climatic zones in Hells Canyon at the border of Oregon and Idaho, in the Malheur River drainage.

Eastside (Interior) riparian-wetlands habitat (Source: nwhi.org/ibis).

Quigley and Arbelbide (1997) concluded that the Cottonwood-Willow cover type covers significantly less in area now than before 1900 in the Inland Pacific Northwest. The authors concluded that although riparian shrubland was a minor part of the landscape, occupying 2%, they estimated it to have declined to 0.5% of the landscape. Approximately 40% of riparian shrublands occurred above 3,280 ft (1,000 m) in elevation pre-1900; now nearly 80% is found above that elevation. This change reflects losses to agricultural development, roading, dams and other flood-control activities. The current riparian shrublands contain many exotic plant species and generally are less productive than historically. Quigley and Arbelbide (1997) found that riparian woodland was always rare and the change in extent from the past is substantial.

- Response to comment #2:

During the meeting, Ray Perkins explained that you have to look at how agricultural return flows relates to the normative stream flow condition – i.e., before irrigation water was removed from the river in the first place.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg

Steven C. Vigg
Principal
Steven Vigg & Company

SCV

Response to Lou Wettstein's Comment

May 23, 2004

Lou Wettstein
3689 Alameda Dr.
Ontario, OR 97914

Dear Lou Wettstein:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) has been posted on the www.Owyhee.us web site:

- Comment #1: What is a geomorphic perspective?

Your comment(s) has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

The term is used, in the context of QHA analysis, to put the "normative" definition into context:

Score	Attribute Rating	Normative (definition)
0	0% of normative	Ideal conditions for similar stream in this ecological province. Note that this is more from a **geomorphic perspective** than a biological perspective.
1	25% of normative	
2	50% of normative	
3	75% of normative	
4	100% of normative	

A "geomorphic perspective" relates to the attribute rating being referenced to "*ideal conditions"* given the "lay of the land" or natural environmental limitations within the Owyhee Subbasin; not necessarily the ideal conditions for the species within its optimum habitat – which would be the biological perspective. Therefore, "ideal conditions" from a geomorphic perspective is a lower standard than "ideal conditions" from a strictly biological perspective.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg
Principal
Steven Vigg & Company

SCV

Response to Darrell Williams' Comments
May 23, 2004

Darrell Williams
1349 Klamath Ave.
Nyssa, OR 97913

Dear Darrell Williams:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) has been posted on the www.Owyhee.us web site:

- Comment #1: Wondered what can be done about beavers.

Your comment has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

During the meeting, Ray Perkins explained that QHA was not conducted on reservoirs or ponds; and we only ranked flowing streams. American Beaver habitat is usually limited by agriculture. Riparian habitat along many water ways has been removed in order to plant agricultural crops, thus removing important habitat and food sources for beaver. All wetland cover types (e.g., herbaceous wetland and deciduous forested wetland) must have a permanent source of surface water with little or no fluctuation in order to provide suitable beaver habitat (Slough and Sadleir 1977). Beavers can usually control water depth and stability on small streams, ponds, and lakes. In riverine habitats, stream gradient is the major determinant of stream morphology and the most significant factor in determining the suitability of habitat for beavers (Slough and Sadleir 1977). Stream channel gradients of 6 percent or less have optimum value as beaver habitat; few beaver colonies are found in streams with a gradient of 15 percent or more. Woody and herbaceous vegetation comprise the diet of the beaver. Herbaceous vegetation is a highly preferred food source throughout the year, if it is available. Woody vegetation may be consumed during any season, although its highest utilization occurs from late fall through early spring. It is assumed that woody vegetation (trees and/or shrubs) is more limiting than herbaceous vegetation in providing an adequate food source. Food preferences of beavers throughout North America are: Aspen, Willow, Cottonwood; and Alder.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg

Steven C. Vigg
Principal
Steven Vigg & Company

SCV

Response to Lawrence Ziemer's Comments

May 23, 2004

Lawrence Ziemer
2626 Mitchell Butte Rd.
Nyssa, OR 97913

Dear Lawrence Ziemer:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) have been posted on the www.Owyhee.us web site:

- Comment #1: Has there been any thought given to the aquifer that local irrigation creates? DEQ has some information on this.
- Comment #2: asked if they took temperature readings of the lower reaches of Cow Hollow Creek before it entered the Owyhee River.
- Comment #3: Why is the Indian Tribe the leader in improving habitat for Redband Trout. Why isn't ODFW stepping up and making the improvements? What is the end result of this plan – are they going to put fish ladders in, take the dams out?

Your comment(s) have been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1:

During the meeting, Tom Dayley suggested that this could be part of future strategies.

- Response to comment #2:

We are not certain regarding the availability of water temperature measurements of the lower reaches of Cow Hollow Creek before it enters the Owyhee River.

- Response to comment #3:

During the meeting, Ray Perkins explained that they ODFW has limited fisheries staff in the Owyhee Subbasin – him. Ray further explained that this plan will be used to prioritize money for enhancement projects within the subbasin. The end result of the Owyhee Subbasin Plan will be the cost-effective implementation of high priority objectives and strategies to enhance fish, wildlife, and the habitats they depend on for survival and sustainability. The Owyhee Subbasin Plan does not recommend removing Owyhee Dam or constructing a fish ladder at the dam.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg

Steven C. Vigg
Principal
Steven Vigg & Company

SCV

Appendix 1.5.7 Comments at the Jordan Valley, Oregon Meeting on April 7, 2004 – listed by stakeholder.

Leonard Beitz's Comment

Comment #1:
The evaluation of the streams by DEQ includes natural pollutants.

Jerry Hoagland's Comment

Comment #1:
Asked if normative could be explained; Ray Perkins of ODFW explained that model uses reference condition (prior to European development) to compare with current conditions – if we made lots of changes, the reach got a low score – if few changes, got a high score.

Elias Jaca's Comment

Comment #1:
I don't want to be forced into using hand line sprinklers on my mountain pastures.

Vernon Kershner's Comments

Comment #1:
P.2 of the limiting factors in the middle Flint Creek #1 and Flint Creek #2 (on the Idaho side) – lower reach confidence is 0.5 and then they identified pollutants and fine sediment as a limiting factor. Where do we go to look to see what pollutants, etc.?

Comment #2:
Deer Creek (ID) has obstruction listed as the limiting factor – what obstruction are you talking about?

Comment #3:
Who are the biologists that did the assessments?

Tim Lowry Comments

Comment #1:
How will this plan impact agency plans? If the strategy is to improve riparian function for fish habitat – won't the agencies use this as a basis for management actions?

Discussion followed. Is this just for private land? No. BPA will not fund projects that are the responsibility of other federal agencies.

Comment #2:
Juniper Creek 1 and Juniper Creek 2 reaches attribute #6 (low flow) got a higher rating when it is dry. If you used BLM information in this area, you are on shaky ground. Attribute #10 pollutants are rated a 2- why is this area considered 50% of normative? His experience has been that when bad science and negative results get written down on paper, it becomes gospel and hurts local people. He is still suspicious that this will be used by people with an agenda.

Dennis Stanford's Comment

Comment #1:
The previous fish and wildlife program has affected us through BLM (in reference to the powerpoint presentation suggesting that previous NWPCC plans have not impacted the area).

Jesse White's Comments

Comment #1:
Jordan Creek #8 on page 3 (State Lands to Headwaters) pollutants are listed as a 1 – what are the pollutants in this reach? Is it the potential for pollution or actual pollution? Ray Perkins stated that in the Oregon portion they used actual pollution.

Comment #2:
It was suppose to be a consistent process throughout the subbasin, but it is obvious that there were inconsistencies between the assessments of the three different states; are man-made pollutants and natural pollutants rated in the same manner? No, if it is a natural pollutant that would not be a basis for restoration or a low score in this QHA model.

Pam White's Comment

Comment #1:
Questioned that if the vision is to mitigate the impacts to anadromous fish, why is this an issue if they did not exist in this subbasin; the mainstem of the Owyhee River is a warm water fishery – some of the feeder creeks are cold water, but the mainstem of the river never has been; prior to the 1930's there were sturgeon, trash fish, etc… but there were not salmon in the mainstem of the Owyhee River.

Michael Hanley's Comment Letter {Mailed April 13, 2004}

Dear Mr. Vigg:

On 7 April 2004 I attended the Owyhee Subbasin question and answer meeting at Jordan Valley. In Attendance were ranchers, farmers and Indians from Duck Valley.

All of us were and are concerned about our most valuable resource, water. However, the purpose of the Owyhee Subbasin Assessment relied heavily on what they called silver (fish) and bucks (deer). Also it was stated that the assessment was to determine a method of mitigating situations resulting from the Bonneville Power Administration appropriation of water for other purposes rather than those promised Indians under treaty.

Let me remind you, that other upstream users, ranchers and farmers in many cases appropriated water under state law for agricultural purposes prior to the Bonneville Administration origin.

I write this because I don't want the focus of the entire program directed toward Tribal objectives and not those of other prior users.

Nobody is more sympathetic to Tribal claims than me but the federal government encouraged settlement of the west and the infrastructure that made it economically viable. All of us benefit from the development of resources which includes hydro generation and all of us must share in mitigating circumstances that arose from it. That includes city people whom appear to be out of the picture. The focus is on the cowboys and Indians who have already given impropriation more that the others.

I don't know anything about the people who did the assessments for Oregon and Nevada, but I do know those who did it for Idaho. Individual ranchers, Owyhee County and Owyhee Cattlemen's Association have appealed the 1997 Owyhee as prepared by the BLM on the grounds that much of the data lacks scientific credibility. For example, the assessment claims that last summer Redband Trout were found on the Owyhee at the stretch from Three Forks to the Warm Springs. They claimed the feeder streams which I suppose were the Middle Fork and North Fork because too warm so they migrated to a cooler place. I'd question this because the river is very warm there because of the warm springs. Other reasons could have been the reason?

Perhaps it's mentioned in the assessment about the amount of water Juniper encroachment is taking from the basin.

I am also questioning mercury pollution which appears to be a problem both naturally and man caused. From the assessment it doesn't appear to be a problem in the Owyhee River on the Oregon stretch.

Sometimes I think we're trying to create a Polly Anna world on the Owyhee that never existed and never will. Back to silver and bucks. There has to be a balance because the interest demands it. Not everybody fishes or hunts, but all of us benefit from the power generated by the hydro power system and all of us enjoy the food produced with the electricity and water.

Last thing: Perhaps of interest, maybe not, John Harney a longtime resident of Duck Valley told me when I asked him if he remembered salmon in the Owyhee. "When salmon come, they die in the water. Some wash up on the banks and others catch on gravel bars. It smelled so bad you can't ride a horse to the river."

I hope the Owyhee Subbasin Assessment doesn't wind up smelling like the salmon…. Time will tell.

s/ Michael Hanley

Mike Hanley
PO Box 271
Jordan Valley, OR 97910

{Handwritten letter typed by Laurie Pickering, Steven Vigg & Company on 4-16-04}

{Editorial Note: the following e-mail comments (attachment) received by Steve Vigg on 5-19-04}

COMMENTS/DISCUSSION ON THE DRAFT OWYHEE SUBBASIN MANAGEMENT PLAN (version presented by Steve Vigg April 28, 2004)

Comments will be referenced to section number and/or page whichever is more appropriate for clarity.

Steve,

I provide the following comment and discussion and request this be incorporated into the draft Owyhee Subbasin Management Plan:

Page 35, Section 4.2.2.2 Current Land Use:

Section 4.2.2.2.6, Page 37: BLM Grazing Allotments: The data cited regarding percentages of Owyhee Resource Area riparian areas not in satisfactory condition has been repeatedly challenged by permittees and by Owyhee County. (see Owyhee County comment on draft BLM-ORMP on page 3) Challenges have been raised on the quality of the data, absence of data, use of untrained personnel to collect data, and the agency's failure to adhere to the established BLM process for conducting riparian assessments. For example, much of the data upon which the PFC assessments were made was collected by a contractor, Scott Miles working for Riparian Resources, who was working as a lone individual doing both data collection and completing riparian PFC assessments. (see Report to Owyhee County Natural Resources Committee by Dr. Chad Gibson page 14) This is clearly not consistent with BLM procedures which require a qualified team for conducting PFC. During his contract employment with BLM in fact, Mr. Miles became uncomfortable with his PFC assessments and ceased to make the assessment, restricting his work to only collecting the data for later analysis by BLM personnel who were not present during data collection. But even this approach is not correct in that the BLM process for PFC requires a team evaluation and the evaluation of one man's collected data, by even a "team" of analysts back in the BLM office does not comply with the intent of the procedure for accurately assessing PFC. In addition to the questions regarding the data and stream condition determinations which were derived from the suspect data, the question of why streams in the area are warm is also in dispute. Knowledgeable local persons maintain that the stream temperatures found on many reaches that were determined to be higher than the allowable standard were not related to human activity but rather to natural climatic conditions of the area. This area is hot, high desert country with intermittent streams and a large number of hot springs that feed the heads of the streams or add water flows below the headwaters in those stream segments that continue to contain water late in the season. Further, the "higher than acceptable" water temperatures are based on an artificially established standard for temperature that is not appropriate for this part of Idaho and this fact has been recognized by Idaho Department of Environmental Quality in their comments on EPA's proposed temperature standards for state and tribal governments, and by Don Essig, IDEQ, (The Dilemma of Applying Uniform Temperature Criteria in a Diverse Environment: An Issue Analysis. Nov. 1998). Perhaps the most important fact to consider in regard to stream temperatures in the area is that these warm waters support thriving populations of native Redband Trout. It should also be noted that the "excessively warm" water temperatures noted in such streams as the main stream of the Owyhee support healthy populations of warm water species such as bass, perch, and crappie and these introduced warm water species have outperformed the salmonids in those reaches.

Since the Taylor Grazing Act was passed in 1934, livestock grazing management has become more scientific in its approach and application. Despite the vast improvements made since passage of the Act, livestock operators have significantly improved the condition of the range on which they operate, yet these improvements are frequently ignored or downplayed by individuals, groups, and even agency persons who wish to remake the instructions of the Congress and remove livestock in favor of increased recreational or other uses of the lands.

The document names specific grazing allotments and provides information which is inaccurate, misleading, or unnecessary. On page 38, Sec. 4.2.2.2.6., the Nickel Creek Allotment for example, the plan cites 303d list information which is no longer valid as there has been a completed and approved TMDL on the cited riparian sections. That TMDL found sediment to be the only pollutant present while the draft subbasin plan still leads the reader to believe that other pollutants must be addressed. Of the specific allotments, only the Nickel Creek Allotment did not refer to a PFC assessment in the draft. As previously noted, the riparian assessments and the data from which they were made have been repeatedly challenged by permittees and Owyhee County. No useful subbasin planning purpose is served by presenting the disputed information in this way. Many of the allotment decisions based on the information presented have been appealed by permittees and those appeals are still pending in the Interior Board of Land Appeals system. Inclusion of allotment-by-allotment data in the subbasin plan appears to be yet another attempt by BLM to get disputed data into a published document in an attempt to lend weight to proposed grazing reductions. Because of the published nature of the plan, it can be used as a reference by entities who would file frivolous lawsuits against grazing interests. The inclusion of the allotment-by-allotment data report does not make the subbasin plan better or more complete, it simply provides more opportunity for dispute, conflict, and will potentially lead to resistance on the part of permittees and landowners when asked to become involved in projects that may be developed through this planning process. This cooperative approach to the plan, and its subsequent projects, will be a key need if good things are to be done in the subbasin. It will also be a significant, and welcome, change from the unsuccessful approach used by BLM. In recent years, landowners and permittees have suggested alternatives to grazing management that were capable of accomplishing the stated goal of riparian improvement while maintaining economically viable livestock operations. Each of these suggested solutions have been rejected by BLM staff in favor of the BLM's preferred approach.(see Owyhee County's Comments on the draft BLM-ORMP Page 3) The resulting protests and appeals of allotment decisions are overwhelming the BLM staff's ability to perform effective management and are detrimental to any reasonable attempts to make progress on riparian conditions. If the subbasin plan is to be successful it should avoid the contentious approach that has not worked for BLM and focus instead on a cooperative means of achieving goals that are agreeable to all stakeholders.

A better way to address this section of the plan is through a simple statement of current conditions across the subbasin planning area that would include the geologic or topographic data found as on page 37 of the April 28th draft, a statement of stream conditions by percentages as PFC, unsatisfactory but improving, and unsatisfactory not improving under the current management plan. In addition to reporting data in this more general way, the plan should indicate the source for the above reported percentages and should make specific note as to which reports of unsatisfactory conditions were completed by a process other than the team approach specified by BLM (as with the work done by Riparian Resources/Scott Miles for example).

Section 4.5.1 Endangered Species Act Requirements, Page 80, re Pygmy Rabbits:

The draft plan incorporated some of the arguments raised against using Pygmy Rabbits as a focal species, however the failure to include the entire statement made in opposition to the selection of this species as a focal species tends to misrepresent the reason for the opposition. The draft plan correctly related our concerns that selection of the pygmy rabbit as a focal species would lead to restrictions on human activity in projects that may be selected to improve habitat for the species. However the draft plan left out important points made in the body of the position paper -- points which indicate that the body of scientific data currently available on the status of the species within the subbasin area is so uncertain as to determine its status-- and also left out the concluding sentences of the position paper which indicated why such restrictions on human activity would be inappropriate. The draft should be revised to include the pertinent points cited from the studies done on Idaho populations of the species showing the differences between the listed population in Washington and the variety of conditions of populations within Idaho. It should also be revised to include the final sentences of the concluding paragraph of the position paper which indicate clearly why human activity should not be restricted in favor of pygmy rabbit projects. Those sentences are as follows: "*With the lack of knowledge available on the species and the questions that are raised by the Idaho State Study, such restrictions and potential economic harm are not supportable. What the group should determine to do with the Pygmy Rabbit, rather than using it as a focal species, is to select the species for more study in order to provide for funding of projects to address the data gaps indicated in the study.*"

Thank you,

Jerry L. Hoagland
13528 Reynolds Creek Rd.
Wilson, ID 83641

References from my Comments:

OWYHEE COUNTY'S COMMENTS ON DRAFT ORMP

In the development of the Owyhee Resource Management Plan, four alternatives were considered. Alternative A was to continue management as was currently occurring. Alternative B was Owyhee County's Plan. Alternative C was BLM's preferred plan, Alternative D was the extreme use Plan, and Alternative E was the environmental plan.

Owyhee County is providing the following comments in reference to the WATER RESOURCES. RIPARIAN WETLANDS. AND FISHERIES HABITAT sections of the Draft RMP. In many cases the comments provided here are equally applicable to other sections of the draft. We trust that you will take action to make necessary and appropriate changes where ever they are applicable.

• The management action proposing to close allotments on July 15 unless they have an approved and implemented grazing plan presents a false premise. Almost all grazing plans will require additional fencing, fence modifications and or water development to support such plans. The bureau is well aware that permittees could not get clearance for these actions within the 2 year limit. This management action suggests that closures could be avoided by approving and implementing grazing plans, however, the reality is that it could not.. It is simply impossible for a grazing plan to be approved and implemented in 2 years on all of the affected allotments. A realistic time for development, approval and implementation of a grazing plan would be 5 years as is proposed in Alternative B. Alternative B would result in developed, approved and implemented grazing plans while the preferred alternative C would result in allotment closures on July 15.

- Alternative B is the only proposal which advocates a process allowing management decisions to be made on the basis of site specific situations and potential impacts on a variety of resource values. Alternative B, also recognizes that adjudicated grazing preference rights must be accommodated and safeguarded under the Taylor Grazing Act. Grazing plans developed on an allotment basis can provide for both the needs of the resource and the livestock operator. All options for the livestock operator are disregarded under the one-size-fits-alt prescriptions of the BLM staff preferred alternative and Alternative D.
- The conclusions that "Beneficial uses are either not supported, partially supported, or supported but threatened on the majority of stream segments in the resource area." is not supported by the documentation. The discussion indicates that 24 stream sites have been monitored. It is simply not credible that 24 sample sites on 500 miles of water could support the conclusion quoted above. There is no data presented in the DEIS from the 24 sample sites to indicate the kind and degree of difference from Idaho Water Quality standards found at these sample sites. The degree of divergence from the standards should be a significant factor in evaluating and selecting appropriate management actions. Recent review by Owyhee County of stream segments identified as being in unsatisfactory condition in the 1978 survey, show many of these segments now to be in satisfactory condition. This again indicates that the above quote from the DEIS is highly questionable. A listing of stream segments along with all of the available monitoring data shows that 78 of the 129 listed stream had insufficient data to determine either condition or trend in 1992. The list shows that 18% had no data, 35% had only one observation, 6 segments had just two observations and 2 segments had only outdated 1976 data.
- On page Ill-7 the DEIS indicates that "A lack of measurable change in riparian area condition indicates that

no trend exists in water quality condition." This statement is highly misleading and inaccurate. In truth, there is a lack of measurements of riparian condition trend, not a lack of measurements indicating positive change. Considerable evidence exists which does indicate significant improvement in riparian areas and consequently improvement in water quality. Owyhee County has made such data available to the Bureau for review. Owyhee county has also reviewed Bureau data which indicates significant improvement in stream segments. Documentation of the stream segments, kind of monitoring information and dates obtained, show conclusively that there is not enough information to support the above statement. Any statement as to stream habitat conditions or water quality issues should be confined to those situations where adequate supportive data is available. A lack of data cannot be viewed as negative information.

- Water Resources, page IV-B-3, environmental consequences.
- The discussion of Water Resources, page IV-B-3 of the environmental consequences again fails to acknowledge that seral juniper invasion is a significant change agent for water quality. The impact of these sites on watersheds is well documented and the consequent impact on water resources is unquestionable. The authors statement under Forest Management, (page 111-14,) "Jt appears that the deep. loamy sites are likely to be occupied in time by dense stands of juniper with virtual elimination of desirable understory vegetation." , fully acknowledges the ongoing destruction of watersheds from seral juniper. However, there is no mention of this problem in the environmental consequences of the BLM staff preferred alternatives C, where prescribed fire treatment of invading juniper is only 1,500 acres annually while expansion is estimated at 2,500 acres.
- The discussion indicates that an 11% increase in livestock grazing would occur. However, it does not point out that the increase is dependent upon monitoring data indicating the increase is sustainable without detrimental impact on the range resource. This statement is a false representation of Alternative B.
- The estimate that 166 miles of the total 512 stream miles would support beneficial uses in 20 years under alternative B is extremely low. These areas have a relatively high rate of improvement compared to uplands. The current rate of improvement combined with improved grazing systems, off stream water developments, creation of riparian and upland pastures and vegetation treatments would result in much greater improvement than estimated by BLM.

- Bureau guidelines for assessment of riparian areas since 1993 has been based on a determination of Proper Functioning Condition (PFC). The bureau has little if any data assessing functional condition and has improperly used the old assessments of satisfactory or unsatisfactory condition to classify the functionality of riparian areas. The objective presented in the DEIS equates unsatisfactory condition with non functioning and functional at risk and proposes to improve all such systems. There is no logical way to equate the old assessments with the PFC evaluation process adopted in 1993. This process of equating functionality with old data is exactly backward to what current guidelines dictate. A true assessment of PFC should be completed first. The subjective estimates used to make a determination of satisfactory condition does not translate to, or provide the analysis necessary to do a proper assessment of functionality.
- The riparian objective calls for improvement of all unsatisfactory or functional at risk riparian areas. By definition many "functional at risk" riparian areas are not in that category because of a need for improvement. They may be in that category simply due to a risk factor peculiar to the system even though it is functioning properly. The objective also calls for maintaining all satisfactory and functioning riparian areas. There need be only one satisfactory system change to unsatisfactory for this objective to fail. There is an extremely high likelihood that within the 20 years there will be a storm event that will cause this objective to fail. If even one riparian area fails to improve the objective will not be achieved. It is totally unrealistic to believe this objective could be met under any circumstance.
- The BLM staff preferred alternative C addresses the riparian/wetland objective through LIMITING USE and does not attempt to apply active management that would both provide for use of the land and riparian needs. It limits recreational vehicle use, livestock grazing use following fire, all livestock grazing after July 15, and is some cases virtually all livestock grazing. The proposed limits presumes that there is no other alternative management of recreational vehicle use or livestock grazing that will produce "improvement." That premise is totally false. Since there are many management options, the July 15 appears to have been chosen to reduce livestock not because it is the only way to meet the objective. The BLM staff preferred alternative C also fails to consider all of the adverse impacts of water diversion, roads, fire, upland condition and wildlife disturbance factors related to riparian areas.
- The BLM staff preferred alternative management actions to dispose of and or acquire riparian areas have

nothing to do with this objective. Neither would have an impact on maintenance or improvement of existing riparian areas and both management actions should be removed from the DEIS.

- Alternative B addresses riparian areas in the same manner as it does soils and vegetation, by taking an active and comprehensive approach to all of the disturbance factors that affect riparian areas. It provides management that seeks to achieve public use of the public lands while considering and mitigating the impacts of that use on riparian areas. • Under the Riparian Wetland Areas, affected environment on page Ill-10, The authors states that "The impact of livestock on riparian zones can be considerable." This statement is followed by a lengthy discussion of the negative impacts of livestock grazing on riparian areas. The narrative implies that current livestock grazing practices are resulting in all of these negative impacts. However, there is no data or discussion supporting the implication. The negative impacts have been identified through experimental designs employing excessive grazing practices. Not one of the negative impacts discussed are pertinent to the resource area without documentation that the same grazing treatments and results are occurring in the resource area. Since, no such information is presented these statements are meaningless and misleading and should not have been in the Draft EIS.
- The authors also indicates that "Riparian vegetation provides shade which lowers water temperatures. preventing lethal water quality conditions for fish.' This is an extremely misleading statement, since shade contributes very little to the cooling of water in streams. There is no evidence referenced in the document that water temperatures have ever had lethal impacts on fish. While water temperatures can affect spawning, the spawning temperature standard is not exceeded during the spawning season. The most important temperature regulating factors include the amount of stream flow, source of water, upstream diversion or impoundment, and micro climatic conditions created by woody vegetation. The authors refer readers to Appendix RIPN1 for characteristics of riparian areas in satisfactory and unsatisfactory condition. It does not alert the reader to the fact that this information is largely 20 years old and was based on entirely subjective estimates. There has been significant positive change documented since that information was obtained. The information also does not reflect the new PFC standard for riparian areas.
- The statement that all unconfined stream segments are in unsatisfactory condition and the inference that only two segments of confined stream segments are in satisfactory condition is again extremely misleading. The

maps and tables provided in the DEIS do not support either of these statements. A list of stream segments provided by BLM with all of the available monitoring data, shows that 78 of the 129 listed streams had inadequate or outdated information and very little actual data.

- The authors lists livestock grazing, mining, roads and recreation as concerns for riparian habitat. It is inconceivable that expanding seral juniper stands were not listed. Expanding juniper pose a greater threat to riparian function, water quality and fisheries habitat than any of the listed concerns. Current estimate of over 300,000 acres of seral juniper, expanding at 2,500 acres annually, is evidence that juniper is having a very significant negative impact on riparian areas. The narrative indicates that

"Once removed, it is the intent to keep seral juniper encroachment in check through periodic prescribed fire." In the very next sentence the draft indicates that certain areas (SRMAs, ACECs, and WSAs covering some 640,000 acres) will not be considered for treatment to remove or prevent seral juniper. These statements are directly contradictory. The bureau cannot possibly eliminate these areas from prescribed fire treatments and meet the goal of eliminating and controlling seral juniper invasion. The proposed acreage limitations on prescribed fire under the Air Quality objective (9,000 ac) will not allow the bureau to correct seral juniper invasion and prevent the continued expansion of seral juniper. The BLM staff preferred alternative proposes to treat only 1,500 acres annually with expansion estimated at 2,500 acres. The bureau could not follow the preferred alternative land use plan as is required by law when objectives and management actions are in direct conflict.

- Riparian Wetland Areas, pageIV-B-8, environmental consequences.
- The discussion as to type of impacts for Alternative A, referenced on this page, is very misleading. The discussion and cited statements are observations and opinions and do not have direct research to support them. Further, the cited opinions and observations are not pertinent unless there is also some documentation that the cited conditions for cause and effect are present in the Owyhee Resource Area. The only factor cited as a cause of deterioration is "too much use during the hot season (July to September)." There is no data presented that indicates the degree of such use or that the resulting trend in riparian areas is down. In most cases riparian trend is up and therefore hot season use is not contributing to degradation as is claimed in the discussion. Current levels of hot season use are actually supporting an upward trend. The rate of change could be improved to a degree, by

improved management of hot season use. Total elimination of hot season use as proposed in the preferred alternative is a drastically exaggerated measure that is not needed to increase the rate of improvement. As is pointed out in the narrative, grazing systems would result in a significant increase in rate of improvement. The estimate that only 142 miles of riparian would improve is a drastic under estimate. Since improvement is already occurring, it is obvious that the implementation of improved grazing systems and significant vegetation treatments would further increase the rate of improvement and result in far greater stream miles in Proper Functioning Condition.

- The listed change agents failed to include the enormous expansion of western juniper into upland sites formerly occupied by sagebrush-grass plant communities. These sites covering at least 300,000 acres, pose a significant threat to riparian areas. When these sites approach the closed canopy state as many of them have, they will increase the sediment production, reduce stream flows and increase water temperatures, resulting in significant degradation of riparian areas. Alternative B would support improved grazing systems with an aggressive program to reduce and prevent seral juniper invasion of upland sites. Watershed function cannot be maintained while allowing the continued spread of seral juniper and failing to address already invaded sites. Alternative C does not propose even to keep up with the expansion of juniper and will do nothing for those sites where the closed canopy state occurs or will eventually occur.
- A simple comparison of map FORS1 and maps RIPN3 and FISH1 demonstrate conclusively that at least half of the riparian and fish habitats are under the degrading influence of seral juniper. The contention that 90% or 587 miles of riparian habitat would improve under the preferred alternative is not possible. This cannot be accomplished without a significantly greater effort to stop seral juniper invasion and reduce juniper on invaded sites. Under Alternative B, virtually all of the 652 miles of riparian areas would achieve significant improvement and objective RIPN1 would be fully met.
- FISHERIES HABITAT
- Fisheries Habitat, page 11-54, description of alternatives.
- The objective to have all perennial streams in satisfactory condition for fish habitat in 20 years is totally unrealistic. The Owyhee Resource Area is an arid land subject to frequent storm disturbances that will at times destroy satisfactory stream fisheries habitat. Only if the bureau devises a means to control the climate of this resource area will this objective be achievable. Natural

occurrences will not likely support more than 80% of all streams in satisfactory fisheries habitat condition. Where down cuts have resulted from beaver activity, road crossings and other causes in the past, it is extremely unlikely that all such perennial streams would recover to a satisfactory condition within 20 years.

• Seral juniper invasion is having a significant negative impact on fisheries habitat through reduction of stream flows, increased water temperatures and increasing sediment loads into streams. This negative impact was not addressed in any manner under this objective in the BLM staff preferred alternative C. By totally ignoring the seral juniper situation, the bureau has virtually ensured that the objective would not be met and would not be met even if it were a more realistic 80% of all streams.

• The preferred alternative calls for a management action to limit livestock grazing to July 15 of each year. This is proposed as an alternative to development of an "approved and implemented grazing system" within 2 years. To date, the bureau has not acknowledged that they would approve any system that does not eliminate grazing in riparian areas after July 15. Even if a system including hot season use could be approved, it could not be developed and implemented within 2 years. While the management action indicates that there are options available, in reality there is only one and that is to end all grazing by July 15.

• The scientific community endorses early grazing use as one method of achieving improvement in fisheries-riparian systems, however it is not the only method. Wayne Elmore, who heads the national riparian team for BLM and the USFS says that he has seen every kind of system work and every kind of system fail. Early grazing is also a system that does not always work as evidenced by the McBride creek riparian demonstration project. The preferred alternative would impose the same grazing system on all allotments without regard to site specific conditions and or situations that may indicate a better system. This proposal also does not consider impacts on use of private lands within affected allotments or to adjudicated grazing preference rights of the permittees. There are numerous alternative grazing systems supported by good science that can be and are effectively used. The approach taken in Alternative B would identify and implement those alternative systems.

• Fisheries Habitat, page 111-19, affected environment.

• The statement that "Resource areawide. 91% of the stream miles inventoried were found to be unsatisfactory condition" is extremely misleading and is not supported by the facts. Data supplied by the BLM show that 18% of the stream segments have no monitoring data. The implication that this situations have not changed in the past 20 years is totally false.

• The narrative also states that "Throughout the resource area, the primary management concern and the biggest impact to fish communities is the degradation of riparian habitat which leads to loss of pool and riffle habitat, loss of instream cover, elevated water temperatures, and fine sediment deposition. Livestock grazing is the primary cause of this degradation." This again is extremely misleading, since it indicates that all of these negative impacts are continuing to occur and that livestock grazing is the primary cause. By any measure possible there is an upward trend in riparian areas and by necessity in fish habitat values. The authors also conveniently failed to even mention that seral juniper stands over 300,000 acres are causing the same negative impacts as attributed to grazing use. With these stands over 300,000 acres and expanding at 2,500 acres annually they are the biggest cause of riparian degradation and also the biggest continuing threat.

• Fisheries Habitat, page IV-B-12, environmental consequences.

• The grazing management proposals and vegetation treatments in Alternative B would result in improvement of virtually all fisheries habitat and over 20 years and would likely achieve satisfactory condition on 80% of these areas. The projected improvement for the preferred alternative is vastly over estimated. Alternatives C and D would not possibly achieve the degree of improvement indicated because neither of these alternatives would address the seral juniper invasion situation. Over the next 20 years a significant number of riverine systems with unsatisfactory fish habitat would remain in that category or would be degraded to that category without greater vegetation treatments.

IDAHO WATERSHEDS PROJECT, et al. v. MARTHA HAHN, STATE DIRECTOR, et al., CIV 97-0519-S-BLM, US DISTRICT COURT, DISTRICT OF IDAHO, (Filed Oct. 31, 1997)

December 5.2000

Owyhee County Natural Resources Committee

Report on BLM riparian monitoring protocol and procedures used to determine compliance with the terms and conditions in the February 29 2000 court order of Judge Lvnn B. Winmill

On May 9 2000 BLM sent out a letter listing the four terms and conditions imposed by judge Winmill. In the same document they released the protocol for measuring, Stubble Height on Streambanks, Woody Species Utilization (Twig Count), Key Species Method for riparian utilization and Monitoring Streambank Stability and Current Year Alteration. During the fall of 2000 BLM personnel inspected various streams to monitor compliance with the court ordered terms and conditions. There are significant discrepancies between the court ordered terms and conditions, BLM protocol and the actual monitoring methods used by BLM.

The terms and conditions as ordered by the court are listed below along with the primary BLM protocol procedures. BLM protocols and actual monitoring methods and procedures are discussed for each term and condition.

1. "Key herbaceous riparian vegetation, where streambank stability is dependent upon it, will have a minimum stubble height of 4 inches on the streambank, along the greenline, after the growing season."

The protocol calls for the identification of a "key area" that best represents the level of riparian use along accessible portions of the streambank. It also calls for a decision as to the "key species" depending on stream type, condition and management objectives. Measurements are taken on the greenline, which is the first perennial vegetation above the stable low water flow. The measurement is made on the leaf blade closest to the toe of the boot. Where a key species is not present, bare ground, forb or woody shrub is recorded if that is all that is present. The protocol also allows the observer to select the nearest plant up to three feet away from the greenline when a plant is not located at the toe of the boot.

The monitoring practice does not objectively identic a key area nor does it examine and identic a key species. Measurements are taken up to three feet from the greenline regardless of plant density. The assessments automatically include all grass and grass like species. Either no determination is being made as to whether a streambank is dependent upon stubble height, or there is an assumption of dependence where it is clearly not justified. Furthermore, the selection of an individual leaf is a very imprecise and subjective action.

The BLM monitoring procedure did not adhere to the established protocol for measurement of stubble height. Furthermore, the procedure does not evaluate the specific factor(s) established by the court order.

2. "Key riparian browse vegetation will not be used more than 50% of the current annual twig growth that is within reach of the animals."

The protocol calls for marked plots (usually 10 on each side of the stream). It requires random selection of 20 twigs (five from each side of the plant) counted as grazed or ungrazed. The protocol notes that caution should be used as wildlife and livestock may graze each terminal bud indicating 100% use. This caution is made because 100% use of terminal buds does not reflect 100% use of "current year's growth". The caution is necessary because the protocol is based on a twig count method that estimates only the incidence of use and not the actual utilization.

In practice, BLM personnel did not establish marked plots for evaluation. Shrubs used for twig counts are subjectively selected, as are the twigs that are counted. Absent a random process of selecting both shrubs and twigs there is no way to prevent inadvertent or intentional observer bias.

The protocol does not establish a procedure for measuring the "utilization" of riparian shrubs as required by the court order. Furthermore the monitoring procedure does not follow the established protocol nor does it measure the factor ordered by the court.

3. "Streambank damage attributable to grazing livestock will be less than 10% on a stream segment."

The protocol states that streambank alterations are physical changes to the streambank attributed to large herbivores, i.e., livestock, wild horses, buffalo, elk, deer, antelope, and moose, during the grazing season. Study sites are to be identified with a permanently located reference post at each end of the 363 foot (110 meter) transect site. The protocol admits that this method is most appropriate for streams with gradients of 4 percent or less and is not appropriate for stream channels dominated by cobbles, boulders, or bedrock. The protocol also requires documentation of any deviations from the established procedures. At each step on a 110 meter transect along the bank full line, a two foot transect line is placed perpendicular to the stream channel with the center at the toe of the boot. Any alteration observed along the line is counted. Alteration is identified as bank shearing from animal use, animal tracks causing a depression or displacement of % inch of soil. Assuming a step is one meter there would be 220 observations at each site. Each observation would be two feet for a total of 440 feet. Just 22 tracks four inches wide would constitute 10% alteration. The actual impact would be 7 feet of 440 or 1.6% instead of 10% value resulting from the BLM protocol.

In practice, the BLM method did not permanently identic the study site. The protocol inclusion of wildlife trampling damage conflicts with the T&C that relates only to livestock use. The protocol method is biased because the estimate of damage is calculated in a manner that vastly overestimates actual trampling impact. The livestock impact identified by the protocol does not relate to the "damage" referred to w the court order. Damage is an impact that will not fully recover by the next grazing season. Clearly, cattle tracks displacing only Vi inch of soi]

do not constitute "damage".
The BLM procedure does not follow the established protocol anri does not evaluate the specific factor(s) established by the court order.

4. "Key herbaceous riparian vegetation on riparian areas, other than the stream banks, will not be grazed more than 50% during the growing season, or 60% during the dormant season."
The protocol proposes to use the Key Species Method to estimate utilization. This method is based on an ocular estimate of the amount of forage removed by weight on individual key species. The protocol states that the method is reasonable accurate depending on the ability of the examiner. The examiner must first compare their ocular estimates against actual weight values obtained by clipping and weighing.
The practice of this method has not been demonstrated on the two stream segments where BLM assessments have been observed. No estimate was made for this utilization standard.

Dr. Chad C. Gibson

Appendix 1.5.8 Letters responding to the comments at the Jordan Valley, Oregon Meeting on April 7, 2004 – listed by stakeholder.

Response to Martin Andre's Comment

April 23, 2004

Martin Andre
P.O. Box 234
Arock, OR 97902

Dear Martin Andre:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment has been posted on the www.Owyhee.us web site:

- Comment #1: If the vision is to return the Owyhee fisheries to what it was, how are you planning on doing this without regulation and without affecting water storage, etc.?

Your comment has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

As I explained in the Jordan Valley Public meeting, the vision of the Owyhee Subbasin Plan is not to restore all Owyhee River fisheries to what they were before European settlement, e.g., pre-1800's. The vision statement of the Owyhee Subbasin management plan is:

"We envision the Owyhee Subbasin being comprised of and supporting naturally-sustainable, diverse fish and wildlife populations and their habitats, that contribute to the social, cultural, and economic well-being of the subbasin and society."

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

42418 East Larch Mountain Road, Corbett, OR, 97019 ● vigg@earthlink.net ● (503) 695-3433

Thank you,

Steven C. Vigg
Principal
Steven Vigg & Company

SCV

42418 East Larch Mountain Road, Corbett, OR, 97019 ● vigg@earthlink.net ● (503) 695-3433

Response to Leonard Beitz's Comment

May 22, 2004

Leonard Beitz
1112 Mendiola Rd.
Nyssa, OR 97913

Dear Leonard Beitz:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) has been posted on the www.Owyhee.us web site:

- Comment #1: The evaluation of the streams by DEQ includes natural pollutants.

Your comment(s) has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

At the Jordan Valley meeting, I replied that DEQ information was not directly used as a basis for determining the QHA ratings for the various stream reaches. The Owyhee Subbasin team includes a representative from Idaho Department of Environmental Quality – Pam Smolczynski – she has expressed awareness during several team meetings – that some potential pollutants (e.g., high water temperatures) may exist naturally in the Owyhee Subbasin. We are also aware that heavy metal pollution (e.g., mercury) in the Owyhee Subbasin can be derived from both natural geologic formations and by man caused disturbances, such as mining.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

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Thank you,

Steven C. Vigg
Principal
Steven Vigg & Company
SCV

42418 East Larch Mountain Road, Corbett, OR, 97019 ● vigg@earthlink.net ● (503) 695-3433

Response to Jerry Hoagland's Comment

May 16, 2004

Jerry Hoagland
HC 79 Box 44
Melba, ID 83641

Dear Jerry Hoagland:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) has been posted on the www.Owyhee.us web site:

- Comment #1: Asked if normative could be explained; Ray Perkins of ODFW explained that model uses reference condition (prior to European development) to compare with current conditions – if we made lots of changes, the reach got a low score – if few changes, got a high score.

Your comment(s) has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1:

In addition to Ray Perkin's response -- "Normative" is defined (for QHA) as: "ideal conditions for similar stream in this ecological province". In other words, the best a stream can be in the ecological province containing the Owyhee Subbasin. The caveat to the definition of the pre-European cultural impact "reference" condition is that climatic variability and catastrophic natural events (e.g., earthquakes) can change the ambient natural environment and thus result in a new "reference" condition.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

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Response to Elias Jaca's Comment:
May 16, 2004

Elias Jaca
Jordan Valley, OR 97910

Dear Elias Jaca:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) has been posted on the www.Owyhee.us web site:

- Comment #1: I don't want to be forced into using hand line sprinklers on my mountain pastures.

Your comment(s) has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

I can't envision any circumstance that the Owyhee Subbasin Plan would force you to use hand line sprinklers on your mountain pastures. This plan has no authority to dictate irrigation practices to private land owners. We will take your comment into consideration as we develop restoration strategies in the Owyhee Subbasin Management Plan.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg

Steven C. Vigg
Principal
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Response to Vernon Kershner's Comments
May 22, 2004

Vernon Kershner
Flint Creek Rd.
Jordan Valley, OR 97910

Dear Vernon Kershner:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comments have been posted on the www.Owyhee.us web site:

- Comment #1: P.2 of the limiting factors in the middle Flint Creek #1 and Flint Creek #2 (on the Idaho side) – lower reach confidence is 0.5 and then they identified pollutants and fine sediment as a limiting factor. Where do we go to look to see what pollutants, etc.?
- Comment #2: Deer Creek (ID) has obstruction listed as the limiting factor – what obstruction are you talking about?
- Comment #3: Who are the biologists that did the assessments?

Your comments have been reviewed by the Owyhee Planning and Technical teams and we provide the following responses:

- Response to comment #1:

We consulted with Paul Seronko, BLM abandoned mine-lands coordinator, to get more information about the pollutants in the Flint Creek #1 and #2 reaches. In these stream reaches, tailings from an abandoned gold mine deliver sediment and heavy metal pollution during overland water flow events. The instream concentration of mercury is about 10 ppm and that for zinc is about 100 ppm. At these levels, Mr. Seronko recommends not to move tailings and sediment, at this time. Given this level of information, we could probably raise the reach confidence from 0.5 to 2.0.

- Response to comment #2:

We are looked into the situation on Deer Creek and found that the limiting factor should not be listed as "obstruction". Therefore, "fine sediment load" (also rated 2.0) is determined to be the limiting factor for this reach. We will make the appropriate changes in our data tables, if we discover any additional relevant data we will let you know.

- Response to comment #3:

As I stated in the Jordan Valley meeting, all of the biologists and other participants at the QHA workshops are listed in the Oregon, Idaho and Nevada QHA workbooks ("Setup" worksheet) which are posted on the Owyhee.US website.

A more complete description of participants at the QHA workshops follows. The first QHA workshop was on November 6th 2003 in Vale, Oregon. The participants were: Jeff

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Fryer (TOAST), Tim Dykstra (Shoshone-Paiute Tribes), Jack Wenderoth (BLM hydrologist) and Steve Vigg (Consultant/Owyhee Subbasin Plan Coordinator). During this meeting we set up the initial version of the river reach system for the Oregon Portion of the Owyhee. On November 25th 2003, we conducted the second QHA workshop at the Vale BLM office. Participants were Cynthia Tait (BLM biologist), Brent Grasty (BLM GIS support), Jack Wenderoth, Ray Perkins (ODFW biologist), Jennifer Martin (OWC), Carl Hill (OWC), Tim Dykstra, Tom Dayley (NWPCC) and Steve Vigg. During this meeting we finalized the river reach system for the Oregon portion of the Owyhee, and completed the “current” and “reference” redband trout habitat ratings.

The Idaho QHA workshops were initiated on January 14th-15th 2004 in Boise. The participants of the first meetings were Pam Druliner (BLM Biologist), Bonnie Hunt (BLM Resource Specialist), Tim Dykstra, Brad Nishitani (GIS consultant), and Steve Vigg. During these meetings we developed the initial version of the river reach system for the Idaho Portion of the Owyhee. Bruce Zoellick (BLM Biologist) provided additional input on the Owyhee-Idaho river reach system after the initial meeting.

The participation at the January 29th, 2004 QHA Workshop in Boise included the following technical and planning members:

- Bonnie Hunt — BLM-Owyhee
- Pat Ryan — BLM-Owyhee
- Jim Desmond — Owyhee County, Natural Resources Committee
- Steven Vigg — Steven Vigg & Co.
- Eric Leitzinger — IDFG
- Jerry Hoagland — Owyhee Watershed Council
- Jennifer Martin — Owyhee Watershed Council
- Leonard Beitz — Ash Grove
- Carl Hill — Owyhee Watershed Council
- Pam Druliner — BLM-Owyhee
- Bruce Zoellick — BLM-Bruneau
- Randy Wiest — DSL
- Guy Dodson Sr. — Shoshone-Paiute Tribe
- Tim Dykstra — Shoshone-Paiute Tribe
- David F. Ferguson — Idaho Soil Conservation Service
- Duane LaFayette — IACSD
- Bradley Nishitani — BioAnalysts, Inc.
- Tracy Hillman — BioAnalysts, Inc.
- Tom Dayley — NWPCC

During this workshop, redband trout habitat ratings were discussed and scoring was initiated for the Idaho Portion of the Owyhee Subbasin. Since the ratings were not completed for the entire river reach system, a third QHA Workshop was convened on February 5th 2004 in Boise. The participants at this workshop included the following fish & wildlife biologists and managers: Eric Leitzinger, Pam Druliner, Bonnie Hunt, Tim Dykstra, Guy Dodson, and Steve Vigg. Tom Dayley (NWPCC Coordinator) also attended to provide Council guidance. During this third Idaho workshop, redband trout QHA ratings were completed for the Idaho Portion of the Owyhee Subbasin.

During March 9th and March 10th 2004, a QHA Workshop was conducted for the Nevada portion of the Owyhee Subbasin in Elko, Nevada. The participants were: Patrick

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Coffin (Fishery Biologist, NV-BLM), Robert Orr (Natural Resource Specialist, NV-BLM), Gary Johnson (Fish & Wildlife Biologist, NDOW), Tim Dykstra, Guy Dodson, and Steve Vigg. During the first day, we set-up the QHA river reach system for Nevada Portion of Owyhee and rated specific stream reaches for redband trout habitat "current" conditions versus "reference" conditions. On the second day of the workshop, we finished the habitat ratings and scored species range worksheet "current" vs. "reference". Ray Lister (Supervisory Biologist, NV-BLM) briefly attended the workshop, and later met with me regarding BLM documents that were relevant to the Owyhee Subbasin Planning process. We obtained both electronic and hardcopy documents from Ray Lister, BLM.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg

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Response to Tim Lowry Comments

May 22, 2004

Tim Lowry
Jordan Valley, OR 97910

Dear Tim Lowry:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comments have been posted on the www.Owyhee.us web site:

- Comment #1: How will this plan impact agency plans? If the strategy is to improve riparian function for fish habitat – won't the agencies use this as a basis for management actions? Discussion followed. Is this just for private land?
- Comment #2: Juniper Creek 1 and Juniper Creek 2 reaches attribute #6 (low flow) got a higher rating when it is dry. If you used BLM information in this area, you are on shaky ground. Attribute #10 pollutants are rated a 2- why is this area considered 50% of normative? His experience has been that when bad science and negative results get written down on paper, it becomes gospel and hurts local people. He is still suspicious that this will be used by people with an agenda.

Your comment(s) have been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

This Subbasin Plan will probably have little impact on other Agencies' resource management plans in the Owyhee Subbasin. BPA's policy is to not fund projects that are the primary responsibility of other federal agencies – due to the "in lieu" provisions of section 4(h)(10(A) of the Power Act. The section of the Act requires that "[expenditures of [BPA] pursuant to this paragraph shall be in addition to, not in lieu of, other expenditures authorized or required from other entities under other agreements or provisions of law." 16 U.S.C. 839b (h)(10)(A). The BPA Fish & Wildlife Division Director has stated: "*our policy of funding only those projects that are Bonneville's responsibility as outlined in the Basinwide Salmon Recovery Strategy (All-H Strategy) and consistent with the in lieu provisions of the Northwest Power Act. … In the All-H Strategy, the members of the Federal Caucus communicated their expectation that Federal land management agencies assume the lead responsibility for implementing elements of the strategy on the lands within their respective jurisdictions. Bonneville's habitat focus is primarily on non-federal lands where others do not have responsibility.*" (Letter to BPA project sponsors from Sarah R. McNary, Director of Fish & Wildlife, BPA, January 28, 2002). The conceptual design of the Owyhee Subbasin Plan includes a comprehensive approach that will coordinate with ongoing Federal Fish & Wildlife habitat restoration efforts, evaluate the effectiveness of ongoing state and Tribal BPA-funded projects and provide incentives and funding for voluntary habitat enhancement on private lands.

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- Response to comment #2.

Idaho DEQ data show that "flow alterations" contribute to Juniper Creek's listing on the 303(d) impaired waters list (WQL-SEG 2644 in HUC 17050107). The limiting factor that we identified for upper Juniper Creek #1 is "low flow" with a QHA rating of 1.0 – which seems consistent with the your statements and the IDEQ data. We will re-examine the lower Juniper Creek (#1) segment that was rated 2.0 for both "high temperature" and "pollutants". Based on the IDEQ information, flow alterations and/or "obstructions" may also be important factors in Juniper Creek; we will research that issue in more detail as time permits. We will also change our data tables according to these data and any additional information that we discover.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg

Steven C. Vigg
Principal
Steven Vigg & Company

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Response to Dennis Stanford's Comment
May 16, 2004

Dennis Stanford
P.O. Box 167
Jordan Valley, OR 97910

Dear Dennis Stanford:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) has been posted on the www.Owyhee.us web site:

- Comment #1: The previous fish and wildlife program has affected us through BLM (in reference to the powerpoint presentation suggesting that previous NWPCC plans have not impacted the area).

Your comment(s) has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

BLM bases its' Resource Management Plans on long term monitoring data, and extensive recent data collection conducted and/or funded by BLM – it does not depend on Bonneville Power Administration (BPA) funding to conduct its land management responsibilities. In fact, nearly all BPA-funded fish & wildlife work in the Owyhee Subbasin has been conducted by the Shoshone-Paiute Tribes on the Duck Valley Indian Reservation, i.e., not on BLM lands.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg

Steven C. Vigg

Principal
Steven Vigg & Company

SCV

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Response to Jesse White's Comments:

May 16, 2004

Jesse White
3580 Hwy 95 W
Jordan Valley, OR 97910

Dear Jesse White:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment(s) have been posted on the www.Owyhee.us web site:

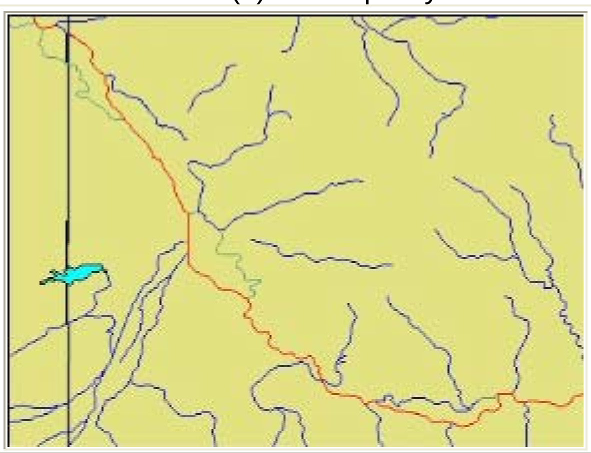
- Comment #1: Jordan Creek #8 on page 3 (State Lands to Headwaters) pollutants are listed as a 1 – what are the pollutants in this reach? Is it the potential for pollution or actual pollution? Ray Perkins stated that in the Oregon portion they used actual pollution.
- Comment #2: It was suppose to be a consistent process throughout the subbasin, but it is obvious that there were inconsistencies between the assessments of the three different states; are man-made pollutants and natural pollutants rated in the same manner? No, if it is a natural pollutant that would not be a basis for restoration or a low score in this QHA model.

Your comment(s) have been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

Actual measureable pollution, not potential for pollution, was used consistently in all portions of the Owyhee. The type of pollutant could vary from place to place, e.g., coliform bacteria, mercury, other heavy metals, or pesticides.

The following data are from EPA 303(d) water quality assessments:

Idaho JORDAN CREEK WILLIAMS CREEK TO OREGON LINE		• PESTICIDES • BACTERIA/ PATHOGENS • METALS - MERCURY • OIL/GASOLINE • SEDIMENT • TEMPERATURE Sources of Impairment: 1.

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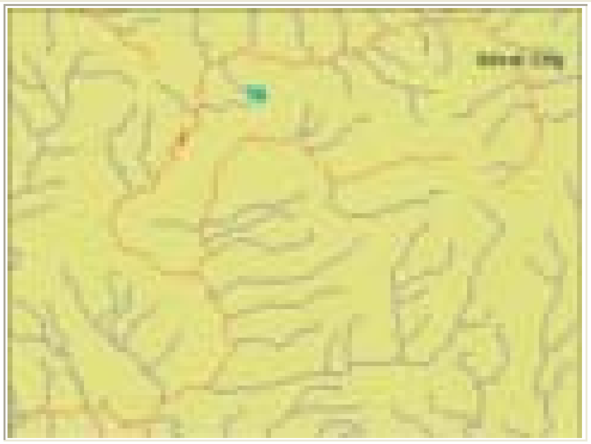
Idaho JORDAN CREEK HEADWATERS TO WILLIAMS CREEK		• PESTICIDES • BACTERIA • METALS - MERCURY • OIL/GASOLINE • SEDIMENT • TEMPERATURE Sources of Impairment: 1.

- Response to comment #2 – Yes, there were consistent guidelines used during all the QHA workshops – in Oregon, Idaho and Nevada. The question about man-made pollutants and natural pollutants was answered during the meeting (see above).

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg

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Response to Pam White's Comment
May 23, 2004

Pam White
3580 Hwy 95 W
Jordan Valley, OR 97910

Dear Pam White:

Thank you for providing input at the public outreach meeting regarding the development of the Owyhee Subbasin Plan. Your comment has been posted on the www.Owyhee.us web site:

- Comment #1: Questioned that if the vision is to mitigate the impacts to anadromous fish, why is this an issue if they did not exist in this subbasin; the mainstem of the Owyhee River is a warm water fishery – some of the feeder creeks are cold water, but the mainstem of the river never has been; prior to the 1930's there were sturgeon, trash fish, etc… but there were not salmon in the mainstem of the Owyhee River.

Your comment has been reviewed by the Owyhee Planning and Technical teams and we provide the following response:

- Response to comment #1

Historical documentation of the presence of anadromous fish in the Owyhee River System prior to 1933 is presented in section "4.2.1.4.2 Owyhee River Basin Fisheries - Spring, Summer, Fall Seasons" found in Chapter 4 of the draft Owyhee Subbasin Plan – which can be accessed on the www.Owyhee.US web site. Anadromous salmonids must have, at least, migrated through the mainstem Owyhee River in order to reach the upstream tributary spawning areas where they were observed and caught for food. Fall-run Chinook salmon, also historically observed in the Owyhee River System, generally spawn in the mainstem river reaches instead of small tributaries. As I explained in the Jordan Valley public meeting, the vision of the Owyhee Subbasin Plan is not to restore all Owyhee River fisheries to what they were before European settlement, e.g., pre-1800's. The vision statement of the Owyhee Subbasin management plan follows:

"We envision the Owyhee Subbasin being comprised of and supporting naturally-sustainable, diverse fish and wildlife populations and their habitats, that contribute to the social, cultural, and economic well-being of the subbasin and society."

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

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Thank you,

Steven C. Vigg
Principal
Steven Vigg & Company

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42418 East Larch Mountain Road, Corbett, OR, 97019 ● vigg@earthlink.net ● (503) 695-3433

May 12, 2004

Mike Hanley
PO Box 271
Jordan Valley, OR 97910

Dear Mr. Hanley:

We thank you for attending the Owyhee Subbasin public outreach meeting at Jordan Valley on 7 April 2004. The Owyhee Subbasin Plan team appreciates the time that you and other stakeholders took to provide input to this planning process. We can all agree that water is one of the most valuable resources in the Owyhee Subbasin and has been central to the utilization of the region – both by humans and fish & wildlife for millennia. It is true that the purpose of the Owyhee Subbasin Plan is about fish & wildlife restoration – protection, mitigation and enhancement as called for under the Northwest Power Act and implemented by the Northwest Power & Planning Council's Fish & Wildlife Program. As you noted, I concluded my presentation with the message that the Owyhee Subbasin Plan was not about money (bucks and silver), but about bucks (wildlife) silver (fish).

I stated that the fish & wildlife mitigation responsibilities of the Bonneville Power Administration are related to losses caused by the development and operation of the Federal Columbia River Power System (FCRPS). Although I didn't talk about Native American Tribe's Treaty rights in my presentation, it is true that Bonneville Power Administration (BPA), and all Federal natural resource management entities, have trust responsibilities to recognized Indian Tribes in the Columbia Basin. We are aware that other upstream users, including ranchers and farmers, appropriated water in the Owyhee Subbasin for agricultural purposes – from the time the region was first settled by European immigrants in the early 1800's, i.e., prior to the development of the FCRPS and the establishment of BPA. In fact the water resource development in the Owyhee River system was conducted by the Bureau of Reclamation, and the dams it constructed are not part of the FCRPS.

The intent of the Council's Subbasin Planning process is to achieve a broad base of local stakeholder participation and support – e.g., ranchers, farmers, hunters, fishers, recreationists, conservation groups, local governments, states and Tribes. Thus the Council's fish & wildlife program is not focused only on Tribal objectives, nor does it ignore Tribal interests. With respect to past BPA-funded fish & wildlife activities, however, the Owyhee Subbasin is rather unique because the Shoshone-Paiute Tribes have a proven track record as the leaders in fish & wildlife restoration. To date, the states of Idaho, Oregon and Nevada have not yet developed BPA-funded fish & wildlife projects or proposals focused on the Owyhee Subbasin. Thus, an appropriate strategy for the Owyhee Subbasin is to maintain ongoing Tribal projects that can be proven effective by monitoring & evaluation, while planning for a more diverse base of projects in the future. As I stated in the presentation, we cannot expect that the subbasin planning process in itself will generate more funding that will be brought in to the Owyhee Subbasin – but instead that it will provide a means to allocate limited funding to projects that have the highest probability of success, based on available information and adaptive management..

It is true that the federal government historically encouraged settlement of the west and developed the infrastructure that made it economically viable. It is also recognized that fish, wildlife, and the habitats they depend on for long term sustainability have suffered losses due to the development of natural resources for settlement. The Northwest Power Act was designed to balance the beneficial use of water for hydro-electric development with the equitable mitigation for fish & wildlife losses.

We are aware that individual ranchers, Owyhee County, and the Owyhee Cattlemen's Association have initiated law suits pertaining to Bureau of Land Management (BLM) resource management plans -- on the grounds that assessment data lack scientific credibility. We will include a synopsis of events relative to the Idaho Watersheds v. Martha Hanon (BLM State Director) concerning the Owyhee Resource Area. If you have specific questions or comments on the habitat ratings for specific reaches in the Qualitative Habitat Assessment (QHA) in the Owyhee Subbasin assessment (handed out at the public outreach meeting you attended) we will take those specific data into consideration.

The issue of increased water consumption (evapotranspiration) by increased Juniper encroachment has been noted. By inspection of the current versus historic maps of the distribution of old growth western Juniper and Mountain Mahogany Woodlands habitat (Source: www.nwhi.org/ibis) – it is apparent that this habitat type has increased in the Owyhee Subbasin. This habitat is dominated by fire-sensitive species, and therefore, the range of western juniper and mountain mahogany has expanded because of federal fire suppression policies (Crawford and Kagan 2004; Wayne Burkhart cited by Jerry Hoagland, Personal Correspondence, April 2004). Quigley and Arbelbide concluded that in the Inland Pacific Northwest, Juniper/Sagebrush, Juniper Woodlands, and Mountain Mahogany cover types now are significantly greater in extent than before 1900; however, this habitat is generally in degraded condition because of increased exotic plants and decreased native bunchgrasses. As far as I am aware, no scientific studies have been conducted to estimate temporal changes in water loss by Junipers in the Owyhee Subbasin (mid-1800's to present). However, I understand that cooperative research has been initiated by USDA, University of Idaho, Oregon State University, and BLM – to study the effects of Juniper woodlands on stream flow in the Owyhee Subbasin and the Burns, Oregon area.

We are also aware that mercury pollution in the Owyhee Subbasin can be derived from both natural geologic formations and by man caused disturbances, such as mining.

The story about the magnitude of salmon carcasses in the Owyhee River that you related – from John Harney a longtime resident of Duck Valley is very interesting: "*When salmon come, they die in the water. Some wash up on the banks and others catch on gravel bars. It smelled so bad you can't ride a horse to the river.*" This observation is actually quite significant from an ecological perspective. It is a well known natural phenomenon that as soon as adult salmon enter fresh water during their spawning migration, that their physiology begins to change, and ultimately the anadromous salmon are programmed to die after spawning in the upriver tributaries. Since Pacific salmon die within a few days of spawning, the nutrients contained in their carcasses become available to the ecosystem, in our case far inland from the ocean where the nutrients were derived. These salmon-transported nutrients are important for the maintenance of ecosystem biodiversity and fish production (Stockner and Ashley 2003). In Idaho streams, Thomas et al. (2003) reviewed the role of marine derived nutrients and concluded that nutrient delivery by anadromous salmon may have been ecologically significant under historic spawning densities. Thus, the elimination of anadromous salmon from the Owyhee System in 1933 could have resulted in significant nutrient losses to both aquatic and terrestrial ecosystems in the Owyhee Subbasin over the past seven decades.

Public input is very important to the development of the Owyhee Subbasin Plan and we appreciate the time that you took to attend the public outreach meeting and provide specific comments. Enclosed is a mini desk clock as a small token of our appreciation for your participation. Please note the web site — www.Owyhee.us — is etched on the clock. We hope this will serve as a reminder that you can access our web site to review the latest documents pertaining to the Owyhee Subbasin Plan and provide additional comments at any time at the following link http://www.owyhee.us/reqdtoc.htm.

Thank you,

Steven C. Vigg

Steven C. Vigg
Principal
Steven Vigg & Company

SCV

May 25, 2004

Jerry L. Hoagland
13528 Reynolds Creek Rd.
Wilson, ID 83641

Dear Mr. Hoagland:

This letter is in response to the comments regarding the April 28th Draft of the Owyhee Subbasin Plan that you e-mailed to me on May 19th, 2004.

Regarding your statement " Inclusion of allotment-by-allotment data in the subbasin plan appears to be yet another attempt by BLM to get disputed data into a published document in an attempt to lend weight to proposed grazing reductions." Jerry this statement is simply not true. I decided to use the BLM grazing allotment assessment information in the "Land Use" section of the OSP because I consider it to be very relevant to habitat conditions in the Owyhee Subbasin where the majority of the land is used for grazing and managed by the BLM. Back in January, Tim Dykstra (Shoshone-Paiute Tribes' subbasin plan biologist) requested numerous documents (in electronic format) from the Owyhee Area BLM office and he subsequently made copies for me. **No one** from the BLM suggested that I use the allotment assessment information or tried to influence me in any way regarding the use of this information, or any other BLM data as far as that goes. I think the allotment data presented in the OSP provides a representative subset of the grazing allotments; we were only limited by the assessments that were available in electronic format at the time of the request. When the plan is revised in the future, I think this section should be expanded to include all available assessments of grazing allotments. I will note in the OSP that "allotment decisions based on the information presented have been appealed by permittees and those appeals are still pending in the Interior Board of Land Appeals system."

Regarding your statement "The document names specific grazing allotments and provides information which is inaccurate, misleading, or unnecessary. On page 38, Sec. 4.2.2.2.6., the Nickel Creek Allotment for example, the plan cites 303d list information which is no longer valid as there has been a completed and approved TMDL on the cited riparian sections. That TMDL found sediment to be the only pollutant present while the draft subbasin plan still leads the reader to believe that other pollutants must be addressed."

This comment references the following excerpt form the OSP:

"Streams on the Nickel Creek Allotment include all or portions of: the North Fork Owyhee River and Deep Creek and its tributaries (Nickel, Smith, Little Smith, Thomas, Little Thomas, Wilson, Beaver, Trap, Castle, Skunk, Jobe, Current, Corral, Dons, and Stoneman creeks). Additionally, Porcupine Creek is a tributary to the Owyhee River.

The North Fork Owyhee River forms a portion of the western boundary of the allotment and flows southwesterly to the Owyhee River in Oregon. The majority of tributaries to Deep Creek flow easterly from Juniper Mountain. Deep Creek flows north to south to the Owyhee River.

In 1998, four water bodies in the Nickel Creek Allotment (one in the Middle Owyhee HUC# 17050107 and three in the upper Owyhee HUC# 17050104) were classified by the Environmental Protection Agency (EPA) under 303(d) of the Clean Water Act as water quality limited for the following reasons:

- HUC #17050107
    - North Fork Owyhee River - Excessive sediment, high temperature, flow alteration
- HUC #17050104
    - Deep Creek - Excessive sediment and elevated temperature
    - Nickel Creek - Excessive sediment
    - Castle Creek - Excessive sediment and elevated temperature"

I checked with Pam Smolczynski regarding your assertions and she provided me with information from the TMDL. The following information is derived from: the Upper Owyhee Watershed Subbasin Assessment and Total Maximum Daily Load Owyhee County, Idaho (IDEQ January 2003).

"The goal of the total maximum daily loads is to achieve state of Idaho water quality standards for temperature and sediment, and to restore and maintain a healthy and balanced biological community for the full support of cold water aquatic life and salmonid spawning. The load allocations and targets will consist of heat reductions for temperature and sediment allocations based on land use. Surrogate measures of total shade and substrate targets will be presented to assist in achieving the load allocations.

Table B. Upper Owyhee Watershed 1998 §303(d) listed Segments and Recommended Actions. (

Water Body	Pollutant(s)	TMDL(s) Completed	Recommended Changes to 1998 §303(d) list	Proposed Future Listing- Pollutant of Concern	Justification
Blue Creek Reservoir	**Sediment**	**Yes Sediment**	**None**	**None**	**None**
Juniper Basin Reservoir	**Sediment**	**Yes Sediment**	**None**	**None**	**None**
Deep Creek	**Sediment and Temperature**	**Yes Sediment and Temperature**	**List Dissolved Oxygen as Pollutant of Concern**	**None**	**None**

Water Body	Pollutant(s)	TMDL(s) Completed	Recommended Changes to 1998 §303(d) list	Proposed Future Listing- Pollutant of Concern	Justification
Pole Creek	Sediment, Temperature and Flow[1]	Yes Temperature	De-List Sediment as a Pollutant of Concern	None	None
Castle Creek	Sediment and Temperature	Yes Sediment and Temperature	None	None	None
Battle Creek	Bacteria	No	De-List Bacteria as a Pollutant of Concern, List Temperature as a Pollutant of Concern	Temperature	BLM[2] Temperature Data Indicated Exceedence of Temperature Criteria
Shoofly Creek	Bacteria	No	De-List Bacteria as a Pollutant of Concern	None	None
Red Canyon Creek	Sediment, Temperature and Flow	Yes Temperature	De-List Sediment as a Pollutant of Concern	None	None
Nickel Creek	Sediment	Yes Sediment	List Temperature Organic Enrichment and Metals as a Pollutants of Concern	None	Idaho DEQ Temperature Data Indicated Exceedence of Temperature Criteria

1 No TMDL for Flow per Idaho DEQ policy, 2 Bureau of Land Management

Thus the information on Deep Creek, Nickel Creek and Castle Creek in the OSP is completely consistent with that from the TMDL. Furthermore, the TMDL stated that DEQ temperature measurements exceeded Thermal criteria for Nickel Creek, and recommended to list temperature, organic enrichment and metals as “Pollutants of Concern”. Pam told me that for the North Fork Owyhee River, the data were revised and excessive bacteria was the only pollutant listed. Pam also confirmed that just because a

TMDL is written for a given area, it doesn't necessarily follow that the water pollution problems have been corrected and that the stream can be removed from the 303(d) list.

Re: your comment on the "Taylor Grazing Act was passed in 1934,…" The previous narrative you provided on the implementation of this Act was incorporated into the version of the OSP delivered at the May 19th OSP meeting.

Re: your comment on "Section 4.5.1 Endangered Species Act Requirements, Page 80, re Pygmy Rabbits" The fact is that the three issue papers regarding the pygmy rabbit as a potential focal species are on the Owyhee.US web site in their entirety, and I see no need to need to include all the points made in all three papers regarding that past issue since the context in the OSP section (referenced above) was not the intended to discuss merits of the pro vs. con arguments regarding the rabbit as a focal species in the OSP. Since the decision was made by the OSP planning Team months ago to exclude the rabbit as a focal species – that is a mute point. I have no problem including the two concluding sentences from the Jim Desmond's issue paper, as you suggested: "*With the lack of knowledge available on the species and the questions that are raised by the Idaho State Study, such restrictions and potential economic harm are not supportable. What the group should determine to do with the Pygmy Rabbit, rather than using it as a focal species, is to select the species for more study in order to provide for funding of projects to address the data gaps indicated in the study.*" I agree with Jim that we should recommend more studies of the pygmy rabbit in the Owyhee Subbasin.

Thank you,

Steven C. Vigg

Steven C. Vigg
Principal
Steven Vigg & Company

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Owyhee Subbasin Plan

Appendix 2 – for the Technical Assessment (Chapter 2)

Prepared By:

The Shoshone-Paiute Tribes,

Contract Administrator and Owyhee Coordinating Committee Member

and

The Owyhee Watershed Council,

Owyhee Coordinating Committee Member

Prepared for:

The Northwest Power and Conservation Council

Final Draft May 28, 2004

Steven C. Vigg,

Steven Vigg & Company

Editor and Project Coordinator

Disclaimer:

Final approval by the Northwest Power and Conservation Council is contingent upon a favorable review by the Independent Scientific Review Panel and meeting requirements for adoption as an amendment to the Council's Fish & Wildlife Program.

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2.1 Appendix 1. Bibliography for the Owyhee Subbasin Technical Assessment.

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2.2 Appendix 2. Raw scores for eleven habitat attributes in the “current” worksheet of the Qualitative Habitat Assessment (QHA) model – for the Idaho, Nevada and Oregon portions of the Owyhee Subbasin.

Appendix Table 2.2.1 QHA scores for the Idaho portion of the Owyhee Subbasin.

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	1
HUC 17050108													
Jordan Cr.-1	Jordan Cr. From OR Boundary to BLM boundary section	1.0	1.0	1.0	2.0	3.0	1.0	1.0	1.0	1.0	1.0	4.0	(
Jordan Cr.-2	From end of #2 to Rail Creek	1.5	2.0	1.0	2.0	2.5	2.0	2.5	2.0	2.0	1.0	4.0	1
Jordan Cr.-3	Rail Cr. Confluence to BLM boundary	2.0	2.0	2.0	3.0	3.0	1.0	2.5	2.0	2.0	1.0	4.0	(
Jordan Cr.-4	BLM boundary near Buck Cr. to BLM boundary	1.5	2.0	1.0	2.0	2.5	2.0	2.5	2.0	2.0	1.0	4.0	(
Jordan Cr.-5	BLM boundary section line to BLM boundary upstream of Louse Cr.	2.0	2.0	2.0	3.0	3.0	2.0	2.0	2.0	2.0	1.0	4.0	(
Jordan Cr.-6	BLM boundary upstream of Louse Cr. To BLM boudary section	3.0	3.0	2.5	3.0	2.5	2.0	2.5	2.0	2.0	1.0	4.0	(
Jordan Cr.-7	BLM Boundary to state land section boundary	2.0	2.0	2.0	3.0	3.0	3.0	2.5	2.0	2.0	1.0	4.0	(

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	1
Jordan Cr.-8	State linelands boundary to headwaters of Jordan Cr.	2.5	2.5	2.5	2.0	3.0	2.5	2.5	2.5	2.5	1.0	4.0	0
Williams Cr.	BLM segments	2.5	2.0	2.0	2.5	2.5	2.0	2.5	2.0	2.0	2.5	4.0	1
Williams Cr.	Including Pole Bridge Cr. And West Cr.	2.5	2.5	2.0	3.0	4.0	3.0	2.5	2.0	2.0	2.5	4.0	0
Duck Cr.	All	1.5	1.5	2.0	1.5	2.5	2.0	2.0	2.0	2.0	2.0	4.0	1
Old Man Cr.	All	1.0	2.0	1.0	2.0	3.0	0.0	2.0	2.0	2.0	2.0	1.0	0
South Mountain Creek	Lower BLM upper put state includes Howl Cr. Cyote Cr.	1.5	1.5	1.0	1.5	2.5	2.0	2.0	2.0	2.5	2.0	4.0	0
Rail Cr.	All	2.0	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.0	2.0	4.0	1
Washington Gulch	All	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.5	2.0	2.5	4.0	1
Flint Cr.1	Lower	2.8	2.5	3.0	1.5	2.5	2.5	3.0	3.0	2.0	1.5	4.0	0
Flint Cr.2	Upper Includes East Cr.	2.8	2.5	3.0	1.5	2.5	2.5	3.0	3.0	2.0	1.5	4.0	2
South Boulder Cr.	From confluence with North Boulder Cr. To confluence with Mill Cr.	2.5	3.0	2.5	2.3	3.0	2.8	2.5	2.5	1.5	2.0	4.0	1
Upper South Boulder Creek	Mill Creek confluence to headwaters	2.0	2.0	2.0	2.0	2.0	2.5	2.5	2.5	1.5	2.0	3.5	0
Indian Cr.	Bogus Cr. (Lower) - confluence with South Fork Boulder to Section 10	1.0	2.0	1.0	2.0	3.0	0.0	2.0	2.0	2.0	2.0	4.0	0
Bogus Cr.	Upper above section 10 and above	2.5	2.5	2.5	2.5	3.0	3.0	3.0	3.0	2.5	3.0	4.0	1

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	1
Combination Cr.	Lower reach of stream	1.5	2.0	2.0	2.5	3.0	2.5	1.5	2.5	2.5	2.5	4.0	1
Rose Cr.	Up to state section.	2.8	3.0	2.5	3.0	3.0	2.5	2.0	3.0	2.5	3.0	4.0	1
Josephine	includes Wickiup and Long Valley and Headwater Josephine	2.8	3.0	2.5	3.0	1.5	2.0	3.0	3.0	2.0	2.5	4.0	1
Louisa Cr.	From confluence with Rock Cr.	1.5	1.5	2.0	1.5	1.0	1.0	2.5	1.5	1.5	1.5	0.0	1
Lower Rock Cr.-1	From confluence of North Boulder to Meadow Creek.	3.0	3.0	3.0	2.5	1.5	1.5	2.5	3.0	2.0	3.0	4.0	1
Rock Cr.-2	From Meadow Creek to BLM	1.0	1.0	1.0	2.0	3.0	1.0	1.0	1.0	1.0	2.0	4.0	0
Rock Cr.-3	BLM portion in Section 26	3.0	3.0	2.5	2.5	1.5	1.5	2.0	3.0	2.0	2.0	4.0	0
Rock Cr.-4	From BLM/PVT boundary in Sec. 26 to above Triangle Reservoir.	1.0	1.0	1.0	2.0	3.0	1.0	1.0	1.0	1.0	2.0	4.0	0
Rock Cr. 5	BLM reach above Triangle Reservoir to Sheep Creek/private boundary	3.0	3.0	2.5	2.5	3.0	2.0	2.5	3.0	2.0	2.0	4.0	1
Rock Cr. 6	From Sheep Creek/private boundary to headwaters	2.0	2.0	2.0	3.0	4.0	3.0	3.0	3.0	2.0	2.0	4.0	0
Meadow Cr.	Headwaters to confluence with Rock Cr.	1.5	1.5	1.0	2.0	3.0	1.5	2.5	3.0	1.5	3.0	4.0	0
Deer Cr.	Confluence with Big Boulder to state section	2.8	2.8	2.5	2.0	2.5	2.5	2.5	3.0	2.5	3.0	2.0	1

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	1
	36												
Owl Cr.	Includes Minear Cr. (Confluence of Lone Tree to headwaters)	2.5	2.5	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0	1
North Boulder-1	From confluence with Big Boulder; BLM reach to Private	3.5	3.5	3.0	3.0	3.0	3.0	3.0	3.0	2.0	3.0	4.0	1
North Boulder-2	From confluence with Mamouth Cr. To headwaters	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	3.0	4.0	1
Louse Cr.	Includes Cottonwood Cr. From confluence of Jordan Cr. To headwaters	1.5	2.0	1.0	2.0	3.0	1.0	2.0	2.0	2.5	2.0	4.0	1
Upper Trout Cr.	From Split Rock Canyon to headwaters, including Nichols, Wood Canyon creeks	2.0	2.0	1.8	2.0	3.0	1.5	2.0	2.5	2.5	2.0	3.0	1
Split Rock Canyon	Confluence with Trout Creek to headwaters.	2.5	2.0	2.0	2.0	3.0	2.5	2.5	2.5	3.0	2.5	4.0	1
Cow Cr.-2	From confluence with Wildcat Canyon Cr. To headwaters	2.0	2.0	2.0	2.0	3.0	2.5	3.0	3.0	2.0	2.0	4.0	1
Soda Cr.	From confluence of Cow Cr. To headwaters	2.5	2.5	2.0	2.0	3.0	3.0	2.0	3.0	2.0	2.0	4.0	1
HUC 17050107													

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	1
NF Owyhee 1	Lower; From the Oregon State line to the confluence of Juniper Cr.	3.0	3.0	3.0	2.5	3.5	2.0	3.0	3.0	2.0	3.0	4.0	1
NF Owyhee 2	Upper; Headwaters of North Fork , Lower Noon Cr. And Lower Pleasant Valley Cr.	3.0	3.0	3.0	3.0	3.5	2.5	3.0	3.0	2.5	3.0	4.0	1
Upper Pleasant Valley Cr.	From the top of Sec. 7 to headwaters	2.0	1.0	1.5	1.5	3.5	1.5	3.0	3.0	2.0	2.0	3.0	1
Cabin Cr.	From the confluence with Juniper Cr. To the headwaters	2.0	2.0	2.5	2.0	3.0	2.5	3.0	3.0	2.0	2.0	4.0	1
Juniper Cr. 1	From the confluence with the North Fork Owyhee to lower private boundary	2.8	3.0	3.0	2.5	3.0	2.5	3.0	3.0	2.0	2.0	4.0	1
Juniper Cr. 2	From the start of the private up to the headwaters	2.0	3.0	2.0	2.0	3.0	1.0	3.0	3.0	2.0	2.0	4.0	(
Lone Tree Cr.	From Oregon State line to headwaters	2.0	2.0	1.5	2.0	3.0	2.5	3.0	3.0	2.0	2.0	4.0	(
Cottonwood Cr.	From the upper private boundary (section 18) to headwaters	2.0	2.0	2.0	2.0	3.0	1.5	3.0	3.0	2.0	3.0	3.0	1
Squaw Cr. 1	From Oregon State line to lower private boundary (section 13)	3.0	3.0	3.0	2.5	3.5	2.5	3.0	3.0	2.0	3.0	3.0	1
Squaw Cr. 2	From the start of	3.0	4.0	3.0	3.0	4.0	2.0	3.0	3.0	2.0	3.0	4.0	(

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	1
	private in section 14 to the BLM in the northwest corner of section 31												
Squaw Cr. 3	From private to headwaters	2.0	2.0	2.0	2.0	3.5	2.0	3.0	3.0	2.0	2.5	4.0	0
Pole Cr.	Oregon State line to headwaters	3.0	3.0	3.0	2.5	3.5	3.0	3.0	3.0	3.0	3.0	4.0	2
Middle Fork Owyhee	Oregon State line to headwaters	0.5	1.5	1.5	2.0	3.5	1.5	2.0	1.5	1.0	2.0	4.0	2
HUC 17050106													
Little Owyhee	From the Nevada State line to the confluence with South Fork Owyhee	2.0	2.3	1.0	2.0	3.0	1.5	1.0	1.0	1.0	1.0	4.0	1
HUC 17050105													
South Fork Owyhee	From Nevada State line to the confluence with Owyhee River	2.8	3.0	2.5	2.0	2.5	1.5	2.5	3.0	1.5	3.0	3.0	1
HUC 17050104													
Blue Cr.-3	Blue Cr. Reservoir to headwaters	1.5	2.0	3.0	3.0	2.0	1.0	3.0	2.0	2.0	3.0	2.0	1
Shoofly Cr.-1	Confluence to BLM boundary	1.0	2.0	1.0	2.0	2.0	1.0	3.0	2.0	2.0	3.0	4.0	1
Shoofly Cr.-2	Private/BLM boundary to Bybee reservoir	2.0	3.0	2.0	3.0	1.0	1.0	3.0	3.0	2.0	3.0	1.0	1
Shoofly Cr.-3	Bybee reservoir to headwaters	2.0	3.0	2.0	3.0	3.5	2.5	3.0	3.0	2.0	3.0	3.0	0

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Owyhee River	DV reservoir border to confluence	3.0	3.0	3.0	3.0	3.0	3.5	3.0	3.5	2.0	4.0	4.0
Owyhee River DVIR portion	Mouth of canyon to NV state line	1.0	1.0	1.0	2.0	3.0	1.0	2.0	2.0	1.0	3.0	4.0
Battle Cr.-1	Confluence to private in sec. 10 (cottonwood draw)	3.0	3.0	2.0	3.0	3.0	3.0	2.5	3.0	1.0	3.0	4.0
Battle Cr.-2	Section 10 to above state section 36	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0
Battle Cr.-3	State section 36 to headwaters	1.5	2.0	1.0	2.0	3.5	1.0	3.0	2.0	2.0	2.0	3.0
Dry Cr.-1	confluence to reservoir	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Dry Cr.-2	Reservoir to headwaters	1.0	1.0	1.0	2.0	4.0	1.0	3.0	2.0	1.0	3.0	1.0
Big Springs Cr.-1	confluence to reservoir	1.5	2.0	2.0	2.0	4.0	2.0	3.0	2.0	1.0	3.0	3.0
Big Springs Cr.-3	BLM boundary to private	1.0	2.0	2.0	2.0	4.0	2.0	3.0	2.0	1.0	2.0	4.0
Deep Cr.-1	Confluence to private	3.0	2.5	2.5	1.0	3.5	2.0	1.0	3.0	1.0	4.0	4.0
Deep Cr.-2	Private to mid section 10	2.0	1.5	1.5	1.0	3.5	2.0	1.0	3.0	1.0	4.0	4.0
Deep Cr.-3	section 10 to Stoneman Cr. Confluence	3.0	1.5	1.5	1.0	3.5	2.0	2.0	3.0	2.0	4.0	4.0
Deep Cr.-4	headwaters including:	1.0	1.0	1.5	1.0	3.5	2.0	2.0	3.0	2.0	3.0	4.0
Stoneman Cr.	Confluence to headwaters	2.0	1.0	2.0	2.0	3.0	1.0	3.0	3.0	2.0	3.0	3.0
Current Cr.	Confluence to headwaters	2.0	1.0	2.0	2.0	3.0	1.0	3.0	2.0	2.0	3.0	3.0
Nickel Cr.	Confluence to headwaters including:	2.0	3.0	3.0	1.0	3.5	2.0	3.0	3.0	2.5	3.0	4.0

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	1
Smith Cr.	Confluence to headwaters including:	2.0	2.0	2.0	1.0	3.5	2.0	3.0	3.0	2.0	3.0	4.0	2
Castle Cr.	Confluence to headwaters including:	1.0	2.0	2.0	1.0	1.0	1.0	2.0	2.0	1.0	3.0	1.0	2
Beaver Cr.	Confluence to headwaters including:	2.0	3.0	3.0	2.0	3.0	2.0	3.0	3.0	3.0	3.0	4.0	2
Red Canyon Cr.	Confluence to headwaters including:	1.5	2.0	2.0	2.0	3.5	2.0	3.0	3.0	1.0	3.0	4.0	2
Petes Cr.	Confluence to headwaters including:	1.5	1.5	1.5	1.5	3.5	2.0	3.0	3.0	1.0	2.0	4.0	2
Dickshooter Cr.	Confluence to headwaters	3.0	3.0	3.0	2.0	3.0	3.0	3.0	3.5	3.0	3.0	4.0	1
Pole Cr.-1	Confluence to Camas Cr. Confluence including Camel Cr.	2.5	3.0	3.0	2.0	3.0	2.0	3.0	3.0	1.0	3.0	4.0	1
Pole Cr.-2	Camas confluence to headwaters	2.0	2.5	2.5	2.0	3.5	1.0	3.0	3.0	1.0	3.0	3.0	1
Camas Cr.	Confluence to headwaters	3.0	3.0	2.5	2.0	3.5	2.0	3.0	3.0	2.0	3.0	4.0	1

Appendix Table 2.2.2 QHA scores for the Nevada portion of the Owyhee.

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10	11.	12.
HUC 17050104													
E.F. Owyhee ID-NV state line to Paradise Point Diversion	Irrigated hay fields, No RBT habitat	2.5	1.0	2.0	1.5	1.5	1.0	2.0	2.5	2.5	1.0	1.0	1
Boyle Cr	Starts in NV and enters Owyhee in ID	1.5	2.0	2.0	2.0	3.5	3.5	3.0	2.5	2.5	3.0	3.5	0.5
S.F of Boyle Cr		1.5	2.0	2.0	2.0	3.5	3.5	3.0	2.5	2.5	3.0	3.5	0.5
E.F. Owyhee Paradise Point to Duck Valley Indian Res border	DVIR	2.0	0.5	0.5	1.5	3.0	2.5	2.0	2.5	2.5	1.0	4.0	1
Skull Cr		1.5	2.0	2.0	2.0	3.5	3.5	3.0	3.0	2.5	3.0	3.5	0.5
N.F. of Skull Cr		1.5	2.0	2.0	2.0	3.5	3.5	4.0	3.0	2.5	3.0	3.5	0.5
E.F. of Skull Cr		1.5	2.0	2.0	2.0	3.5	3.5	4.0	3.0	2.5	3.0	3.5	0.5
Reed Cr		1.5	2.0	2.0	2.0	3.5	3.5	3.0	2.5	2.5	3.0	3.5	0.5
Summit Cr		1.5	2.0	2.0	2.0	3.5	3.5	3.0	2.5	2.5	3.0	3.5	0.5
Fawn Cr	USFS RBT occupied for sure 4.8miles	2.5	3.0	3.0	3.0	4.0	4.0	4.0	3.0	2.5	3.0	4.0	1.5
Jones Cr		1.5	2.0	2.0	2.0	3.5	3.5	3.0	2.5	2.5	3.0	3.5	0.5
Granite	probably fishless	1.5	2.0	2.0	2.0	3.5	3.5	3.0	2.5	2.5	3.0	3.5	0.5
E.F. Owyhee Duck Valley Indian Res border to Patsville (Mill Cr)	U.S.F.S.	2.0	2.0	1.0	2.0	3.0	2.5	2.5	2.5	2.5	0.5	4.0	1.5
Slaughter House Cr	Occupied RBT 2 miles	3.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
Brown's Gulch (Slaughter house Trib	2.4 miles RBT occupied	3.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
Miller Cr.	3 mile occupied RBT	2.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
West Fr. (of Slaughterhouse Cr)	1.5 miles occupied RBT	3.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
California Cr	Min. occupied RBT by headwater of Cr.	2.0	2.0	2.0	2.0	3.0	1.0	3.5	3.0	1.5	4.0	3.0	2
North Fr (trib of	No RBT, lack of	2.0	2.0	2.0	2.0	3.0	3.0	3.5	3.0	1.5	4.0	3.0	2

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10	11.	12.
California Cr)	flow(Drought yr)												
Dip Cr	1 mile RBT occupied	3.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
Big Springs Cr	Unoccupied (insufficient flow)	3.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
South Fr.	2 mile RBT occupied	2.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
Pixley	1 mile RBT occupied	3.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0	2
E.F. Owyhee Mill Cr.to Badger Cr	U.S.F.S.	2.5	1.5	1.0	2.0	3.0	2.5	3.0	2.5	3.0	3.0	2.5	1.5
Lower Mill Cr to S.F Owyhee River	Unoccupied, pollution, mine tailings	0.5	2.0	0.5	2.0	3.0	3.0	2.0	2.0	2.0	0.5	4.0	2
Upper Mill Cr to Rio tinto Mine	occupied RBT whole distance in none drought years	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
McCall Cr.	5.5 miles occupied RBT	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Allegheny	Native Dace only	2.0	2.0	2.0	2.0	3.0	1.0	3.5	3.0	1.5	4.0	3.0	2
Cold Spring (trib to Allegheny)	Native Dace only	2.0	2.0	2.0	2.0	3.0	1.0	3.5	3.0	1.5	4.0	3.0	2
Trail Cr	8.2 occupied RBT, Brook Trout(MGT concern)	3.0	3.0	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	2.0	2
Van Duzer Cr. (Trib to Trail Cr)	5 mile occupied, Brook Trout (MGR concen)	3.0	2.5	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	2.0	2
Lime Cr (trib to Van Duzer)	.3 occupied by RBT, Brook Trout prsnt	3.0	2.5	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Cobb Cr (trib to Van Duzer)	4.5 RBT occupied	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Deer Cr (trib to Trail Cr.)	min. occupied RBT in a single pool	2.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0	2
Springs Cr.	0.1 mile RBT occupied, Brook trout	2.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0	2
Wood Gulch	Mine prsnt, 2 mile RBT occupied	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
Hutch Cr	1mile RBT occupied, Brook Trout	2.5	2.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0	2

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10	11.	12.
Timber Gulch	0.35 RBT occupied, Brook Trouth	2.5	2.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0	2
Sheep cr	2 mile RBT occupied, Brook Trout	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
Road Canyon	1.2 RBT occupied	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
Gravel Cr	Lower 0.1 RBT occupied (spawning ground)	2.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2
E.F. Owyhee Badger Cr. To Wildhorse Res.	U.S.F.S.	3.5	3.0	3.0	3.0	2.5	2.0	2.5	2.0	3.0	3.0	1.0	2
Badger Cr.	7 miles RBT occupied, some livestock concerns, fair condition, 1600 fish	2.5	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Beaver Cr.	All occupied by RBT	2.5	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Wildhorse Res		3.0	3.0	3.0	3.0	3.0	1.0	2.0	3.0	2.0	2.0	1.0	2
Hendricks Cr	RBT appearing (questionalble genetics,rainbow?)	2.5	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Warm Cr (Trib of Hendricks)	not RBT occupied, warm water temp, soil type/erosion, agriculture	2.5	2.5	4.0	4.0	4.0	2.5	3.0	3.0	3.0	4.0	3.5	2
Penrod	RBT occupied entire way	2.5	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Hay meadow Cr	only native dace present	2.0	2.0	2.0	2.0	3.0	1.0	3.5	3.0	1.5	4.0	3.0	2
Thompson Cr (hay meadow trib)	no fish present in drough yrs	2.0	2.0	2.0	2.0	3.0	1.0	3.5	3.0	1.5	4.0	3.0	2
Martin Cr. (trib to Penrod)	4.5 RBT occupied, Brook Trout	3.0	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.5	2
Gold Cr. (trib to Martin Cr)	1.8 RBT occupied	2.5	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2
Sweet Cr	0.5 RBT occupied	2.0	2.0	2.0	2.0	3.0	1.0	3.5	3.0	1.5	4.0	3.0	2
Rosebud Cr	Native Dace only	2.0	2.0	2.0	2.0	3.0	1.0	3.5	3.0	1.5	4.0	3.0	2
Deep Cr trib to Wildhorse (E.F. Owyhee)	1.5 miles occupied RBT, some on prvt land?	3.0	3.0	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	3.0	2
Clear Cr trib to (Deep Cr)	no fish present in drough yrs	3.0	3.0	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	4.0	2

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10	11.	12.
Riffe Cr (Deep Cr)	3 mile occupied RBT, beaver ponds	3.0	3.0	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	4.0	2
N.F. of Deep Cr	No RBT, lack of flow(Drought yr)	3.0	3.0	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	4.0	2
Middle Fork of Deep Cr	2 mile occupied RBT	3.0	3.0	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	4.0	2
S.F of Deep Cr	3 miles RBT occupied	3.0	3.0	3.0	3.0	4.0	2.0	4.0	4.0	3.0	3.0	4.0	2
E. F. Owyhee Above Wildhorse Res to head waters	Spotted Frog habitat	2.5	2.5	3.0	1.0	3.0	1.5	2.0	3.0	2.0	3.0	3.0	2
Clear Cr trib to Upper E.F Owyhee	Historic potential habitat, poisioning in 1988 to remove chub, killed Trout	3.0	3.0	3.0	3.0	4.0	3.0	4.0	4.0	3.0	3.0	3.0	2
Hanks Cr trib to Upper E.F Owyhee	Dace prsnt, habitat concerns (livestocke) no RBT	1.5	2.0	2.0	2.0	3.0	3.0	4.0	3.0	2.0	2.0	4.0	2
HUC 17050105													
State line to Petan ranch	Red Band prsnt seasonally(Spring) during good water yrs when sutiable water temps	2.5	4.0	2.5	3.0	2.0	4.0	4.0	2.5	3.0	3.5	2	2.5
Lower boundry of Petan Ranch to Red Cow Cr.	Red Band prsnt seasonally(Spring) during good water yrs when sutiable water temps	2.0	2.0	2.5	3.0	2.0	4.0	4.0	2.5	3.0	3.5	2	2.5
From Red Cow to Hot cr.	RBT Occupied yr round, low density	2.5	3.0	2.5	3.0	2.0	4.0	4.0	2.5	3.0	4.0	2	2.5
hot creek to McCann	Prvt Land, Brook Trout prsnt in Spring Heads, RBT are seasonal, White Fish yr round	2.5	2.0	2.5	3.0	2.0	4.0	4.0	3.0	3.0	3.0	1	2.5
Four mile cr from S.F. to Chimney Res.	RBT Down migration during good water yrs, dry 10months of yr, flow controlled by Chimney	2.0	1.5	3.0	2.0	1.0	3.0	3.0	2.0	4.0	2.0	1	2.0
Chimney Cr. Res to T41N	RBT Down migration during	1.5	1.5	2.0	4.0	4.0	4.0	4.0	2.0	4.0	4.0	2	1.0

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10	11.	12.
R49E sec4	good water yrs, dry 10months of yr, flow controlled by Chimney												
T41N R49E sec4 to Head Waters	Occupied by RBT year round, 3miles of reach occupied	2.5	2.0	2.5	4.0	4.0	4.0	4.0	2.0	4.0	4.0	2	2.0
Chimney Cr Res. To Winters Cr.	Int/Dry 10mnths/yr, no RBT	1.5	1.5	2.0	4.0	4.0	4.0	4.0	2.0	4.0	4.0	1	1.0
Winters Cr.	Recently occupied, but not currently, historic habitat (no record), stocked in 1972 with RBT, ceased in 2000due to fire/livestock grazing	2.5	2.0	2.5	4.0	4.0	4.0	4.0	2.0	4.0	2.5	2	2.0
Sheep Creek-S.F. Owyhee to Sheep Cr. Res		1.5	1.5	2.0	4.0	4.0	4.0	4.0	2.0	4.0	1.0	0.5	1.0
Sheep Cr. Res to T46n R51E sec 11	Int/Dry, no RBT, spring down migration	1.5	1.5	2.0	4.0	4.0	4.0	4.0	2.0	4.0	4.0	0.5	1.0
T46n R51e sec 11 to head waters		1.5	1.5	2.0	4.0	4.0	4.0	4.0	2.0	4.0	4.0	0.5	1.5
Indian Cr. (Trib to S.F. Owyhee)	Occupied RBT through National Forest	3.0	3.0	3.0	3.0	3.0	4.0	4.0	3.0	4.0	1.0	1.5	3.0
Winters Cr. Trib to Indian Cr	2 miles occupied RBT through National Forest	3.0	3.0	3.0	3.0	3.0	4.0	4.0	3.0	4.0	4.0	1.5	3.0
Mitchell Cr. Trib to Indian Cr	2 miles occupied RBT through National Forest	3.0	3.0	3.0	3.0	3.0	4.0	4.0	3.0	4.0	4.0	1.5	3.0
Wall Cr. Trib to Indian Cr	1 Mile occupied RBT through National Forest	3.0	3.0	3.0	3.0	3.0	4.0	4.0	3.0	4.0	4.0	1.5	3.0
Silver Cr. (Trib to S.F. Owyhee)	2 miles occupied RBT through National Forest	2.0	3.0	2.5	3.0	2.5	4.0	4.0	3.0	4.0	3.0	1.5	3.0
White Rock Cr.	Unoccupied, probably historic, mining influence	3.0	3.0	3.0	3.0	2.5	4.0	4.0	3.0	4.0	3.0	1.5	3.0

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10	11.	12.
Cottonwood Canyon Cr.	Unoccupied, probably historic, mining influence	3.0	3.0	3.0	3.0	2.5	4.0	4.0	3.0	4.0	3.0	1.5	3.0
Breakneck Cr	2 miles occupied RBT	3.0	3.0	3.0	4.0	4.0	4.0	4.0	3.0	4.0	3.0	1.5	3.0
Bull Run Cr.- S.F. Owyhee to Bull Run Canyon	Diverted for Agriculture use	2.0	3.0	2.5	3.0	2.5	4.0	4.0	3.0	4.0	3.0	0.5	3.0
Mouth of Bull Run Canyon to Cap Winn Cr.	probably recruitment from upstream tribs	3.0	3.0	3.0	3.0	3.0	4.0	4.0	3.0	4.0	2.0	1.5	3.0
Frost Cr.	Low number of RBT	2.5	2.0	2.0	4.0	4.0	4.0	3.0	3.0	4.0	4.0	2	1.0
Cap Winn Cr	Occupied RBT,	3.0	2.0	2.0	4.0	4.0	4.0	3.0	3.0	4.0	4.0	2	1.5
Doby George	Occupied RBT,	3.0	2.0	2.0	4.0	4.0	4.0	3.0	3.0	4.0	4.0	2	2.0
Columbia Cr	Occupied RBT, Low number (200's), Brook Trout abundant	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Blue Jacket Cr	Occupied RBT (700), Brook Trout	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	2	3.0
Deep Cr. Trib to S.F. Owyhee		2.0	2.0	1.5	2.5	2.0	4.0	3.0	3.0	4.0	2.0	2	1.5
S.F Owyhee to Head Waters	Unoccupied, RBT probably present historically												
Red Cow Cr.	Occupied 1mile by RBT	2.0	1.0	3.0	3.0	2.0	4.0	3.0	3.0	4.0	4.0	2	1.5
Amazon	Ephemerial, no record of RBT, probably historic	2.0	1.0	3.0	3.0	2.0	4.0	3.0	3.0	4.0	4.0	1	1.5
Big Cottonwood Trib	1mile occupied by RBT	2.0	1.0	3.0	3.0	2.0	4.0	3.0	3.0	4.0	4.0	2	1.5
Harrington Cr	Unsurveyed, Prvt Land, Probable RBT	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	1	3.0
Marsh Cr.	Occupied RBT	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Boyd Cr	Occupied RBT	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Scoonover Cr.	Occupied RBT	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Dorsey	Occupied RBT	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Coffin Cr.	Occupied RBT	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Jack Cr	Occupied RBT, no brook trout surveyed in last	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10	11.	12.
	2yrs(used to be abundant)												
Chicken Cr	Occupied RBT,	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Mill Cr	Occupied RBT, Brook trout, included 3 forks	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Niagra Cr	No Surveyed Data	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	0.5	3.0
Snow Canyon Cr	Occupied RBT, 5 mi occupied	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Jarritt Canyon	Int/Dry, Unoccupied, Histeric Salmon	2.5	2.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	1.5	2.5
Burns Cr.(Trib to Jarritt Canyon0	1.5 mile occupied on National Forest, Trout Prsnt	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
Schmidtt Cr.	4 miles occupied	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.5	2	3.0
McCann Cr	5 mile occupied RBT, low desnity RBT	2.5	2.0	2.5	3.0	2.0	4.0	3.0	3.0	4.0	3.0	2	2.0
Taylor Canyon Cr (trib to S.F. Owyhee)	2 miles occupied RBT, BT common	3.0	4.0	3.5	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2	4.0
Water Pipe Canyon (trib to Taylor Canyon)	2.5 mile occupied RBT	2.5	3.0	3.0	4.0	4.0	4.0	4.0	3.0	4.0	3.0	2	2.0

Appendix Table 2.2.3 QHA scores for the Oregon portion of the Owyhee.

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Owyhee R-1	Mouth to Owyhee Ditch Co Dam (RM14)	3.5	2.5	2.5	1.0	1.0	1.0	0.5	2.0	1.5	3.0	3.0	1
Owyhee R-2	DC Dam to RM28	3.0	3.0	3.5	3.5	2.0	2.0	3.5	2.5	1.0	3.5	4.0	2
Owyhee R-3	Dam to Upstream High Water (RM80)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA
Dry Creek	Dry Creek upstream to Crowley Road	2.5	3.0	3.0	3.0	2.5	2.5	3.0	3.5	2.0	4.0	3.5	2
Owyhee R-4	High Water upstream to Jordan Cr	3.5	3.5	3.5	3.0	3.5	3.5	3.5	4.0	3.0	3.0	4.0	2
Rinehart Creek	Mouth to falls	3.5	3.5	3.5	3.0	3.5	3.5	3.5	4.0	4.0	4.0	3.5	1
Jordan Creek	Mouth to State Line	2.0	2.5	2.0	2.0	2.5	1.0	1.5	3.0	1.0	3.0	2.5	1
Cow Creek	Mouth to State Line	1.0	2.5	2.0	2.0	3.5	1.0	1.5	3.0	1.0	4.0	2.5	0.5
Owyhee R-5	Confl. Jordan Creek upstream to Sline	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4.0	3.0	4.0	4.0	2
NF Owyhee	Mouth to Sline	3.0	3.5	3.5	3.5	3.5	3.5	3.5	4.0	3.0	4.0	4.0	2
Middle Fork	Idaho Segment ()	1.5	3.5	3.5	2.0	3.0	3.5	3.0	4.0	3.0	4.0	4.0	0
Antelope Creek R-1	Mouth upstream to corrals (~8 mi)	4.0	4.0	4.0	3.0	3.5	3.5	3.5	4.0	3.5	4.0	4.0	2
Antelope Creek R-2	Corrals upstream to Star Valley Road (dry segment)	3.5	3.5	3.5	3.0	3.5	3.5	3.5	4.0	4.0	4.0	4.0	2
Antelope Creek R-3	SV Road upstream to Headwaters	2.5	3.0	2.5	3.0	3.5	3.5	2.5	3.5	2.5	4.0	4.0	2

4th Field HUC/ Reach Name	Description	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
WLO R-1	Mouth upstream to Anderson Crossing	3.5	3.5	3.5	3.0	3.5	3.5	3.5	4.0	3.0	4.0	4.0	2
WLO R-2	Anderson Crossing to headwaters	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4.0	3.0	4.0	4.0	2

Appendix Table 2.2.4 Key and definitions for QHA habitat attributes for the appendix tables above. The number code in the first column of this table corresponds to the habitat attributes in the header of the QHA rating tables.

#	Attribute	Description
1.	Riparian Condition	Condition of the stream-side vegetation, land form and subsurface water flow.
2.	Channel stability	The condition of the channel in regard to bed scour and artificial confinement. Measures how the channel can move laterally and vertically and to form a "normal" sequence of stream unit types.
3.	Habitat Diversity	Diversity and complexity of the channel including amount of large woody debris (LWD) and multiple channels.
4.	Fine sediment load	Amount of fine sediment within the stream, especially in spawning riffles.
5.	High Flow	Frequency and amount of high flow events.
6.	Low Flow	Frequency and amount of low flow events.
7.	Oxygen	Dissolved oxygen in water column and stream substrate.
8.	Low Temperature	Duration and amount of low winter water temperatures that can be limiting to fish survival.
9.	High Temperature	Duration and amount of high summer water temperature that can be limiting to fish survival.
10.	Pollutants	Introduction of toxic (acute and chronic) substances into the stream.
11.	Obstructions	Dam, irrigation diversion, or natural geologic feature that blocks fish movement.
12.	Reach Confidence	Confidence Rating (0-1-2 scale), where: 0 = Speculative; 1 = Expert Opinion; and 2 = Well Documented.

Appendix Table 2.2.5 Key for scoring habitat attributes in "Current" QHA appendix tables above.

Score	Attribute Rating	Normative (definition)
0	0% of normative	Ideal conditions for similar stream in this ecological province. Note that this is more from a geomorphic perspective than a biological perspective.
1	25% of normative	
2	50% of normative	
3	75% of normative	
4	100% of normative	

2.3 Appendix 3. Description of the Qualitative Habitat Assessment (QHA) Model.

The following sections have excerpts from McConnaha et al. (2003) that explain the basic ecological processes incorporated into the Qualitative Habitat Assessment (QHA) Model.

Source:
Chip McConnaha, Drew Parkin and Jeff Fryer. 2003. QHA User's Guide for Subbasin Planning in Oregon. December 3, 2003. CRITFC, Portland, Oregon fryj@critfc.org and qha@subbasin.org.

2.3.1 Comparison of QHA with Ecosystem Diagnosis and Treatment (EDT) used for Anadromous Subbasins.

QHA relies on the same conceptual framework as the more technically sophisticated Ecosystem Diagnosis and Treatment (EDT) technique. There are, however, several significant differences. While each of the habitat characteristics used in QHA is also used in EDT, EDT considers many more habitat factors and seeks to link these directly to measurable data. QHA, by contrast, relies on the judgment of knowledgeable professionals to draw this link.

EDT relies on a set of biological rules derived from the technical literature to establish the link between a species and its habitat. Again, QHA relies on professional judgment to make this link. EDT uses a series of life history trajectories to model the movement of fish through its environment over several life stages. QHA collapse life history into fewer stages and treats each stream reach as a static unit. Again, QHA relies on the knowledge of experts to think through these life history dynamics.

EDT analysis can incorporate, or, more accurately, link to information on out-of-subbasin effects, i.e., survival outside of the natal subbasin. QHA relies on expert opinion to make this connection.

Lastly, EDT produces a series of numerical products that estimate productivity, abundance, and related factors that give an indication of how well habitat supports fish. As a qualitative technique QHA does not generate these outputs but rather produces a series of products that suggest directions for management but explicitly leaves the decision process up to experts.

Appendix 2.3.2 Description of QHA Excel Workbook Tabs/worksheets.

Setup Worksheet

This sheet provides a means for subbasin planners to input essential background information on the drainage being assessed, the focal species being considered, and the people contributing to the assessment. It also provides a brief summary of the method.

Current and Reference Worksheets

Summary. The "reference" and "current" tables are the heart of the assessment. Using these tables subbasin planners characterize the physical condition of the subbasin. This is accomplished by supplying information concerning a range of habitat characteristics, with information arrayed by reach.

Definition of Reference. In the "reference" conditions table we consider what this subbasin would be like if the system were restored to the fullest extent possible short of disrupting infrastructure that is vital to modern society and that is likely to remain in place for the foreseeable future. In a subbasin with little cultural modification this reference condition might equate to "historic" conditions, that is, the conditions that were in place prior to European settlement. By contrast, in a largely urbanized subbasin, say, the lower Willamette in Portland, this might mean accepting the urban fabric but taking aggressive action to restore habitat within the confines of this urban fabric.

Definition of Current. In the "current" conditions table we rate the condition of the aquatic environment as it is today. The one conceivable wrinkle is a situation where significant habitat enhancement is currently underway that would significantly change habitat quality. In these cases planners may decide to characterize current conditions as if these enhancements were complete.

Habitat Characteristics. In both the reference and current condition tables we look at 11 habitat characteristics, or attributes. These eleven are:

1. Riparian condition
2. Channel form
3. Habitat diversity

4. Fine sediment
5. High flow
6. Low flow
7. Oxygen
8. High temperature
9. Low temperature
10. Pollutants
11. Obstructions

Definitions of the above attributes are found in the QHA "definitions" worksheet.

These are the habitat characteristics that are generally thought to be the main "drivers" of fish production and sustainability. There may, of course, be unique situations where planners believe that other factors may be equally or more important. While, for purposes of consistency we encourage planners to retain the existing list of factors, it is possible to delete a factor and add another -- or to expand the definition of a factor to encompass a more expansive concept. If this is the case, planners should clearly identify the change and document why this change was made. Theoretically it would also be possible to add factors. We have elected to not offer this option as it would decrease consistency and have implications for the Excel algorithms.

To make it easier to interpret results, we have also included a provision for entering distance (river mileage) data for both the reference and current conditions. If stream lengths have changed due to channelization, diversions, filling, or other such activities, the stream mile values can be changed in the reference conditions. Note that this data does not affect results. It only appears in the output as a table giving the number of current miles of habitat and the relative change from the reference condition.

Defining Reaches or Small Watersheds. Here we define a series of "reaches" or "small watersheds" that collectively make up the subbasin. Subbasin planners make the decision regarding whether to use reaches or small watersheds and how these will be defined. A reach (or segment) is a linear stretch of stream that is defined by hydrological or ecological characteristics. A small watershed is a polygonal unit that includes several reaches that drain to the same point. The USGS/EPA hydrologic unit system available at http://NWPCC.bpa.gov provides the basis for developing both reach and watershed definitions.

Reaches may be hydrologically defined, as is the case in the USGS/EPA river reach system where a reach is defined as the area between confluences. The 1:100,000-scale river reach system is the best example. Using this scale a subbasin will typically have between 1,000 and 3,000 reaches depending on size. This is probably beyond the scope of this project and in many cases planners will seek to define larger reaches that would bring the total number down to, say, 60 for the smallest subbasin and 300 for the largest. (This is the number of reaches that the developers of this system consider to be most appropriate for this type of assessment. We base this on (1) the accuracy that is possible through a qualitative assessment, and (2) the amount of time that it will take to fill in the table.) The alternative to a purely hydrological reach definition is a system based on ecological character, whereby subbasin planners manually review the streams in the subbasin and divide them into meaningful ecologically-consistent segments. The number of reaches will depend on the level of resolution. Planners could “lump“ or “split” to arrive at a number of reaches that is scientifically defensible and realistic in terms of workload.

Filling in the Table. The reference and current condition tables consider the relative value of the physical environment to fish productivity and sustainability by viewing each of the 11 habitat factors through the eyes of the focal species that inhabit the area. The cell that forms the intersection between a reach and a habitat characteristic is rated according to the following rating scheme:

0 = 0% of normative (range 0%-12.5%)
1 = 25% of normative (range 12.5%-37.5%)
2 = 50% of normative (range 37.5%-62.5%)
3 = 75% of normative (range 62.5%-87.5%)
4 = 100% normative (range 87.5%-100%)

There is no magic in the above rating scheme. Our intent was to have enough categories that knowledgeable professionals could discriminate between values but not so many that it would exceed what is considered realistic in a qualitative assessment. Planners have the option of using whole numbers (0 through 4) or using decimal places if they wish to discriminate more finely. We encourage planners to use just whole numbers or, if they must differentiate further, go no further than the midpoints between these whole numbers (i.e. 0.5, 1.5, 2.5, 3.5).

For the algorithm to work each and every cell must be rated. If a cell is not rated, it will be treated as if a zero was entered. If you absolutely do not know give a rating based on what you would suspect it to be and give a low confidence. (One way to do this would be to extrapolate a rating using another similar area where you have a higher level of confidence.)

Confidence Levels. Below the list of habitat characteristics is a row entitled “attribute confidence.” In this row subbasin planners have the option of rating the level of confidence that those filling in the table have in their knowledge of each habitat characteristic in this subbasin. The rating scale is as follows:

0 = speculative
1 = expert opinion
2 = well documented

Similarly, at the right side of the table is a column labeled “reach confidence.” This provides planners with the option of identifying the confidence that the planners have in their knowledge of individual reaches. The same rating scale is used (as above).

By filling in the row and column confidence ratings it is possible to ascribe a confidence level for any given cell in the table. In fact, this is what the spreadsheet does (though you cannot see it yet.) Essentially, what happens is as follows:

(1) For each cell a rating is given that is the sum of the row and column confidence ratings, i.e., a number between 0 and 4.
(2) The ratings in each row are added up to give a number between 0 and 44.
(3) The ratings are averaged, giving a number between 0 and 4.
(4) The averaged ratings are divided by 4. This gives a final rating between 0 and 1.

In the tornado worksheet you will see a "restoration confidence" and a "protection confidence" rating for each reach. These numbers were derived using the above formula.

Documentation. The table offers the opportunity to identify source materials or make comments. Planners will have to decide the extent to which they wish to use this. At the least, planners should seek to create a list of bibliographic references that they consulted in completing the table. Whether they link these to individual reaches/watersheds or create one list for the subbasin is up to them.

Species Hypothesis Worksheet

The "species hypothesis" worksheet is a table that provides subbasin planners with the opportunity to apply their understanding of biological systems to make decisions regarding the relative importance of each life stage to fish productivity and sustainability. The first order of business is to rate the life stages according to overall importance in the subbasin (the LifeStageRank table). Note that while there are several ways to delineate life stages, we have opted for the most simple – spawning, summer rearing, winter rearing and migration. (Migration also includes adult.) Planners should rate life stages using a 4 to 1 scale, with 4 being most important. You may rate all life stages differently (1, 2, 3, 4) or give some or all life stages the same value. Giving three a weight of 1 and the fourth a weight of 4 would indicate that one is significantly more important than the others. The reason for doing this is to define the life stage that will be used to evaluate the importance of the various habitat factors.

The second task is to rate each habitat characteristic for each life stage (Habitat Attribute table). The scale is as follows:

0 = no effect
1 = does effect
2 = critical effect

By rating both life stages and habitat characteristics you are establishing a simple hypothesis concerning how a given species interacts with its environment in this subbasin. The QHA applies the hypothesis to the information you have developed in the reference and current condition tables to develop a series of products. (We will get to the products later.) The sample QHA presents one typical hypothesis where spawning is weighted highest, then rearing and certain factors (e.g., sediment) is given a proportionally higher importance for the spawning life stage. The most simple hypothesis would be to rate all life stages equally (any number from 1 to 3 would work but for sake of this discussion use 1) and assume that all habitat characteristics made the same contribution to the species (i.e., give all habitat characteristics a 1 for all four life stages). In practice, it may be useful to consider more than one hypothesis, for example all 1s as described immediately above and one or more hypotheses where you use differential weightings. You could then generate a set of products using both hypotheses and compare findings.

Species Range Worksheet

This Table arrays focal species distribution by reach (Species Range table). You will note that two conditions are identified – reference and current. For each there are four categories – range, spawning/incubation, summer rearing, winter rearing, and migration. The idea is to tag those reaches/small watersheds where the fish are present during any life stage and to weight the importance of that reach to each life stage of the fish. Weightings can range from 0 to 2 where 0 is not present and 2 would be the highest possible weighting. For the current condition biologists will use their knowledge of the subbasin. In many cases there are GIS data layers available to help with this. See www.streamnet.org or contact the river information system people in your state's fish and wildlife agency. For the reference condition you will obviously need to extrapolate from your understanding of what conditions are required by fish at a given life stage and what conditions would be like if the subbasin were fully restored). In almost all cases the current distribution will be the same as – or a subset of – the reference conditions. In a subbasin with little disturbance the reference and current distribution may close to the same. In a disturbed subbasin there may be areas not currently inhabited by the focal species but where the focal species would return if habitat conditions were improved. This is, by the way, the case in the sample QHA where Whale Creek does not currently have fish but could if restored.

One should be aware that the distributionTable and the life stage/habitat characteristics Table interact. That is, in the computations the ratings given in the life stage/habitat characteristics Table are applied to reaches where a given life stage exists. For a hypothesis where all life stages and characteristics received the same weight (e.g., 1), this would have no effect. But if you had weighted one life stage higher than the others, and if a given reach had all four life stages present, the life stage with higher ratings will have greater impact than those with lower ratings.

The user should also rate the percentage of the stream miles utilized by the focal species both currently and in the reference condition. These data are used to compute the miles of a reach currently, and formerly, used by the focal species along with the percentage habitat loss for display on the tornado page. It is not used in the calculation of habitat protection or restoration ratings.

Habitat Ranking Worksheet

This Table identifies relative protection and restoration value by reach and habitat characteristic, based on an algorithm using information from the current, reference, species hypothesis, and species range tables. The highest value is given a 1 (and highlighted in red), followed by 2 and so on. The Table also identifies which reaches/small watersheds offer the most value (to the left of each row under the "reach score" heading) and which habitat characteristics (at the bottom of each column by the "attribute score" heading) are most important. These scores adhere to the same 1, 2, 3 hierarchy.

This Table gives planners a snapshot of what the protection and restoration opportunities may be given the information that was used in creating the table. Planners should not accept this as absolutely correct or as the total answer. Rather, they should use it as a tool to provoke thought. Does this Table.appear to reflect what experts believe to be the case with this system? If not, why is this? What does this suggest about limiting factors? Are there assemblages of habitat characteristics that are influenced by the same upland land uses? Are there opportunities for re-connections between reaches or small watersheds? Are there clusters of reaches/small watersheds in close proximity that exhibit similar characteristics and that should be considered as a group?
The Algorithm. The restoration rankings Table is generated from information in the reference and current conditions tables and the hypothesis tables. Rankings are generated initially by the following equation:

where "i" is the life stage (spawning, winter rearing, summer rearing, migration) and j is the reach.
A protection habitat score is computed for each habitat variable as:

A restoration habitat score is computed for each habitat variable as:

Tornado Worksheet

Click on the tornado worksheet and you will see a summary chart that shows, for each reach: (1) relative restoration ratings, (2) relative protection ratings, (3) confidence ratings for each of these, and (4) the miles of current habitat and percent habitat loss. We call the Figure giving relative restoration and protection ratings a tornado because it looks like one. Note that often a reach will have both restoration and protection value. The purpose of this graph is to allow planners to look at the system from a holistic perspective. It also gives an indication of the confidence that planners have in potential restoration and protection priorities and may suggest areas where future research is needed.

To the right of the tornado diagram is a column listing, by reach, the miles of current habitat and the percent habitat loss. This provides a measure of the magnitude of the task of restoring or protecting a reach, and also provides an estimate of the historic habitat that has been lost.

Miles of current habitat is computed as the sum of the total miles of habitat from the Current sheet multiplied by the Current percent reach utilization from the Species range sheet. A similar computation is made to estimate the total miles of reference habitat. Percent habitat loss is calculated as:

Where C is the total miles of current habitat and H is total miles of historic habitat.

Definitions Worksheet

This worksheet presents definitions for each of the habitat characteristics used in the QHA. It also presents a Table that identifies the types of measurable data that could be useful in determining the condition of each habitat characteristic.

Reference Documents Worksheet

This serves as a repository for bibliographic references and comments. It serves a key documentation role and provides a means to generate a bibliography for the assessment portion of the plan document.

How do we deal with areas were we have no information?

Information gaps are an issue regardless of assessment technique. A technique based on expert opinion (as is the case with QHA) probably allows more flexibility for dealing with this issue than a purely quantitative approach that relies on measurable field sampling. One approach for dealing with this is to identify similar watersheds where there is a good base of information and assume that the target watershed has similar environmental characteristics and biological responses. If this is done it is important to make note of this in the comment fields. Planners will also want to give a confidence rating that reflects this. If there is no information and no similar watersheds (a highly unlikely scenario), planners may leave blank those rows in the "current" habitat rating Table where this is the case. If this is the case please leave the entire row blank or the program will attempt to compute a score with only partial information and errors will result.

The QHA responds to two of the major criticisms of qualitative assessment approaches in that: (1) it channels expert opinion into a logical and sequential thought process, and (2) it provides a means to track and document decisions. In addition, just because this is labeled a qualitative approach does not mean that it ignores quantitative information. Quite the contrary, planners who use QHA are urged to base their assessments on measurable data wherever and whenever these exist.

2.4 Appendix 4. Sensitive Plants.

Appendix Table 2.4.1 Listing of Sensitive Plants in the Owyhee Subbasin (ONHP 2001; ICDC 2001; NNHP 2001a; NNHP 2001b)

Scientific Name	Common Name	NVE[1]	NVH	OR	ID
Allenrolfea occidentalis	Iodine bush			x	
Allium bisceptrum	Two-stemmed onion			x	
Amsinckia carinata	Malheur Valley fiddleneck			x	
Angelica kingii	Nevada angelica				x
Antennaria arcuata	Meadow pussytoes	x			
Arabis falcatoria	Grouse Creek rockcress	x			
Arabis falcifructa	Elko rockcress	x			
Argemone munita	Prickly-poppy			x	
Artemisia packardiae	Packard's artemisia			x	
Artemisia papposa	Owyhee sagebrush			x	
Astragalus alvordensis	Alvord milkvetch			x	
Astragalus anserinus	Good Creek milkvetch	x			
Astragalus atratus var. owyheensis	Owyhee milkvetch			x	
Astragalus calycosus	King's rattleweed			x	
Astragalus calycosus var. monophyllidius	One-leaflet torrey milkvetch	x			
Astragalus jejunus var. jejunus	Starveling milkvetch	x			
Astragalus lentiginosus var. latus	Broad-pod freckled milkvetch	x			
Astragalus mulfordiae	Mulford's milkvetch			x	x
Astragalus newberryi var. castoreus	Newberry's milkvetch				x
Astragalus purshii var. ophiogenes	Snake River milkvetch			x	x
Astragalus robbinsii var. occidentalis	Lamoille Canyon milkvetch	x			
Astragalus solitarius	Lonesome milkvetch		x		
Astragalus sterilis	Barren milkvetch				x
Astragalus sterilis var. cusickii	Sterile milkvetch			x	
Astragalus tetrapterus	Four-wing milkvetch			x	x
Astragalus tiehmii	Tiehm milkvetch		x		
Astragalus yoder-williamsii	Osgood Mountains/Mud Flat milkvetch	x	x		x

Scientific Name	Common Name	NVE[1]	NVH	OR	ID
Atriplex powellii	Powell's saltbush			x	
Bergia texana	Texas bergia			x	
Blepharidachne kingii	King's desertgrass				x
Camissonia palmeri	Palmer's evening primrose			x	x
Camissonia pterosperma	Winged-seed evening primrose				x
Carex hystericina	Porcupine sedge			x	
Carex tumulicola	Foothill sedge				x
Castilleja pallescens var. inverta	Inverted pale paintbrush			x	
Caulanthus barnebyi	Barneby stemflower		x		
Caulanthus pilosus	Hairy wild cabbage			x	
Chaenactis cusickii	Cusick's false yarrow/Cusick's chaenactis			x	x
Chaenactis macrantha	Large-flowered chaenactis			x	
Chaenactis stevioides	Desert pincushion				x
Cleomella plocasperma	Alkali cleomella				x
Collomia renacta	Barren Valley collomia	x		x	
Coryphantha vivipara	Cushion cactus				x
Cryptantha humilis	Low cryptantha				
Cryptantha propria	Malheur cryptantha				
Cryptantha schoolcraftii	Schoolcraft catseye		x		
Cymopterus acaulis var. greeleyorum	Greeley's cymopterus/Greeley's wavewing			x	x
Cymopterus longipes ssp. Ibapensis	Ibapah wavewing				
Cyperus rivularis	Shining flatsedge				x
Damasonium californicum	Fringed waterplantain				x
Dimeresia howellii	Dimeresia				x
Downingia bacigalupii	Bacigalupi's downingia				x
Downingia insignis	Downingia				x
Dryopteris filix-mas	Male fern				
Eatonella nivea	White eatonella				x
Epipactis gigantea	Giant helleborine				x
Erigeron latus	Broad fleabane	x		x	
Eriogonum anemophilum	Windloving buckwheat		x		
Eriogonum argophyllum	Sulphur Springs buckwheat	x			
Eriogonum chrysops	Golden buckwheat			x	
Eriogonum crosbyae	Crosby buckwheat		x		

Scientific Name	Common Name	NVE[1]	NVH	OR	ID
Eriogonum lewisii	Lewis buckwheat	x			
Eriogonum ochrocephalum	Ochre-flowered buckwheat			x	
Eriogonum salicornioides	Playa buckwheat			x	
Eriogonum shockleyi var. packardiae	Packard's buckwheat				x
Eriogonum shockleyi var. shockleyi	Matted cowpie buckwheat				x
Glyptopleura marginata	White-margined wax plant				x
Hackelia cronquistii	Cronquist's stickseed			x	
Hackelia ophiobia	Rattlesnake stickseed/Three Fork's stickseed			x	x
Hackelia patens var. patens	Spreading stickseed			x	
Heliotropium curassavicum	Salt heliotrope			x	
Hymenoxys cooperi var. canescens	Cooper's goldenflower			x	
Ipomopsis polycladon	Spreading gilia				x
Ivesia rhypara var. rhypara	Grimy ivesia	x	x	x	
Ivesia shockleyi var. shockleyi	Shockley's ivesia			x	
Juncus torreyi	Torrey's rush			x	
Langloisia setosissima spp. punctata	Punctate langloisa			x	
Lathyrus grimesii	Grimes' vetchling	x			
Lepidium davisii	Davis' peppergrass	x		x	x
Lepidium montanum var. nevadense	Pueblo Valley peppergrass		x		
Lepidium papilliferum	Slick spot peppergrass				x
Leptodactylon glabrum	Bruneau River prickly phlox	x	x		x
Lipocarpha aristulata	Aristulate lipocarpha			x	
Lomatium foeniculaceum var. fimbriatum	Fringed desert-parsley			x	
Lomatium packardiae	Succor Creek parsley (Packards' desert parsley)		x	x	x
Lomatium ravenii	Raven's lomatium			x	
Lupinus biddlei	Biddle's lupine			x	
Lupinus uncialis	Inch-high lupine				x
Lygodesmia juncea	Rush-like skeletonweed			x	

Scientific Name	Common Name	NVE[1]	NVH	OR	ID
Malacothrix torreyi	Torrey's malacothrix			x	
Melica stricta	Nodding melic			x	
Mentzelia mollis	Smooth stickleaf/Smooth mentzelia		x	x	x
Mentzelia packardiae	Packard stickleaf/Packard's mentzelia	x		x	
Mirabilis bigelovii var. retrorsa	Bigelow's four-o'clock			x	
Muhlenbergia minutissima	Annual dropseed			x	
Nemacladus rigidus	Rigid threadbush				x
Oryctes nevadensis	Oryctes		x		
Oxytropis sericea var. sericea	White locoweed			x	
Pediocactus simpsonii	Simpson's hedgehog cactus			x	x
Penstemen floribundus	Cordelia beardtongue		x		
Penstemon janishiae	Janish's penstomen			x	x
Penstemon kingii	King's penstemon			x	
Penstemon perpulcher	Beautiful penstemon			x	
Penstemon pratensis	White-flowered penstemon			x	
Penstemon seorsus	Short-lobed penstemon			x	
Penstomen procerus var. modestus	Small flower beardtongue	x			
Peteria thompsoniae	Spine-noded milkvetch				x
Phacelia gymnoclada	Naked-stemmed phacelia			x	
Phacelia inundata	Playa phacelia		x		
Phacelia lutea var. calva	Malheur yellow phacelia				x
Phacelia lutea var. mackenzieorum	Mackenzie's phacelia			x	
Phacelia minutissima	Least phacelia	x			x
Physaria chambersii	Chambers twinpod			x	
Plantago eriopoda	Hairy-foot plantain			x	
Polystichum kruckebergii	Kruckeberg's holly fern			x	
Potentilla basaltica	Soldier Meadow cinquefoil		x		
Potentilla cottamii	Cottam cinquefoil	x			
Primula capillaris	Ruby Mountains primrose	x			
Psathyrotes annua	Annual brittlebrush				x
Psorothamnus kingii	Lahontan indigobush		x		
Pyrrocoma radiata	Snake River goldenweed			x	
Rafinesquia californica	California chicory			x	

Scientific Name	Common Name	NVE[1]	NVH	OR	ID
Senecio ertterae	Ertter's senecio			x	
Silene nachlingerae	Nachlinger catchfly	x			
Smelowskia holmgrenii	Holmgren smelowskia		x		
Stanleya confertiflora	Biennial princesplume/Biennial stanleya			x	x
Stylocline filaginea	Stylocline				x
Stylocline psilocarphoides	Malheur stylocline			x	
Teucrium canadense var. occidentale	American wood sage				x
Thelypodium howellii spp. spectabilis	Howell's spectacular thelypody			x	
Trifolium leibergii	Leiberg clover	x			
Trifolium owyheense	Owyhee clover			x	x
Viola lithion	Rock violet	x			
Lichens					
Aspicilia fruticulosa	Rim Lichen		x		
Catapyrenium congestum	(no common name)				x

[1]ID = Idaho Conservation Data Center
NVH = Nevada Natural Heritage Program Humboldt County
NVE = Nevada Natural Heritage Program Elk County
OR = Oregon Natural Heritage Program

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Owyhee Subbasin Plan

Appendix 3: Appendices for the Inventory of Restoration Activities (Chapter 3)

Prepared By:

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and

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Prepared for:

The Northwest Power and Conservation Council

Final Draft May 28, 2004

Steven C. Vigg,

Steven Vigg & Company

Editor and Project Coordinator

Disclaimer:

Final approval by the Northwest Power and Conservation Council is contingent upon a favorable review by the Independent Scientific Review Panel and meeting requirements for adoption as an amendment to the Council's Fish & Wildlife Program.

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Appendix 3. Appendices to Inventory of Restoration Activities (OSP Chapter 3)

Appendix 3.1. Bibliography for Chapter 3 of the Owyhee Subbasin Plan.

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Appendix 3.2. Laws related to Fish & Wildlife Management

Appendix Table 3.2.1. Nationwide Laws Guiding Agency Activities Affecting Columbia River Basin Fish and Wildlife (source GAO 2004).

Nationwide law	Citation	Description
Anadromous Fish Conservation Act	16 U.S.C. §§ 757a-757f	Authorizes the Secretaries of Commerce and of the Interior to enter into cooperative agreements for the development, conservation, and enhancement of anadromous (migratory) fish resources.
Bald Eagle Protection Act	16 U.S.C. §§ 668-668d	Prohibits the taking or possession of and commerce in bald and golden eagles, with limited exceptions.
Clean Air Act	42 U.S.C. §§ 7401 -7671 q	Requires EPA to set limits on air pollutants and approve state implementation plans to reduce pollutants that exceed limits, and requires federal activities to comply with limits.
Federal Water Pollution Control Act (commonly referred to as the Clean Water Act)	33 U.S.C. §§ 1251-1387	Provides for the restoration and maintenance of the Nation's waters. Authorizes EPA to establish effluent limitations and requires permits for the discharge of pollutants from a point source to navigable waters. EPA approves state and tribal limits for the maximum amount of a pollutant that a water body can receive and still meet water quality standards for specified -purposes, including fish and wildlife.
Coastal Zone Management Act of 1972	16 U.S.C. §§ 1451 -1465	Directs federal agencies to cooperate with state and local governments to control polluted runoff in coastal waters and to

Nationwide law	Citation	Description
		otherwise generally protect, develop, and restore the resources of the nation's coastal zone, including fish and wildlife and their habitats.
Comprehensive Environmental Response, Compensation, and Liability Act of 1980	42 U.S.C. §§ 9601-9675	Provides for the cleanup of hazardous waste by imposing, liabilities and duties on responsible parties, including federal agencies, and by authorizing the federal government to take cleanup actions in response to releases or threatened releases of hazardous substances.
Endangered Species Act	16 U.S.C. §§ 1531 -1544	Provides for the conservation and recovery of species of plants and animals that the National Marine Fisheries Service or the U.S. Fish and Wildlife Service determine to be in danger of or soon to become in danger of extinction. Includes measures to protect the habitats of these species.
Federal Water Project Recreation Act	16 U.S.C. §§4601-12 to 1-21	Declares that recreation and fish and wildlife enhancement should be given full consideration as purposes of federal water development projects.
Fish and Wildlife Conservation Act of 1980	16 U.S.C. §§ 2901 -2912	Provides for financial and technical assistance to states for development and implementation of conservation plans and programs for nongame fish and wildlife.
Fish and Wildlife Coordination Act	16 U.S.C. §§ 661 -666c	Authorizes the Secretary of the Interior to, among other things, provide assistance to, and cooperate with, federal,

Nationwide law	Citation	Description
		state, and public or private agencies and organizations in the development, protection, rearing, and stocking of all species of wildlife and their habitat, in minimizing damages from overabundant species, and in providing public shooting and fishing areas.
Flood Control Acts	E.g. Flood Control Act of 1970, Pub. L. No. 91 -611, 84 Stat. 1818(1970) and Flood Control Act of 1965, Pub. L. No.89- 298, 79 Stat. 1073(1965).	Authorize projects for the benefit of navigation, the control of destructive floodwaters, protection of the shorelines, and other purposes.
Magnuson-Stevens Fishery Conservation and Management Act of 1972	16 U.S.C. §§ 1801 -1883	Establishes a framework for the conservation and management of United States coastal and Outer Continental Shelf fishery resources and anadromous species, which includes the establishment of national standards for fishery management and conservation and of eight Regional Fishery Management Councils to develop fishery management plans. Requires federal agencies to consult with the Secretary of the Interior with respect to any of the Department's actions that may adversely affect fish habitat, and requires the Secretary to recommend habitat conservation measures to the agency.
Marine Mammal Protection Act	16 U.S.C. §§ 1361 -1421 h	Enacts various measures to protect marine mammals and their habitats. Most notably, prohibits the taking of marine mammals, except under certain conditions, including as an

Nationwide law	Citation	Description
		incidental take during commercial fishing operations.
Marine Protection, Research and Sanctuaries Act of 1972	33 U.S.C. §§ 1401-1445,16 U.S.C. §§ 1431-1434	Regulates the dumping of all types of materials into ocean water sand authorizes the EPA to issue dumping permits for material other than dredged material and the Army Corps of Engineers to issue permits for the transportation and dumping of dredged materials, based in part on the effect of the dumping on fish and wildlife and the marine environment.
Migratory Bird Conservation Act	16 U.S.C. §§ 715-715r	Establishes a Migratory Bird Conservation Commission, headed by the Secretary of the Interior, to approve areas of land or water recommended by the Secretary, and approved by the state in which the land is located, for acquisition as reservations for migratory birds.
Migratory Bird Treaty Act	16 U.S.C. §§ 703-712	Implements various treaties and conventions between the United States, Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Prohibits taking, killing, or-possessing migratory birds.
National Environmental Policy Act of 1969	42 U.S.C. §§ 4321 -4347	Enacts measures to promote efforts to prevent or eliminate damage to the environment. Requires federal agencies to examine the impacts of proposed major federal actions "significantly affecting" the environment.

Nationwide law	Citation	Description
National Historic Preservation Act of 1966	16 U.S.C. §§ 470	Encourage agencies and individuals to develop historic preservation programs, and requires agencies to oversee any historic sites under their jurisdiction and consider the effects of its actions on historic sites. Provides for tribes to designate an official to administer the preservation program on tribal lands
Non indigenous Aquatic Nuisance Prevention and Control Act of 1990	16 U.S.C. §§ 4701 -4751	Enacts measures to prevent the unintentional introduction of non indigenous species into the waters of the United States and to minimize the economic and ecological effects of such species that become established. Establishes a task force, comprising, among others, the FWS, the Coast Guard, and EPA to develop a program to prevent introduction of and to control the spread of introduced aquatic nuisance species.
North American Wetlands Conservation Act	16 U.S.C. §§ 4401-4414	Enacts measures to protect, enhance, restore, and manage wetlands and their ecosystems (which include fish and wildlife). Authorizes the Secretary of the Interior to fund wetland
Oil Pollution Act of 1990	33 U.S.C. §§ 2701 -2761	Imposes liability on responsible parties for damages (e.g., loss of natural resources) and for removal costs those agencies, tribes, and others incur from oil discharges into navigable waters.
Public Rangelands	43 U.S.C. §§ 1901 -1908	Establishes a national

Nationwide law	Citation	Description
Improvement Act of 1978		policy to improve conditions on public rangelands; requires the Secretary of the Interior and Secretary of Agriculture to develop, update, and maintain and inventory of range conditions; and authorizes funding for range improvement projects.
River and Harbor Act of 1899, §§9,10	33 U.S.C. §§ 401, 403	Prohibits projects that interfere with navigation, unless Congressional approval is given and a permit is obtained from the Department of Transportation for bridges or causeways, or from the Army Corps of Engineers for other projects such as piers, wharfs, breakwaters, bulkheads, jetties, weirs, dams, or dikes.
Safe Drinking Water Act of 1974	42 U.S.C. §§ 300f to j-26	Enacts measures to protect public drinking water. Requires EPA to promulgate national drinking water regulations to be enforced by states, and prohibits federal agencies from assisting actions that will contaminate an aquifer designated as a drinking water source.
Sikes Act	16 U.S.C. §§ 670-670o	Establishes a program for conservation and rehabilitation of natural resources, including fish and wildlife, at military installations, in accordance with a plan developed by the Secretaries of Defense and the Interior in coordination with the appropriate state agency.
Transportation Equity Act	§49 U.S.C. § 138 note	Directs the Secretary of

Nationwide law	Citation	Description
for the 21sf Century, 3039		Transportation, in coordination with the Secretary of the Interior, to study alternative transportation needs on public lands, such as national parks, recreation areas, and wildlife refuges, to encourage and promote the development of transportation systems for the betterment of those areas in order to, among other things, conserve natural, historical, and cultural resources and prevent adverse impacts, relieve congestion, reduce pollution, and enhance the visitor experience.
Watershed Protection and Flood Prevention Act	16 U.S.C. §§ 1001 -1010	Authorizes the Secretary of Agriculture to provide financial and other assistance to state and local entities and to Indian tribes to plan and carry out projects in watersheds for flood prevention, conservation, development, utilization, and disposal of water, or for conservation and proper use of land.
Wild and Scenic Rivers Act	16 U.S.C. §§ 1271-1287	Institutes a national wild and scenic rivers system and implements a policy of protecting rivers that comprise the system and preserving them in a free-flowing state, by enacting protective and other measures.
Wilderness Act	16 U.S.C. §§ 1131-1136	Establishes a National Wilderness Preservation System composed of federally owned areas the Congress designates as "wilderness areas," which

Nationwide law	Citation	Description
		are to be administered in a way that protects the areas and preserves their wilderness character. Federal agencies that had jurisdiction over areas designated as part of the system are to retain jurisdiction and continue to manage them.

Appendix 3.3. Inventory of existing fish, wildlife, and habitat restoration activities in the Owyhee Subbasin.

Appendix Table 3.3.1 Summary of attributes for of fish & wildlife projects in the Owyhee Subbasin; including both BPA-funded projects and those funded from other sources.

Project Title/ Duration	**Management Entity/ Funding Source and ID # (BPA # if applicable)**	**Brief Project Description/ Scale of Project**	**Subwatershed Name/ (Subwatershed # see reference map attached)**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
Assess Resident Fish Stocks of the Owyhee/Bruneau Subbasins	DVIR/ **BPA # 200007900**	access the current status of native salmonids in the rivers and tributaries within the boundaries of the Duck Valley Indian Reservation/ **rivers and tributaries within the boundaries of the Duck Valley Indian Reservation**		salmonid populations and habitat/ **(1) provide baseline information on genetic variation within and among populations of redband trout within the East Fork Owyhee River and Bruneau River drainage; (2) assess the extent of hatchery introduced rainbow trout introgression within these populat**	**Six of the ten streams scheduled for sampling in 2001 were completed and fin clips are currently being analyzed at a regional genetics laboratory**
Agricultural component of comprehensive TMDL implementation plans for the Bruneau subbasin/ **Initiated**	ISCC	Agricultural component of comprehensive TMDL implementation plans for the Bruneau subbasin			
Bruneau Hot Springsnail Cooperative	BLM, ISU				

Project Title/ Duration	**Management Entity/ Funding Source and ID # (BPA # if applicable)**	**Brief Project Description/ Scale of Project**	**Subwatershed Name/ (Subwatershed # see reference map attached)**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
Monitoring project/ **Ongoing since 1993**					
Bruneau Hot Springsnail habitat monitoring project/ **Ongoing since 1999**	USFWS, ISU				
Bull trout in the Jarbidge River system	Southwest Basin Native Fish Technical Group	seek funding for the Jacks Creek bridge in Nevada; to identify ways to reduce road impacts and explore ways to move the road from the flood plain		Protect bull trout habitat and populations/ **To recover spawning and juvenile rearing habitat and populations**	
California Bighorn Sheep	The Nature Conservancy	Protect and maintain California bighorn sheep populations and their habitats		California bighorn sheep populations and habitats/ **Protect and maintain California bighorn sheep populations and their habitats**	
Fenced off Bruneau hot springsnail habitat from cattle grazing/ **Completed 1992**	BLM	Fenced off Bruneau hot springsnail habitat from cattle grazing			
Fenced off Indian Bathtub in Hot Creek Watershed**/ Completed 1990**	USFWS	Fenced off Indian Bathtub in Hot Creek Watershed			
Groundwater, spring discharge and annual well	USFWS, USGS				

Project Title/ Duration	**Management Entity/ Funding Source and ID # (BPA # if applicable)**	**Brief Project Description/ Scale of Project**	**Subwatershed Name/ (Subwatershed # see reference map attached)**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
withdrawals monitoring/ **Ongoing since 1993 (excluding 1997)**					
Habitat enhancement and protection – Shoshone-Paiute Reservation/ **Ongoing**	Shonshone-Paiute Tribes/ **BPA # 9701100**	Habitat enhancement and protection – Shoshone-Paiute Reservation		Habitat enhancement and protection	
Intermittent Streams and Rivers	The Nature Conservancy	Maintain the high quality and diversity of the riparian communities within and along intermittent streams and rivers and prevent the degradation of these systems		Protect riparian communities/ **Maintain the high quality and diversity of the riparian communities within and along intermittent streams and rivers and prevent the degradation of these systems**	
Jarbidge Sage Grouse Working Group	BLM, IDFG, local ranchers, sportsmen, environmental groups	Prevent fire in critical Wyoming big sagebrush, low sagebrush and mountain sagebrush communities and related cheatgrass and exotic annual grass infestations; Rehabilitate areas following wild fire with native seeds before weed infestation occurs/ **Jarbidge Resource**		**Maintain huntable and sustainable sage grouse populations; Sustain, maintain or improve sage grouse habitat in the various sub-units of the Jarbidge Resource Area**	

Project Title/ Duration	**Management Entity/ Funding Source and ID # (BPA # if applicable)**	**Brief Project Description/ Scale of Project**	**Subwatershed Name/ (Subwatershed # see reference map attached)**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
		Area			
Native Salmonid Assessment Project / **1998-**	IDFG/ **BPA # 199900200**	**a**ssess the current status of native salmonids in the Middle and Upper Snake Provinces in Idaho (Phase I), identify factors limiting populations (Phase II), and develop and implement recovery strategies and plans (Phase III)/ **Middle and Upper Snake Provinces in ID**		Salmonid populations and habitat	
Owyhee County Sage Grouse Working Group		Map locations of all known active and historic sage grouse leks in Owyhee County; Identify and map sage grouse breeding (nesting and early brood) habitat associated with active leks; Identify and map known sage grouse wintering habitat/ **Owyhee County**		Preserve sage grouse populations/ **Preserve and increase sage grouse populations in Owyhee County**	

Project Title/ Duration	**Management Entity/ Funding Source and ID # (BPA # if applicable)**	**Brief Project Description/ Scale of Project**	**Subwatershed Name/ (Subwatershed # see reference map attached)**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
Project 32007		monitor bull trout densities and habitat conditions annually to assess project effectiveness; Bull trout spawning surveys			
Project 32012		assessing water quality standards attainment and meeting grazing, fisheries and terrestrial objectives			
Rangewide surveys for all geothermal springs/ **Ongoing (every 2-3 years) since 1993**	USFWS, ISU				
Redband and Bull Trout	The Nature Conservancy	Protect and maintain population strongholds of redband trout by focusing on the protection and enhancement of riparian habitat within the stronghold population's watershed		Protect redband and bull trout populations and habitat/ **Protect and maintain population strongholds of redband trout by focusing on the protection and enhancement of riparian habitat within the stronghold population's watershed**	
Replace culvert on Jack Creek to remove passage barrier/	Jarbidge Bull Trout Group	Replace culvert on Jack Creek to remove			

Project Title/ Duration	Management Entity/ Funding Source and ID # (BPA # if applicable)	Brief Project Description/ Scale of Project	Subwatershed Name/ (Subwatershed # see reference map attached)	Key Ecological Functions Addressed/ Goal of Project	Results of Project: Accomplishments and failures (Include a Quantitative assessment)
Completed in 1997		passage barrier			
Sage grouse habitat fragmentation study/ **2000-2004**	IDFG and UI	Researchers will monitor sage grouse using radio telemetry to determine sage grouse use of fragmented habitats; examine sagebrush patch size selection, nest site selection, seasonal movements, and seasonal habitat use in fragmented versus continuous habit/ **Jarbidge Resource Area**		Sage grouse populations and habitat	
Sage grouse life history study/ **Data collected in 2000/2001**	IDFG, UI				
Sage Grouse Predator Project/ **2002-2008**	IDFG	six year study that will monitor six sage grouse populations across the state, one of which is in the Sheep Creek drainage west of the Bruneau River/ **Idaho**		Sage grouse populations and predator effects/ **(1) evaluate the effect of predator control on sage grouse nest success; (2) evaluate the effect of predator control on sage grouse survival; (3) document cause-specific**	

Project Title/ Duration	**Management Entity/ Funding Source and ID # (BPA # if applicable)**	**Brief Project Description/ Scale of Project**	**Subwatershed Name/ (Subwatershed # see reference map attached)**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
				mortality of sage grouse eggs, juveniles and adults; (4) evaluate the effect of preda	
Sage grouse recovery in Elko County	Eastern Nevada Stewardship Group, Inc. (Northeast Nevada 2001)	Rehabilitate annual grasslands to perennial plant communities capable of supporting diverse land uses; Improve water quality and quantity within managed basin; Manage uplands and riparian vegetation to improve systems at risk and nonfunctioning systems/ **Elko County**		Preserve sage grouse populations/ **To manage watersheds, basins, or subbasins in a manner that restores or enhances (as appropriate) the ecological processes necessary to maintain proper function ecosystems inclusive of sage grouse**	
Shoshone-Paiute Tribes Sage Grouse Working Group	tribal members, Wildlife and Parks Department biologists and Tribal Business Council members	**Duck Valley Indian Reservation**		Preserve sage grouse populations/ **To maintain a sustainable sage grouse population on the Duck Valley Indian Reservation, promote healthy ecosystems and preserve traditional and cultural appreciation of the species**	

Project Title/ Duration	**Management Entity/ Funding Source and ID # (BPA # if applicable)**	**Brief Project Description/ Scale of Project**	**Subwatershed Name/ (Subwatershed # see reference map attached)**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
Shrub Steppe Habitat	The Nature Conservancy	Identify and protect the existing high quality shrub steppe habitat (late seral condition areas), while moving the fair quality shrub steppe (mid seral areas) into late seral conditions		Protect shrub steppe habitat/ **Identify and protect the existing high quality shrub steppe habitat (late seral condition areas), while moving the fair quality shrub steppe (mid seral areas) into late seral conditions**	
Snake River Native Salmonid Assessment/ **1998-2015**	IDFG/ **BPA # 980002**	assess the status of native salmonids in the Middle and Upper Snake Provinces in Idaho (Phase I), identify factors limiting populations of native salmonids (Phase II), and develop and implement recovery strategies and plans (Phase III)/ **Snake River**		Salmonid populations	**in the first 3+ years of the project, fish and habitat surveys have been made at a total of 757 sites on private and public lands across southern Idaho in nearly all other major watersheds, including the Weiser, Owyhee, Payette, Boise, Goose, Raft, Rock,**
Spotted frog surveys/ **ongoing**	USFWS, IDFG, BSU				
Springs, Spring Creek Systems, and Wetlands	The Nature Conservancy	Maintain or improve the ecological conditions of all springs, spring creek systems, and wetlands so as		Protect springs, spring creek systems, and wetlands/ **Maintain or improve the ecological conditions of all**	

Project Title/ Duration	**Management Entity/ Funding Source and ID # (BPA # if applicable)**	**Brief Project Description/ Scale of Project**	**Subwatershed Name/ (Subwatershed # see reference map attached)**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
		to be rated in Proper Functioning Condition		**springs, spring creek systems, and wetlands so as to be rated in Proper Functioning Condition**	
SWCD Agricultural Implementation Projects: The Bruneau River SWCD/ **ongoing**	SWCD	currently working with private landowners to apply agricultural BMPs on 1,800 acres of cropland with the objective of preserving Bruneau hot Springsnail habitat, and improving groundwater quality. The project also includes planting native plants/ **1,800 acres of agricultural land**		Preserving Bruneau hot springsnail habitat	
Jordan Valley Range Improvement/ **5 years**	NRCS/ **EQIP**	Fencing, livestock water pipe & troughs, range seeding/ **1 Ranch**	**170501090902**	Improving upland function and riparian condition	
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management, fencing/	**170501102502**	Improving water quality	

Project Title/ Duration	**Management Entity/ Funding Source and ID # (BPA # if applicable)**	**Brief Project Description/ Scale of Project**	**Subwatershed Name/ (Subwatershed # see reference map attached)**	**Key Ecological Functions Addressed/ Goal of Project**	**Results of Project: Accomplishments and failures (Include a Quantitative assessment)**
		4 Farms			
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management, fencing/ **10 Farms**	**170501102501**	Improving water quality	
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management, fencing/ **2 Farms**	**170501100104**	Improving water quality	
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management, fencing/ **1 Farm**	**170501150303**	Improving water quality	
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management,	**170501030102**	Improving water quality	

Project Title/ Duration	Management Entity/ Funding Source and ID # (BPA # if applicable)	Brief Project Description/ Scale of Project	Subwatershed Name/ (Subwatershed # see reference map attached)	Key Ecological Functions Addressed/ Goal of Project	Results of Project: Accomplishments and failures (Include a Quantitative assessment)
		fencing/ **1 Farm**			
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management, fencing/ **1 Farm**	**170501100104**	Improving water quality	
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management, fencing/ **1 Farm**	**170501100101**	Improving water quality	
Irrigation Improvement Project/ **5 years**	NRCS/ **EQIP**	Buried mainline, pump, sprinklers, gated pipe, irrigation water management, sediment ponds, grazing management, fencing/ **2 Farm**	**170501170101**	Improving water quality	
Erosion Control Project/ **2 years**	OWC/ **OWEB**	converting from open dirt ditch to pipe/ **1 Ranch**	Jordan	Improve water quality/ **Reduce soil erosion**	
Riparian Protection Project/ **2 years**	OWC/ **OWEB**	Install animal waste management system to prevent animal	Jordan	Improve water quality/ **Elimate any potential animal waste**	

Project Title/ Duration	Management Entity/ Funding Source and ID # (BPA # if applicable)	Brief Project Description/ Scale of Project	Subwatershed Name/ (Subwatershed # see reference map attached)	Key Ecological Functions Addressed/ Goal of Project	Results of Project: Accomplishments and failures (Include a Quantitative assessment)
		waste contamination; fencing of riparian area/ **1 Ranch**		**contamination and protect riparian area**	
Rangeland enhancement project/ **2 years**	OWC:BLM/ **OWEB**	**o**ff-site water development and use exclusion from the Owyhee River/ **BLM Allotment**	Lower Owyhee	**I**mprove upland condition and protect riparian areas/ **Improve livestock distribution and minimize livestock impacts on the banks of the Owyhee River**	
Sagebrush Pasture Solar Project/ **2 years**	OWC:BLM/ **OWEB**	off-site water development / installation of a solar pumping system/ **pasture within a BLM allotment (Nyssa Allotment)**	Lower Owyhee	Improve upland condition and function/ **Improve livestock distribution, enhance wildlife habitat, and improve riparian conditions**	
S. Board Mainline Extension/ **2 years**	OWC/ **OWEB**	conversion of cement ditch irrigation system to sprinkler and/or drip system/ **1 Farm**	Lower Owyhee	Improve water quality/ **Reduce irrigation-induced erosion through improved farm irrigation system**	
Irrigation Improvement Project/ **2 years**	OWC/ **OWEB**	off-site water development and reduction of irrigation-induced erosion/ **portion of 1 Farm**	Lower Owyhee	Improve water quality and protect riparian areas/ **Improve riparian condition and reduce irrigation-induced erosion through improved farm**	

Project Title/ Duration	Management Entity/ Funding Source and ID # (BPA # if applicable)	Brief Project Description/ Scale of Project	Subwatershed Name/ (Subwatershed # see reference map attached)	Key Ecological Functions Addressed/ Goal of Project	Results of Project: Accomplishments and failures (Include a Quantitative assessment)
				irrigation system	
Range Seeding Project/ **2 years**	OWC/ **OWEB**	**brush control and range seeding/** portion of 1 ranch (approx. 640 acres)	Lower Owyhee	Improve hydrologic function of uplands/ **Improve grazing management for the benefit of livestock and wildlife**	
Rangeland enhancement project/ **2 years**	OWC/ **OWEB**	off-site water development / installation of a solar pumping system/ **portion of 1 ranch**	Middle Owyhee	Improve upland condition and function/ **Achieve proper grazing management; provide reliable source of water for livestock/wildlife**	
Rangeland enhancement project/ **2 years**	OWC/ **OWEB**	off-site water development**/** **portion of 1 ranch**	Crooked-Rattlesnake	Improve upland condition and function/ **Improve livestock distribution, reduce pressure on riparian areas, achieve proper grazing management**	
Erosion Control Project/ **2 years**	OWC/ **OWEB**	conversion from dirt ditch irrigation system/ poriton of 1 farm	Jordan	Improve water quality/ **Reduce irrigation-induced erosion through improved farm irrigation system**	

Appendix 3.4. Owyhee Subbasin Existing / Past Restoration Activities Inventory Survey Questionnaire, contact lists, and responses.

Appendix 3.4.1 Owyhee Subbasin Existing / Past Restoration Activities Inventory Survey Questionnaire sent out by Jennifer Martin on April 12th, 2004.

Please answer the following questions to the best of your ability and return to Steven Vigg via email as soon as possible at Vigg@earthlink.net. If you would prefer to return your survey by mail, please send to Jennifer Martin at: Owyhee Watershed Council 2925 S.W. 6th Ave., Ste. 2 Ontario, OR 97914

Organization Name:

Organization Type:
- Federal
- State
- Local
- Private
- Tribe
- Special District
- Other (please list)

Project Title:
Project ID (if applicable):
Contact Information (name, phone number, address, and email):
County:
Stream Name(s):

Project Type:
- Agricultural/Rangeland Improvements: e.g.) riparian fencing, guzzlers, tailwater recovery ponds, filter strips, sediment basin and terraces.
- Fish Passage Improvement projects: e.g.) fish screens, ladders, infiltration galleries.
- In-stream Flow Restoration: e.g.) canal piping or lining project, water right acquisition, leasing
- In-stream Habitat Restoration: e.g.) large woody debris, fish habitat improvements
- Monitoring
- Road Abandonment/Restoration
- Stream bank restoration e.g.) riparian plantings, floodplain improvements
- Upland Habitat Restoration: e.g.) forest health, juniper removal, range seedling, road rehabilitation

- Wetland Restoration projects
- Other: (please describe)

Land Owner:
- BLM
- USFS
- Other federal
- City
- County
- Private
- Private non-profit
- State
- Tribal
- Multiple
- Other

Funding Source:
- Federal
- State
- Local
- Private
- Mix
- Other

Budget:
- Actual Budget Amount

Start Date & End Date

Project Size:
- acres
- feet
- miles
- lat/long
- each

Project Location:
- township/range/section
- latitude / longitude
- HUC #

Status:
- complete
- not started
- on-going

Limiting Factor/Environmental Process Addressed:
- Fish habitat
- Water quality
- Water quantity
- Upland habitat
- Riparian/wetland habitat

Brief Description
Results

3.4.2. Owyhee Subbasin Existing / Past Restoration Activities Inventory Survey Questionnaire Contact List.

Name	Organization Name	Email Address
Brayton Willis	Army Corps of Engineers	Brayton.P.Willis@usace.army.mil
Jenna Whitlock	Bureau of Land Management	jenna_whitlock@blm.gov
Glen Secrist	Bureau of Land Management	glen_secrist@blm.gov
Dave Henderson	Bureau of Land Management	dave_henderson@or.blm.gov
	Bureau of Water Quality Planning	tporta@ndep.state.nv.us
Duane LaFayette	IASCD	dlafayette@netboise.com
Jeff Dillon	Idaho Dept. of Fish and Game	jdillon@IDFG.State.ID.US
Tom Hemker	Idaho Dept. of Fish and Game	themker@idfg.state.id.us
Jon Rachael	Idaho Dept. of Fish and Game	jrachael@idfg.state.id.us
Pam Smolczynski	IDEQ	psmolczy@deq.state.id.us
Dave Ferguson	ISCC	DFERGUSO@agri.state.id.us
Bob Lattan	NDOW	blayton@ndow.org
Loren Jamison	NDOW	
Gary Johnson	NDOW	
Doug Hunt	NDOW	twells@ndow.org
Pete Sinclair	NRCS	Pete.Sinclair@id.usda.gov
Ed Petersen	NRCS	ed.petersen@or.usda.gov
Ken Diebel	ODA	kdiebel@oda.state.or.us

Ron Jones	ODA	rjones@odat.state.or.us
Phil Richerson	ODEQ	richerson.phil@deq.state.or.us
Mitch Wolgamott	ODEQ	wolgamott.mitch@deq.state.or.us
Bob Hooton	ODFW	robert.m.hooton@state.or.us
Ray Perkins	ODFW	raymond.a.perkins@state.or.us
Walt VanDyke	ODFW	walt.a.VanDyke@state.or.us
Nancy Pustis	Oregon Dept. of State Lands	nancy.pustis@dsl.state.or.us
Randy Wiest	Oregon Dept. of State Lands	Randy.Wiest@dsl.state.or.us
Clint Shock	OSU Malheur Experiment Station	ccshock@fmtc.com
Trish Klahr	The Nature Conservancy	tklahr@tnc.org
Bas Hargrove	The Nature Conservancy	bhargrove@TNC.org
Alynn Meuleman	USBR	ameuleman@pn.usbr.gov
Tom Woolf	USDA-ARS	twoolf@nwrc.ars.usda.gov
Pat Clark	USDA-ARS	pclark@nwrc.ars.usda.gov
Keith Paul	USFWS	keith_paul@fws.gov
Jack Doyle	USGS	jddoyle@usgs.gov

3.4.3. Owyhee Subbasin Existing / Past Restoration Activities Inventory Survey Questionnaire Responses:

Idaho Department of Environmental Quality Response:

Organization Name: IDEQ
Organization Type:

- Federal
- State X
- Local
- Private
- Tribe
- Special District
- Other (please list) -

Project Title: No Projects have been funded under our grant program in the Owyhee Subbasin. HOWEVER The TMDLs have been completed for the Subbasin. Monitoring projects have occurred as a result of the TMDL process.
Project ID (if applicable):
Contact Information (name, phone number, address, and email):
County:
Stream Name(s):
Project Type:

- Agricultural/Rangeland Improvements: e.g.) riparian fencing, guzzlers, tailwater recovery ponds, filter strips, sediment basin and terraces.
- Fish Passage Improvement projects: e.g.) fish screens, ladders, infiltration galleries.
- In-stream Flow Restoration: e.g.) canal piping or lining project, water right acquisition, leasing
- In-stream Habitat Restoration: e.g.) large woody debris, fish habitat improvements
- Monitoring
- Road Abandonment/Restoration
- Stream bank restoration e.g.) riparian plantings, floodplain improvements
- Upland Habitat Restoration: e.g.) forest health, juniper removal, range seedling, road rehabilitation
- Wetland Restoration projects
- Other: (please describe)

Land Owner:

- BLM
- USFS
- Other federal
- City
- County
- Private
- Private non-profit
- State
- Tribal
- Multiple
- Other

Funding Source:

- ***Federal***
- ***State***
- ***Local***
- ***Private***
- Mix
- ***Other***

Budget:
- Actual Budget Amount

Start Date & End Date
Project Size:
- acres
- feet
- miles
- lat/long
- each

Project Location:
- township/range/section
- latitude / longitude
- HUC #

Status:
- complete
- not started
- on-going

Limiting Factor/Environmental Process Addressed:
- Fish habitat
- Water quality
- Water quantity
- Upland habitat
- Riparian/wetland habitat

Brief Description
Results

Oregon Department of Fish and Wildlife Response:

Organization Name:ODFW
Organization Type:
- State X

Project Title: Fish Population monitoring
Project ID (if applicable):
Contact Information (name, phone number, address, and email):
County: Malheur
Stream Name(s): Owyhee River, Dry Creek, N. F. Owyhee River, West Little Owyhee River
Project Type:
- Monitoring

Land Owner:
- BLM

Funding Source:
- ***State***

Budget:
- Actual Budget Amount

Start Date & End Date1951-present
Project Size:
- acres
- feet
- miles
- lat/long
- each

Project Location:
- township/range/section
- latitude / longitude
- HUC #

Status:
- on-going

Limiting Factor/Environmental Process Addressed:
- Fish habitat
- Water quality
- Water quantity
- Upland habitat
- Riparian/wetland habitat

Brief Description
Normal inventory of fish populations
Results

Appendix 3.5. Alternative Funding Sources (Source Inter-mountain Province Subbasin Planning, GEI Consultants, Inc. November 17, 2003; NWPCC Web site).

The Technical Guide for Subbasin Planners requests that subbasin plans include activities outside the responsibility of the Bonneville Power Administration (BPA). Specifically, the Technical Guide says, "Subbasin plans need to integrate and coordinate Bonneville obligations under the NW Power Act, Endangered Species Act and Clean Water Act requirements and tribal trust and treaty based responsibilities. Beyond Bonneville specific responsibilities, subbasin plans should be developed broadly enough to take into account other federal, state, and local activities, objectives, and responsibilities. Including these other elements, though they may not be a funding responsibility of Bonneville, should enable planners and implementers to coordinate their activities in a more cost-effective manner and in a way that produces cumulative and synergistic benefits."

This subbasin plan does include recommended strategies for fish and wildlife protection and restoration that are outside BPA's mandate. In order to aid fish and wildlife managers and the public in implementing this plan, we have included this appendix with a list of alternative funding sources that may be willing to provide financial support for strategies in this plan. The information in this appendix came from: Directory of Watershed Funding Resources - Environmental Finance Center at Boise State University: http://ssrc.boisestate.edu/index.asp . More detailed information about funding is available on this website.

The mission of the Environmental Finance Center (EFC) at Boise State University is to provide help to those facing the "how to pay" challenges of environmental protection. The EFC is committed to helping the regulated community build and improve the technical, managerial, and financial capabilities needed to comply with federal and state environmental protection laws. Their goal is to assist local communities and watershed groups in finding creative funding solutions to support their own plans for environmental protection.

There is a tremendous volume of information available for funding watershed restoration. However, finding and sorting through this information can be a daunting task. In an effort to address this need, the EFC has created an on-line, searchable database for watershed restoration funding. The database includes information on funding programs available for federal, state (Oregon, Washington, Idaho, and Alaska), private, and other funding sources.

Users can query the information in a variety of ways including agency sponsor, keyword, or by a detailed search. At the end of a query, a brief description of each matching program will be displayed. When a specific program is selected, a detailed page of that program will be displayed and can be printed.

The database is a work-in-progress. Information is added and updated regularly. The database is a result of a collaborative effort between the EFC and the following organizations:

* Alaska Department of Community and Economic Development (OCED)
* Idaho Department of Water Resources (IDWR)
* Oregon Watershed Enhancement Board (OWEB)
* Washington Infrastructure Assistance Coordinating Council (IACC)
* U.S. Environmental Protection Agency (EPA)

CATEGORY	NON - BPA FUNDING SOURCES
Federal / Interstate Agency Sponsors	
	Bureau of Indian Affairs
	Agriculture on Indian Lands
	Bureau of Indian Affairs
	Environmental Management on Indian Lands
	Fish, Wildlife, and Parks Programs on Indian Lands
	Forestry on Indian Lands
	Indian Loan Guaranty Program - BIA
	Native American Employment Assistance (BIA)
	Soil and Moisture Conservation
	Training and Technical Assistance for Indian Tribal Governments
	Water Resources on Indian Lands
	Bureau of Land Management
	BLM Learning Landscapes - Idaho
	BLM Learnng Landscapes - Oregon & Washington
	Challenge Cost Share
	Secure Rural Schools & Community Self-Determinatio
	Wyden Amendment
	Bureau of Reclamation
	Bridging-the-Headgate - A Conservation Partnership
	Construction Program
	General Investigations Program
	Native American Program
	Planning/Technical Assistance Program
	Technical Assistance to States
	Waste Water Reuse Program
	Cooperative State Research Education and Extension Service
	Sustainable Agriculture Research Education (SARE)
	Water Quality Special Research Grants Program
	Corporation for National and Community Service
	AmeriCorps Education Awards Program

AmeriCorps Indian Tribes and US Territories Program
AmeriCorps National Civilian Community Corps (NCCC)
AmeriCorps National Program
AmeriCorps State Program
AmeriCorps Volunteers In Service To America (VISTA)
Learn and Serve America Program
Senior Corps
Department of Health and Human Services
Indian Environmental Regulatory Enhancement
Economic Development Administration
Center for Economic Development - University of Alaska
Economic Adjustment Program
Partnership Planning Grants for Economic Development Districts, Indian Tribes, & Other Eligible Area
Public Works and Development Facilities Program
Public Works and Economic Development Program
Sudden and Severe Economic Dislocation Program
Support for Planning Organizations
Technical Assistance Program (Local)
Environmental Protection Agency
Brownfields Assessment and Demonstration Projects
Brownfields Cleanup Revolving Loan Fund Pilots
Brownfields Job Training and Development Pilots
Capitalization Grants for Drinking Water State Revolving Fund
Chemical Emergency Preparedness and Prevention Technical Assistance Grants
Clean Water Act Indian Set-Aside Grant Program
Clean Water Act Water Quality Cooperative Agreements
Direct Implementation Tribal Cooperative Agreements
Drinking Water SRF Tribal Set-Aside Program
Energy Star Program
Environmental Education Grants Program
Environmental Justice Collaborative Problem-Solving Grant Program
Environmental Justice Grants to Small Community Groups
Environmental Justice Through Pollution Prevention
Environmental Monitoring for Public Access and Community Tracking (EMPACT)
Five-Star Restoration Program
Guidebook of Financial Tools
Hazardous Waste Management Grants for Tribes
Indian Environmental General Assistance Program (GAP) Grant
Indian Set-Aside Wastewater Treatment Grant Program
National Estuary Program
Nonpoint Source Implementation Grants
Pesticide Environmental Stewardship Grants
Pollution Prevention Incentives for States
Regional Geographic Initiative (RGI) Program
Science to Achieve Results Program
Small Community Wastewater Technical Assistance and Outreach Program

State/Tribal Wetland Planning Grants
Superfund Technical Assistance Grants
Sustainable Development Challenge Grants
Toxic Substances Compliance Monitoring Cooperative Agreements
Tribal Drinking Water Capacity Building/Source Water Protection Grants
Tribal Grants for Surface and Groundwater Protection, Pesticide Management Planning
Tribal Multimedia Compliance Assistance and Enforcement Support
Tribal Municipal Solid Waste Landfills Programs
Tribal Pesticide Program Support
Water Pollution Control - State and Interstate Program Support
Water Protection Grants to the States
Water Quality Cooperative Agreements
Watershed Assistance Grants
Watershed Iniative
Wetland Protection, Restoration, and Stewardship Discretionary Funding
Wetlands Program Development Grants

Farm Service Agency
Conservation Reserve Enhancement Program
Conservation Reserve Program
Conservation Reserve Program - Idaho
Conservation Reserve Program - Washington
Emergency Conservation Program
Farm Debt Cancellation-Conservation Easement Program
Farm Ownership and Operating Loans
Interest Assistance Program
Water Quality Incentives Projects

Federal Emergency Management Agency
Flood Mitigation Assistance Program
Hazard Mitigation Grant Program
Project Impact Grant Program

Federal Highway Administration
Alaska Scenic Byways Program
Transportation Environmental Research Program (TERP)
Transportation Equity Act for the 21st Century (TEA-21)

National Credit Union Administration
Revolving Loan Fund for Credit Unions

National Fish & Wildlife Foundation
Bring Back the Natives
Centennial Refuge Legacy
Challenge Grants for Conservation
National Wildlife Refuge Support Group Grant Program 2002 Application Kit
Pacific Grassroots Salmon Initiative

National Oceanic and Atmospheric Administration
Coastal Services Center Cooperative Agreements
Coastal Zone Management Administration/Implementation Awards
Community-Based Restoration Program
Fisheries Development and Utilization Research & Development Grants & Cooperative Agreement Program

Fisheries Financing Program
Saltonstall-Kennedy Fisheries Research and Development Grants
National Park Service
Historic Preservation Grants-In-Aid
Outdoor Recreation
Rivers, Trails, and Conservation Assistance Program
Natural Resources Conservation Service
Columbia-Pacific Resource Conservation and Economic Development District
Conservation of Private Grazing Land Program
Conservation Security Program (CSP)
Conservation Technical Assistance Program
Emergency Watershed Protection Program
Environmental Quality Incentive Program - Idaho
Environmental Quality Incentive Program - Washington
Farm and Ranch Land Protection Program (FRPP)
Farm Bill 2002 Conservation Programs
Forestry Incentives Program - Washington
Plant Materials Program
Resource Conservation and Development (RC&D) Program
River Basin Surveys and Investigations
Rural Development (RD) Program
Snow Survey & Water and Climate Services Program
Soil and Water Conservation
Soil Survey Program
Tribal Conservation Districts
Water Bank Program
Watershed Protection and Flood Prevention Program
Wetlands Reserve Program (WRP)
Wildlife Habitat Incentives Program (WHIP)
Small Business Administration
Pollution Control Loans
SBA Bond Guarantees for Small Businesses
SBA Business Development Assistance to Small Businesses
SBA Loans for Small Businesses
SBA Minority Enterprise Development
Small Business Development Centers
U.S. Army Corps of Engineers
Basinwide Restoration New Starts General Investigation
Construction of Municipal and Industrial Water Supply Projects
Ecosystem Restoration in the Civil Works Program
Flood Fighting
Floodplain Management Services Program
Levee Rehabilitation
Partners for Environmental Progress
Section 107: Small Navigation Projects
Section 1135: Project Modifications to Improve the Environment
Section 14: Emergency Streambank and Shoreline Protection
Section 203: Tribal Partnership Program
Section 204: Environmental Restoration Projects in Connection with

Dredging
- Section 205: Flood Damage Reduction Projects
- Section 206: Aquatic Ecosystem Restoration Program
- Section 208: Snagging and Clearing for Flood Control
- Section 22: Planning Assistance to the States Program (PAS)
- Section 306: General Investigation Studies for Environmental Restoration

U.S. Department of Agriculture
- Agricultural and Economic Research
- Business and Industry Loans
- Grassland Reserve Program
- National Integrated Water Quality Program (NIWQP)
- National Organic Certification Cost-Share Program - Idaho
- National Research Initiative Competitive Grants Program
- Small Watershed Rehabilitation Program
- Water Conservation Program
- Watershed Processes and Water Resources Program

U.S. Department of Commerce
- Alaska Export Assistance Center
- Alaska Minority Business Development Center
- Community Development Quota (CDQ) Fisheries Program

U.S. Department of Defense
- Doing Business with the Federal Government (PTAC)

U.S. Department of Energy
- Best Practices Program
- Center of Excellence for Sustainable Development
- Million Solar Roofs Initiative
- Office of Industrial Technologies Clearinghouse, The
- Rebuild America

U.S. Department of Health and Human Services
- Administration for Native Americans Grants
- Capacity Building Among American Indian Tribes
- IHS Sanitation Facilities Construction Program
- Improving the Capability of Indian Tribal Governments
- Mitigation of Environmental Impacts to Indian Lands Due to Department of Defense Activities
- Office of Community Services - Grant Programs

U.S. Department of Housing and Urban Development
- Community Development Block Grant Program (ICDBG) - Idaho
- Indian Community Development Block Grant Program

U.S. Department of Interior
- Abandoned Mine Land Reclamation Program
- Acid Mine Drainage Grant
- Land & Water Conservation Fund Grants to States

U.S. Fish & Wildlife Service
- Alaska Coastal Conservation Grants
- Chehalis Fisheries Restoration Program
- Clean Vessel Act Grant Program
- Coastal Grant Program
- Cooperative Endangered Species Conservation Fund
- Fish Screen Construction Program

Greenspaces Program
Habitat Conservation - Partners for Fish and Wildlife Program
Habitat Conservation - U.S. Fish and Wildlife Service Coastal Program
Habitat Conservation Plan Land Aquisition Grants Program
Habitat Conservation Planning Assistance Grants - Cooperative Endangered Species Conservation Fund
Hatfield Restoration Program
Jobs-in-the-Woods Program
National Coastal Wetlands Conservation Grant Program
National Wildlife Refuge Challenge Cost Share Program
Neotropical Migratory Bird Conservation Act Grants Program
North American Wetlands Conservation Act Grants Program
Partnerships for Wildlife
Private Stewardship Grant Program
Puget Sound Program
Recovery Land Acquisition Grants - Cooperative Endangered Species Conservation Fund
Refuges and Wildlife - North American Waterfowl Management Plan
State Wildlife Grants
Washington State Ecosystems Conservation Program

U.S. Fish and Wildlife Service
Landowner Incentive Grant Program - (Non - Tribal)

U.S. Forest Service
Economic Action Programs
Forest Land Enhancement Program - Idaho
Forest Land Enhancement Program - Washington
Forest Legacy Program - Cooperative Forestry Assistance Program
Forest Legacy Program - Washington
Forest Stewardship & Stewardship Incentive Program
Forest Stewardship Program
Mini-Grants Assistance Program
Rural Community Assistance Program
Stewardship Incentive Program
Urban & Community Forestry Program
WACERT Process

U.S. General Services Administration (GSA)
Doing Business with the Federal Government (GSA)

U.S. Geological Survey
State Partnership Initiative

USDA - Rural Development
Agricultural Cooperatives Technical Assistance
Community Facilities Direct and Guaranteed Loans and Grants for Rural Areas - Idaho
Community Facility Loan and Grant Program
Emergency Community Water Assistance Grant Program
Guaranteed Business and Industry Loans
Guaranteed Water and Waste Disposal Loans
Intermediary Relending Program
Rural Alaskan Village Water and Waste Disposal Grants
Rural Business Enterprise Grant Program

Rural Business Loan Fund
Rural Economic Development Loan Program
USDA Water and Waste Disposal Grants
USDA Water and Waste Disposal Loans
Water and Waste Disposal Direct and Guaranteed Loans and Grants for Rural Areas - Idaho
Water and Waste Disposal Loan and Grant Program

State - Idaho

Idaho Department of Agriculture
- Container Recycling Operation Program (CROP)
- Idaho OnePlan Program
- National Organic Certification Cost-Share Program - Idaho
- Noxious Weed Cost-Share Program
- Pesticide Disposal Program

Idaho Department of Commerce
- Community Development Block Grant Program (ICDBG) - Idaho
- Idaho Gem Community Implementation Grants

Idaho Department of Environmental Quality
- Drinking Water Revolving Loan Fund - Idaho
- Nonpoint Source Implementation Grant (319) Program - Idaho
- Planning Grant Program for Drinking Water Facilities - Idaho
- Planning Grant Program for Wastewater Facilities - Idaho
- Water Pollution Control State Revolving Loan Fund - Idaho

Idaho Department of Fish & Game
- Habitat Improvement Program (HIP)
- Project WILD - Idaho
- State Wildlife Grants Program - Idaho
- Wildlife Conservation and Restoration Program (WCRP)

Idaho Department of Lands
- Arbor Day Grants
- Community Transportation Enhancement (CTE) Grant
- Forest Land Enhancement Program - Idaho
- Forest Legacy Program - Idaho
- Hazardous Fuels Treatment Grants
- Urban & Community Forestry (UCF) - Program Development Grant
- Urban & Community Forestry (UCF) - Tree Planting & Care Grant
- Urban & Community Forestry Program - Idaho
- Western Wildland Urban Interface (WUI)

Idaho Department of Parks and Recreation
- Land and Water Conservation Fund - Idaho
- Motorbike Recreation Fund
- Off-highway Vehicle Programs
- Recreational Trails Program - Idaho
- Snowmobile Registration Fund
- Waterways Improvement Grants

Idaho Department of Water Resources
- Energy Conservation Loan Program
- Idaho Water Resource Board Funding Programs

Idaho Office of Species Conservation
- Idaho Wolf Depredation Compensation Program

Idaho Soil Conservation Commission
- Natural Resource Conservation Tax Credit
- Resource Conservation and Range Development Program (RCRDP) Loans
- Water Quality Program for Agriculture (WQPA)

Idaho Transportation Department
- Congestion Mitigation and Air Quality Improvement Program - Idaho
- Enhancement Program
- Transportation Equity Act for the 21st Century (TEA-21) - Idaho

Idaho Water Resources Research Institute
- Water Resources Research Institute

University of Idaho
- Project WET - Idaho

State - Washington

Interagency Committee for Outdoor Recreation
- Athletic Facility Account Program
- Boating Facilities Program
- Firearms and Archery Range Recreation
- Non-Highway & Off-Road Vehicle Activities Program
- Riparian Habitat Program
- Salmon Recovery Funding Board
- Washington Wildlife and Recreation Program (WWRP)

Transportation Improvement Board (TIB)
- FEMA Match Program
- Small City BRAC Match Program
- Small City Pedestrian Safety and Mobility Program
- Small City Program (SCP)
- Urban Pedestrian Safety and Mobility Program

Private / Foundation Sponsors

A Territory Resource (ATR)
- A Territory Resource (ATR)

Acorn Foundation
- Common Counsel Foundation (Acorn Foundation)

American Farmland Trust
- Farm Legacy Program

American Land Conservancy
- American Land Conservancy Program

American Water Works Association Research Foundation (awwaRF)
- American Water Works Association Research Foundation (AwwaRF)

American Wildlands
- American Wildlands

Andrew Mellon Foundation
- Conservation and the Environment Program

ARCO Foundation, The
- ARCO Foundation

Barker (Donald R.) Foundation
- Barker (Donald R.) Foundation

Bay Foundation, The
- Bay Foundation, The

Ben & Jerry's Foundation
- Ben & Jerry's Foundation

Bikes Belong Coalition
- Bikes Belong Coalition

Bonneville Environmental Foundation
- Bonneville Environmental Foundation Watershed Program, The
- Renewable Energy Program

Braemar Charitable Trust
- Braemar Charitable Trust

Brainerd Foundation
- Communications & Capacity Building Program - Brainerd Foundation
- Endangered Ecosystems Program

Bullitt Foundation
- Bullitt Foundation (Rivers, Wetlands, Estuaries, and Marine Ecosystems Grant Program), The

C. Giles Hunt Charitable Foundation
- C. Giles Hunt Charitable Trust

Captain Planet Foundation
- Captain Planet Foundation

Cascade Natural Gas Foundation
- Cascade Natural Gas Foundation

Charla Richards Kreitzberg Charitable Foundation
- Charla Richards Kreitzberg Charitable Foundation

Collins Foundation
- Collins Foundation Environmental Program, The

Compton Foundation
- Compton Foundation Environmental Grants, The

Conservation Alliance, The
- Conservation Alliance Grants

Conservation Fund, The
- Conservation Fund, The
- Kodak American Greenways Award

Defenders of Wildlife
- National Stewardship Initiatives: Conservation Strategies for U.S. Land Owners

Diack Ecology Education Program
- Diack Ecology Education Program

Doris Duke Charitable Foundation
- Doris Duke Charitable Foundation, The

Ducks Unlimited
- Ducks Unlimited
- Matching Aid to Restore States Habitat (MARSH) - Ducks Unlimited

U.S. Habitat Projects
Earth Force, Inc.
Earth Force, Inc.
Educational Foundation of America
Educational Foundation of America, Environmental Grant Program, The Environmental Program
Evergreen Community Development Association
Evergreen Community Development Association
Evergreen Rural Water of Washington
Evergreen Rural Water of Washington Technical Assistance and Training
First Nations Development Institute (FNDI)
First Nations Development Institute
FishAmerica Foundation
FishAmerica Grant Program
Flintridge Foundation
Flintridge Foundation's Conservation Program
FMC Corporation and The National Fish and Wildlife Foundation
FMC Corporation Bird and Habitat Conservation Fund
For the Sake of the Salmon
Technical Assistance Directory (TAD)
Watershed & Community Support
Friends of Paul Bunyan Foundation
Friends of Paul Bunyan Foundation
Fund for Wild Nature
Fund for Wild Nature Grant Program
General Electric Foundation
General Electric Foundation
Gifts In Kind International
Gifts In Kind International
Greenville Foundation
Greenville Foundation Environment Funding
Groundwater Foundation, The
Groundwater Foundation, The
Henry M. Jackson Foundation
Henry M. Foundation (Environmental and Natural Resource Management Program)
Home Depot Corporation
Home Depot Coporate Contributions Programs
Homeland Foundation, The
Homeland Foundation, The
Homer Foundation, The
Homer Foundation, The
Hugh and Jane Ferguson Foundation
Hugh and Jane Ferguson Foundation, The
Idaho Fish and Wildlife Foundation
Idaho Fish and Wildlife Foundation
Idaho Forest Products Commission
Project Learning Tree - Idaho
Teachers Grant Program

Izaak Walton League
  Save Our Streams Program
Jackson Foundation, The
  Jackson Foundation, The
Jessie Smith Noyes Foundation
  Sustainable Agriculture Program
Kongsgaard-Goldman Foundation
  Environmental Protection and Conservation Program
L.J. and Mary C. Skaggs Foundation
  L.J. and Mary C. Skaggs Foundation, Environmental Education Grant Resource
Laird Norton Endowment Foundation, The
  Laird Norton Endowment Foundation
Lamb Foundation
  Lamb Foundation Grants
Land Trust Alliance
  Land Trust Alliance-Northwest Program
Laura Jane Musser Fund
  Laura Jane Musser Fund
Lawrence Foundation
  Lawrence Foundation, The
Lazar Foundation, The
  Lazar Foundation, The
Mountaineers Foundation
  Mountaineers Foundation Environmental Program, The
Nathan Cummings Foundation
  Nathan Cummings Foundation Grant Program, The
National Association of Development Organizations (NADO)
  National Association of Development Organizations
National Congress for Community Economic Development (NCCED)
  National Congress for Community Economic Development
National Congress of American Indians (NCAI)
  National Congress of American Indians
National Economic Development and Law Center (NED&LC)
  National Economic Development and Law Center
National Environmental Education & Training Foundation
  NEETF Challenge Grant Program
National Fish and Wildlife Foundation
  Challenge Grants
  Community Salmon Fund
  Migratory Bird Conservancy
  National Fish and Wildlife Foundation in partnership with Natural Resources Conservation Service
  National Fish and Wildlife Foundation, The
  Natural Resources Conservation Service: Conservation on Private Lands
  Nature of Learning, The
  Pathways to Nature Conservation Fund
  Pulling Together Initiative
National Forest Foundation
  Community Assistance Program (CAP)

National Forest Foundation Matching Awards Program
National Foundation for Integrated Pest Management Education
Pesticide Environmental Stewardship Grants
National Geographic Society
Expeditions Council Grants
National Geographic Society
Conservation Trust
Grants for Scientific Field Research and Exploration
National Geographic Society Education Foundation
Grosvenor Grant Program
Teacher Grants
Venture Fund
National Natural Resource Conservation Foundation
National Natural Resources Conservation Foundation
National Science Foundation - Division of Environmental Biology
Water and Watersheds
National Wildlife Federation
National Wildlife Federation
Native American Fish & Wildlife Society
Native American Fish & Wildlife Society
Nature Conservancy, The
Nature Conservancy, The
Patagonia
Patagonia Environment Grants
Paul G. Allen Forest Protection Foundation
Paul G. Allen Forest Protection Foundation, The
Pew Charitable Trusts
Pew Charitable Trusts Environmental Program, The
PGE Foundation
PGE Foundation
Pheasants Forever
Pheasants Forever
Phillips Petroleum Company
Phillips Petroleum Company
Plum Creek Foundation
Plum Creek Foundation Grants
Public Welfare Foundation
Public Welfare Foundation - Environment Grants
REI
REI Conservation and Outdoor Grants
River Network
Watershed Assistance Grants
Rockefeller Family Fund
Rockefeller Family Fund (Environment Grants Program)
Rocky Mountain Elk Foundation
Rocky Mountain Elk Foundation
Rural Community Assistance Corporation
RCAC - Technical Assistance and Training
Ruth H. Brown Foundation

- Ruth H. Brown Foundation

Ruth Mott Fund
- Ruth Mott Fund

Seventh Generation Fund
- Seventh Generation Fund

Skaggs Foundation, The
- Skaggs Foundation, The

Strong Foundation for Environmental Values, The
- Strong Foundation for Environmental Values, The

Training Resources for the Environmental Community (TREC)
- Training Resources for the Environmental Community (TREC)

Treasure Valley Land Trust
- Treasure Valley Land Trust

Trout Unlimited
- Embrace-A-Stream, Education Project
- Embrace-A-Stream, Research Project
- Embrace-A-Stream, Resource Project

Turner Foundation
- Turner Foundation Environmental Grant Programs

Wal-Mart Foundation
- Local Wal-Mart Environmental Grant Program, The

Washington Water Trust, The
- Washington Water Trust

WaterWatch
- WaterWatch

Weyerhaeuser Company Foundation
- Weyerhaeuser Company Foundation

Wilburforce Foundation
- Wilburforce Foundation

Wildhorse Foundation
- Wildhorse Foundation

William and Flora Foundation
- William and Flora Hewlett Foundation

William C. Kenney Watershed Protection Foundation
- William C. Kenney Watershed Protection Foundation

Appendix 3.6. Watershed Protecting Transformations in Malheur County Farming Practices 1980-2004 (Shock et al. Third Draft, May 25, 2004)

Clinton C. Shock[1], Herb Futter[2], Lynn B. Jensen[3], Jim Nakano[2], Vince Gaona[4], and Ray Dunten[5]

[1]Malheur Experiment Station, Oregon State University, Ontario, Oregon

[2]Malheur Watershed Council, Ontario, Oregon

[3]Malheur County Extension Service, Oregon State University, Ontario, Oregon

[4]Simplot Growers Solutions, Ontario, Oregon

[5]Farm Services Agency, USDA, Ontario, Oregon

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III. Notes on the Implementation of New Practices

Introduction

Malheur County occupies Oregon's southeastern corner. Both the Malheur River and Owyhee River, tributaries of the Snake River, drain the area. The largest city, Ontario, is only 56 miles from Boise, Idaho, but 377 miles from Portland, Oregon. There are only 31,300 inhabitants in this arid county, mostly concentrated in the towns situated in the area of intensive agriculture. Rainfall is far less than crop water needs, averaging only 10 inches per year at the lower elevation sites, with frequent occurrence of drought. Rainfall is distributed mostly in the colder months when plant growth is restricted by freezing temperatures.

The county covers 6,352,000 acres, of which 94% is rangeland and 4% is irrigated cropland. Agricultural industries in Malheur County consist of developed intensive crop production, crop processing, extensive cattle operations, and confined animal feeding. The discussion here focuses on practice changes in the areas of intensive crop production.

Irrigation water comes largely from snow melt and runoff from rangelands. Reservoirs capture the seasonal runoff at elevations higher than irrigated cropland. Water flows via canal systems to farms by gravity. The region was developed predominantly using furrow irrigation systems prior to 1940. Fields are generally small and rectangular consistent with the development of furrow irrigation at that time. The field size and the design of the water delivery system makes conversions to other systems costly or impractical. Sixteen irrigation districts manage the reservoirs, canals, and water. The Owyhee Irrigation District, Vale Oregon Irrigation District, Warm Springs Irrigation District, and the Owyhee Ditch Company are the larger districts (1).

Many changes have occurred in farming practices in Malheur County since 1980. The following sections of this report describe the practices of the late 1970's, research into changes in those practices to improve production efficiency while ameliorating associated environmental problems, and implementation of the new practices in Malheur County.

I. Agricultural Practices in the Early 1980's

I. A. Water and Soil Use Practices

From 1978 through 1980 the Malheur County Court under the leadership of Judge Ray Hirai evaluated water quality problems related to non-point source pollution in Malheur County, and set about trying to solve these problems (2). The effort had ample participation by Malheur County citizens. The county study a "Two-Year Sampling Program, Malheur County Water Quality Management Plan" demonstrated water quality problems with phosphorus, nitrate, sediment load, and bacteria and set out a series of Best Management Practices (BMP) to address the problems. Various agencies cooperated with Malheur County in making the study.

The Malheur County Soil and Water Conservation District (SWCD) was given the lead to implement the plan to reduce non-point pollution, but the SWCD was given no resources to do so. No state, state agency, or federal funding was found to assist with the implementation of the plan or the improvements recommended by the plan. The county judge following Ray Hirai was E.M. Seuell, who was not particularly interested in the program and provided no funding. Neither the OSU experiment station nor the extension service were involved in demonstration or education on these issues at the time. Consequently, improvements in the field proceeded at a slower pace, fueled only by private investments and work by the Soil Conservation Service (SCS).

From 1980 through 1985, Herb Futter recalls that the mind set was still that surface erosion was something that you had to have, a necessary evil of irrigation. Crop productivity was increasing through the use of better varieties, improved weed control, and enhanced disease control, along with chemical fertilizer inputs, and these changes were masking the degradation of the soil from surface erosion.

Irrigation systems were dominated by surface flood irrigation in meadows and pastures from dirt ditches and surface furrow irrigation from dirt and concrete ditches. Siphon tubes were used to deliver the water from the ditch to the irrigation furrows. Fields had been leveled, but not with laser leveling. Gated pipe, turbulent fountain weed screens, PAM, and straw mulch were not used.

Soil was prepared in the fall after harvest and in the spring. Spring soil preparation tended to compact and dry the soil. Since efficient weed control was becoming established through the adoption of herbicides in the 1970's, this innovation was already leading to fall bedding of the soil (conserving winter soil moisture and protecting the soil from physical damage when the soil was worked wet in the spring) and leading to the adoption of environmentally sound crop rotations. Crop rotations include onions (*Allium cepa*), sugar beets (*Beta vulgaris*), wheat (*Triticum aestivum*), corn (*Zea mays*), beans (*Phaseolus vulgaris*), potatoes (*Solanum tuberosum*), alfalfa (*Medicago sativa*), alfalfa grown for seed, spearmint (*Mentha spicata*), peppermint (*Mentha piperita*), and other crops.

Prior to the advent of modern herbicides, growers were confined to using the same land for row crops year after year. In those days onions were raised in the same fields year after year. This was due to the fact that onion fields were kept fairly weed free. Onions cannot compete well with weeds. There was insufficient labor to hire to weed the onions so the family did all the weeding. Once the fields were kept fairly weed seed free, onions were planted in the same fields year after year. The onion yields and size would decline considerably with repeated planting as root disease organisms proliferated. Onions are a high user of nitrogen fertilizer, and supplying this need probably caused nitrogen to leach into the vadose zone and the shallow aquifers.

The only rotation crops used with onions were sugar beets and potatoes. Potatoes and sugar beets could also benefit from the dominance over weeds which had been established in the onion fields. High rates of nitrogen were also applied to sugar beets. Growers were paid by the ton, so growers disregarded the low percentage of sugar in highly fertilized beets and tried to achieve maximum tonnage per acre. Alfalfa, wheat or corn could have helped use up the excess or carry over nitrogen following these row crops, but they were not used until the advent of effective herbicides which allowed growers to rotate crops and use most of the fields at their disposal for row crops.

The herbicide Dacthal (DCPA) was widely used in Malheur County by onion and alfalfa seed growers to control a wide spectrum of weeds. Several chemicals such as Dacthal were applied at the full broadcast rate, which was 12 lb per acre broadcast. Groundwater became contaminated with nitrate and the breakdown products of DCPA (3).

Irrigation scheduling was based on the calendar and grower intuition and experience. No soil moisture measurement tools were used.

I. B. Fertilizer Use

After World War II the availability of chemical fertilizer was not a problem. More row crops were planted due to the increase in demand and higher commodities prices created by the war effort and the strong economy following the war. Due to high demand and commodity prices, more farmers switched from cereal crops to row crops, crops that were fertilized at higher nitrogen rates.

During this period farmers with experience using various blends started formulating their own special mixes of fertilizer. No soil analysis or follow-up plant tissue testing of petiole or root samples were taken. Each grower had his own special blend of fertilizer for onion, potatoes and sugar beets. Up through the early 1980’s it was common practice for farms to have their secret crop mix made up of 1000 to 1500 lb of 16-16-16 per acre for fall fertilizer. A lot of these fall fertilizer mixes contained 150 to 200 lb/acre of nitrogen, which were followed up in the spring with another 150 to 300 lb/acre of nitrogen sidedressed. Due to relatively high commodity prices, excess nitrogen was applied, trying to achieve maximum yields.

Fertilizer was applied in the fall. Two of the main reasons for fall applications were that the fertilizer acted as a soil conditioner to help mellow the crust that builds up during the winter months and fall application helped avoid soil compaction from spring broadcast fertilizer application and other spring tractor work.

Fertilizer rates were determined by the growers financial condition and yield aspirations, not based on carefully identified crop needs.

Published fertilizer guides appear to be based on yield maximization, with little thought as to the fate of excess nutrients.

I. C. Fate of Crop Residues

Crop residues from growing wheat and sweet corn and growing and processing sugar beets were largely recycled. Beet pulp was recycled into cattle feed. Manure from dairies was recycled onto farm ground.

Alfalfa seed screenings, the by product of processing alfalfa seed, were hauled to the landfills for burial due to environmental regulations against their traditional use as an animal feed supplement. Alfalfa seed screenings constituted 16 percent of local land fill volume in the 1980's. Potato processing waste was fed to cattle, but the residual sludge from processing was trucked to holding ponds where it was stored and accumulated. Cull onions were buried in shallow pits. Spent mushroom compost from growing mushrooms was largely deposited in a growing pile outside of Vale.

I. D. Labor considerations

Ample labor was usually available to help conduct supplemental weeding and make onion harvests.

I. E. Contradictions, problems, and opportunities

By the end of the 1970's, environmental needs for irrigated agriculture in the Treasure Valley included the reduction of soil loss and nutrient loss from crop land, improvement in irrigation efficiency, the reduction of nutrient loss to groundwater, preservation of soil structure, and the transformation of agricultural chemical use so that very low rates of agricultural chemicals would be required. Where chemical products were required, they needed to degrade quickly without off site effects. Reduced and timely tillage could reduce the physical damage to the soil that was resulting from cultivation.

The reduction in sediment and nutrient loss could help retain agricultural productivity and reduce the contaminate load to streams rivers, and reservoirs. Irrigation-induced losses of phosphorus (P) and sediment were documented problems (2). Increases in irrigation efficiency would facilitate reductions in irrigation-induced erosion and nitrate leaching. Re-examination of fertilization recommendations and refinement of soil and plant tissue sampling and application techniques could redirect fertilization toward only satisfying plant nutrient needs and economical crop responses. Innovations in the development of integrated pest management and the use of short half life agricultural chemistry could reduce the chemical load to off site targets.

In 1985 three of us (Herb Futter, Lynn Jensen, and Clint Shock) came to the conclusion that there was a systematic over-application of N fertilizer. This conclusion was based on the amount of N applied to each crop in a typical crop rotation and the amount of N contained in the harvested crops from the same rotation (4). Without any access to resources to address the N application issue an indirect approach was considered. Research and demonstration trials conducted for entirely different purposes were very carefully fertilized using soil tests and tissues sampling. Relatively high yields could be obtained with relatively low N inputs, demonstrating better N use efficiency. These trials could start to change grower perceptions and practices.

Nitrogen management and irrigation management are closely linked, and trying to manage one without the other becomes self-defeating. Nitrogen only leaches when excess water is applied and conversely excess water can only leach if substantial amounts of nitrate is available to be leached from the soil profile. The goal is to have enough nitrogen available to maximize crop growth, but not excess, and enough water in the soil profile to keep crop growth adequate without pushing too much water through the soil profile. Nutrients are washed off the field when ample amounts of water mover across and off the field with substantial force to move soil off the field.

II. Research, Demonstrations, and Adoption

Over the last two decades, a wide range of research and demonstration efforts have been planned and conducted to improve production efficiency and ameliorate associated environmental problems. With each initiative there were few road maps prior to the start of that initiative which indicated how beneficial each potential new practice would be. Starting on each project, it was difficult to foresee the extent to which a new practice would be adopted. Part of the unknown of each new practice was how it would eventually modify crop production, product quality, or the ease of farming. Alternatively, a new practice could be too much trouble or too costly.

Too many variables influence the adoption of innovations to provide 20/20 vision into the future. Incentives toward change include decreased costs, improved productivity, improved crop quality, eligibility for cost share programs, and attitudes of stewardship. Disincentives for change are practices which increase costs, reduce productivity, increase risk or uncertainty, require large capital outlays, or involve substantial red tape. Extremely low margins in farming can force the minimization of inputs, including site specific management to remediate or minimize environmental effects of farming.

The research and demonstration discussed below have positive environmental benefits and have been adopted by some or most growers.

II. A. 1. Efficiency of furrow irrigation and irrigation-induced erosion

A wide array of practices were investigated to improve the efficiency of furrow irrigation and reduce irrigation-induced erosion. These included laser leveling fields, mechanical straw mulching, gated pipe, alternate furrow irrigation, surge irrigation, modified surge, PAM, sedimentation basins and pump back systems, and turbulent fountain weed screens

II. A. 1. a. Laser leveling

Prior to the 1980's, fields had been leveled by conventional means. Fields were surveyed, staked, and soil was moved about within a field by farm tractor powered equipment. Fields with slopes of 0.6 to 0.7 or more feet per hundred feet required too much water to irrigate due to excessive runoff and resulted in too much soil erosion. Fields with slightly irregular slopes had parts which required long furrow irrigation durations, and also had flat spots with excessive water infiltration which resulted in excessive deep leaching. Crop plants growing on steeper spots were subject to yield and quality loss from water stress. Plants growing on flatter spots were subject to loss from ponded water and decomposition.

Dressing fields with laser leveling to a slope of 0.3 to 0.4 feet per hundred feet provided immediate benefits for surface irrigation. Herb Futter was able to show less soil was lost from the field and the field irrigated much more uniformly. The uniformity of irrigation allowed for the conservation of water, less leaching in the wetter parts of the field, and improved crop performance. During the early 1980's ASCS would not fund laser leveling, but starting in the latter half of the 1980's they did participate in cost share based on Herb Futter's results.

From 1985 through 1999 approximately 4500 acres of cropland have been laser leveled through cost share programs, improving irrigation efficiencies. Efficiency increases of 15 to 20 percent have been obtained. The practice is widely accepted by growers at their own initiative to the point that the practice now seldom receives cost share incentives.

II. A. 1. b. Demonstrations of the use of straw mulch to reduce erosion

In the early 1980's Malheur County growers Vernon Nakada and Joe Hobson were applying wheat straw mulch by hand to reduce irrigation-induced erosion. One method of reducing soil movement within the field and loss of sediment and nutrients off the field is to use mechanical straw mulching techniques (5, 6, 7, 8, 9, 10). The process of using straw mulch on fields is not a new concept. In fact, the hand mulching of onions and other various crops has been used for many years. Spreading the mulch by hand can be extremely expensive, so there was a need for another cost effective way to spread mulch.

Joe Hobson, a neighbor of the Malheur Experiment Station, realized the great time and effort necessary to hand-apply straw mulch. Joe Hobson started to build the mechanized mulcher in Ontario in the mid 1980’s to help reduce mulching costs. His mechanical mulcher made the spreading of mulch economically feasible for farmers. Several variations of his original idea are used in the Treasure Valley. Early mechanical mulching trials starting in 1985 demonstrated effectiveness reducing erosion (5) and improving sugar beet yields (6).

There are many different factors to take into consideration when mechanically spreading mulch. None of these factors had been evaluated. The size, type, and rate of mulch application determines the costs and benefits of spreading. Another financial consideration is the initial start-up cost of purchasing a mechanical mulcher versus renting one, and the cost of labor to run the mechanical mulcher. These factors play a major role for the grower's cost-benefit analysis (11, 12).

Mechanical straw mulching improved onion yield and size in furrows that were compacted by tractor wheel traffic (9, 11). Five replicated trials were conducted between 1988 and 1995, in commercial fields and at the experiment station.

In the 1991 trial, onion yield was unaffected in the commercial field. The mulch was applied at a rate of 650 lb per acre. The same year trial at the experiment station in a field with 3 percent slope showed that straw mulch increased onion yield by 64%. The increase was through both jumbo and colossal onions, and decreased the yield of mediums. In the 1995 experiment station trial in the same field with 3 percent slope, similar results were obtained with a 74% onion yield increase. In both of the trials conducted at the experiment station, wheel-compacted furrows were irrigated. The experiment station rate in 1991 was 800 lb of mulch per acre, and was 560 lb of mulch per acre in 1995, with split applications of straw.

During the trials at the experiment station, water runoff, infiltration, irrigation efficiency, and water use efficiency of the onion crop were measured in addition to onion yield and grade responses. The correlation for the increase in onion yields and straw mulch is attributed to reduced water runoff, increased lateral water movement, and improved soil moisture. The straw mulch placed in the furrows caused more water to move laterally into the beds as a result of slow water movement at the furrow bottom and the higher level of water in the furrows.

The measurements in onion fields showed mechanical straw mulching had conservation benefits by reducing soil erosion and irrigation water runoff (5, 6, 7, 8, 9, 10). Synthetic materials such as polyacrylamide (PAM) can control erosion and enhance water infiltration in irrigation furrows. A single application of straw mulch is apparently as effective as repeated applications of PAM in reducing erosion (13). Mechanically applied straw was more effective than PAM in increasing water infiltration and maintaining soil water potential, hence straw was more effective in increasing onion yields.

Straw mulch was also related to benefits in potato fields (14).

From 1985 to 1999 growers applied straw mulch to approximately 4000 acres through cost share funds.

II. A. 1. c. Introduction of gated pipe

Gated pipe was introduced to allow more uniform irrigation on many surface irrigation sites. The water set in each furrow can be less than with siphon tubes, and allows surface irrigation with conservation of water, reduced irrigation induced erosion, and less leaching potential. Gated pipe also can facilitate the eventual adoption of surge irrigation.

Gated pipe was first used in a substantial way in Malheur County in 1977, a year of severe drought. The 80 miles of fiberglass pipe arrived too late to do much good that year. The project was promoted by the SCS and was cost shared by the ASCS. The fiber glass pipe proved to have poor durability outdoors in the sunlight.

More durable plastic gated pipe was introduced and supported by cost share programs. From 1985 to 1999 growers have converted the delivery systems from open ditches to gated pipe on approximately 60,000 acres of cropland. The decrease in water use on these systems is 35-40%.

II. A. 1. d. Surge irrigation

Surge irrigation is a conservation practice that has been thoroughly developed and tested by the University of Nebraska and valve manufacturers, but still remains one of the lesser known and lesser used methods in the Treasure Valley of southeastern Oregon and southwestern Idaho. Surge Irrigation can reduce irrigating costs through lower water use and reduced labor to irrigate. Surge irrigation reduces the total amount of irrigation water applied, excess water infiltration, and runoff water losses. Surge irrigation helps reduce the amount of sediment lost from furrow-irrigated fields.

Surge irrigation uses a surge controller butterfly valve placed in the center of the top of the field with gated pipe leading out of the valve going both directions along the top of the field. In fields with some side slope, the surge valve can be placed in the corner of the field, and extra pipe used to distribute the water. The valve works by oscillating water from one side of the valve to the other at decided intervals. (In conventional irrigating systems the water flows continuously for the irrigation set.) The alternating flow of water on each side of the valve causes an intermittent wetting and soaking cycle in the irrigated furrow. This causes soil particles to settle to the bottom of the furrow and can reduce the water intake rate of the soil. With a reduced intake rate the water can advance down the furrow faster giving the field a more uniform water application, while requiring less water for an adequate irrigation. One of the major drawbacks of surge irrigation is the cost involved in switching irrigation systems. When a field needs to be re-leveled and the surface irrigation system redesigned, the benefits of surge are most definitely worth looking into.

Surge valves have controllers which allow the grower to choose the durations of the irrigation oscillations from one side of the field to the other.

Studies done at the Malheur Experiment Station on surge irrigation have shown significant benefits with regard to increased irrigation efficiency, yield maintenance while using less water, reduced nitrogen leaching in some fields, and reduced sediment loss (15, 16, 17, 18). Costs of components have been estimated (19).

A 1990 trial "Surge irrigation of 'Bliss' spring wheat" showed that surge irrigated furrows tended to finish more uniformly than conventional furrows irrigated solely with gated pipe, and conventional irrigation and surge irrigation had equivalent yields (15). Over the entire irrigation season, surge used half the amount of water of conventional irrigation. The trial had one third of a field irrigated using conventional furrow irrigation with gated pipe. The remaining two thirds were irrigated using gated pipe with a surge valve placed in the center of the of the gated pipe, oscillating water between the two thirds. During the first irrigation water in 18 out of 112 (16%) surge irrigated furrows failed to reach the end of the furrow, while in the conventional furrows, 22 out of 56 furrows failed to reach the end (39%).

A 1991 trial on a grower's field "The effect of surge irrigation on onion yield and quality, irrigation efficiency, and soil nitrogen losses" showed that 71 percent of the water applied with surge irrigation soaked into the soil, where only 50 percent of the water soaked in with conventional irrigation (16). Based on the hours of applied water and the flow rate, surge irrigation only required 57 percent of the water volume needed using conventional furrow irrigation for the entire irrigation season.

In the report "Surge irrigation of wheat to increase irrigation efficiency and reduce sediment loss, 1993", 'Treasure' spring wheat was grown using conventional furrow irrigation and surge irrigation on 12 one-half-acre plots (17). Both systems were operated simultaneously five times during the season. Conventional irrigation applied 24.7 ac-in/ac of water with runoff of 5.6 ac-in/ac and infiltration of 19.1 ac-in/ac. Surge irrigation applied 12.0 ac-in/ac with 1.7 ac- in of runoff and 10.3 ac-in/ac of infiltration. Average grain yield under both systems was 128 bu/ac with no significant difference in grain quality. Surge irrigation reduced the loss of sediment in the runoff by 70 percent. Season long sediment losses averaged 1383 lb/acre with conventional irrigation and 406 lb/acre with surge irrigation.

In the 1994 trial "Water savings through surge irrigation", 'Stephens' winter wheat was grown using conventional furrow irrigation and surge irrigation on 12 one-half-acre plots (18). Both systems were operated simultaneously four times during the season. Conventional irrigation applied 26.5 ac-in/ac of water with runoff of 0.8 ac-in/ac and infiltration of 25.7 ac-in/ac. Surge irrigation applied 13.7 ac-in/ac with 0.5 ac-in/ac of runoff and 13.1 ac-in/ac of infiltration. Average grain yield was 95.0 bu/ac with conventional furrow irrigation and 98.7 bu/ac with surge irrigation with no significant difference in grain yield or quality. Season long sediment losses averaged 131 lb/acre with conventional irrigation and 51 lb/acre with surge irrigation.

How can an irrigation system be changed to surge irrigation? If a gated pipe system is already in place, changing the current system to surge could be relatively easy and low-cost with many benefits, if there is not too much side fall in the field. All that would be needed would be a surge control valve, and added pipe to connect to the valve. Fields with substantial side fall can be adapted to surge irrigation by placing the valve at the corner of the field where water enters and have a transmission pipe parallel the gated pipe down the first half of the field.

II. A. 1. e. PAM to reduce irrigation-induced erosion

Polyacrylamide is a synthetic water-soluble polymer made from monomers of acrylamide. It binds soil particles to each other in the irrigated furrow. Soil particles in suspension are bound together making them larger and water has a harder time washing them out of the field. Water-soluble polymers like PAM have been known to benefit soil properties for a long time. Recently they have gained renewed attention for their use in reducing irrigation-induced erosion, now that the cost of applying PAM has become economically feasible. Other uses of polymers like PAM include treatment of municipal water supplies, food packaging, adhesives, a boiler water additive, film former in the imprinting of soft-shell gelatin capsules, adjuvants in the manufacturing of paper and paperboard, and the list goes on and on.

After Soil Science published a set of papers that introduced water-soluble polymers as soil conditioners (20), the Monsanto Chemical Company spent about 10 million dollars producing and marketing the water-soluble polymer Krilium during the 1950's. Krilium was not adopted by commercial agriculture. Although Krilium was able to reduce soil erosion and other problems associated with furrow irrigation run-off, it was too expensive to justify applying it on fields and the recommended application rates were just too high to be economically feasible. Since then, more extensive research has been done identifying water-soluble polymers for agricultural use and low, cost-effective application rates.

PAM is highly effective in reducing soil erosion off of fields and can increase water infiltration into irrigated furrows (21, 22, 23, 24, 25, 26, 27). PAM has been shown to significantly reduce soil erosion by 90-95 percent when applied to irrigation water. Increases in infiltration rates vary from 20-60 percent from trials and experiments listed below in the "links" section. The increased use and distribution of polyacrylamide products in the past few years has brought down product prices, making PAM a more economical BMP option (28). PAM's many forms and application techniques make integration into the farmer's irrigation routine smooth and relatively easy once the initial set-up is complete. Relatively low-cost, high reduction of irrigation-induced erosion and soil loss, ease of use and integration, make Polyacrylamide a best management practice worth looking into by any agricultural operation.

How is PAM applied and what forms does it come in for application? PAM's three most common forms are dry granules, solid blocks (cubes), and emulsified liquids. The application method of PAM chosen depends on the form of PAM selected. The use of dry granular PAM into irrigation water is facilitated by the use of an augured metering system and excellent mixing and thorough dissolving before the PAM reaches the irrigated furrows. PAM blocks (or cubes) are usually placed in wire baskets that need to be secured to the edge of the ditch to avoid washing of the blocks down the ditch. Liquid PAM can be metered directly from the container into the irrigation ditch, directly into the furrow, or through a pipe line or injector pump.

Dry granules of PAM can be applied either by dissolving directly in the irrigation ditch before it hits the furrow, or applied directly in the furrow using what is known as the "patch method". In order for the PAM to dissolve properly in the irrigation ditch it must have proper agitation. Unlike sugar or salt which dissolve fairly quickly in water, granular PAM needs to be agitated thoroughly in order for it to dissolve. If not agitated, PAM globules form, and in time the globules can float down the furrow with little effect on the furrow erosion. A way to make sure the applied PAM is dissolved is to have a drop structure in the irrigation ditch to add turbulence to the water before it hits the furrow. Another tip to achieve desired dissolving is to place the applicator close to the point where the irrigation water first hits the ditch. In a concrete ditch, tins or boards will provide sufficient turbulence. In a earthen ditch a drop dam works nicely.

The "patch method" involves placing PAM at the point in the furrow where the water first hits; applying it for a length of about 3-5 feet down the furrow to reduce the risk of the PAM becoming buried in the furrow or washing down the furrow with little to no effect. The patch method creates a sort of gel-slab at the top of the furrow where the water slowly dissolves the PAM and carries it down the furrow.

PAM blocks are usually placed in wire baskets in flowing ditches at turbulent points. The blocks slowly dissolve, releasing small amounts of PAM into the water. Of the three forms, PAM blocks may not perform as well as well as liquid or granular PAM in furrow irrigation. PAM blocks, however, have been useful for treating settling ponds to accelerate water clarification and promote flocculation. They can also be used to dose concentrated runoff areas on fields that otherwise cause uncontrolled erosion.

Emulsified PAM (special liquid PAM solutions) can be applied like the granular form into irrigation ditches or into furrows using the patch method. Emulsified PAM doesn't require quite the vigorous mixing as the granular form, but still needs adequate mixing for dissolving. Emulsified PAM is more voluminous than dry forms, but is easier to dissolve and is the only form of PAM that should be used for sprinkler irrigation systems, due to greatly reduced the risk of clogging the lines.

In an experiment done at the Malheur Experiment Station in 1995, tests on two different application techniques of PAM (liquid and granular) showed both reduced sediment loss and increased water infiltration into the soil (26). The experiment was designed to determine if granular PAM could be as effective at reducing erosion in furrows when applied starting at the beginning of the head ditch (where it has not yet thoroughly dissolved) as when applied to the furrows further down the head ditch. Since applying granular PAM tended to be easier for farmers to handle rather than liquid PAM, research needed to be done to determine whether or not there was a significant difference between the two. The two forms of PAM were supposed to be applied at similar rates, but liquid PAM ended up being applied at a rate of 0.9 lb/acre and the granular PAM at a rate of 1.8 lb/acre. The difference was caused by the changes in volume of water flowing in the head ditch during the experiment and by other changes in irrigation management on the commercial farm. For soil erosion the check furrows lost 322 lb/ac of sediment off of the field in the runoff water during a single irrigation. Furrows irrigated with granular PAM lost 7 lb/ac of sediment off of the field, while those irrigated with the liquid solution of PAM lost 104 lb/ac. Remember though, the granular PAM was applied at a rate double the liquid.

In increasing water infiltration, the check furrows lost 37.5 percent of the water as runoff and 62.5 percent was infiltrated. Out of the total water applied treated with granular PAM, 26.5 percent was lost as runoff and 73.3 percent of the water infiltrated into the soil. Out of the total water treated with liquid PAM, 29.1 percent was lost as runoff and 70.8 percent of the water infiltrated. Granular PAM used as a "patch" was effective to control the loss of sediment and increase water infiltration.

Since the recommended rate of PAM in water is around 10 ppm to be effective for reduced soil erosion when the water is first advancing through the field, trial and error for each field is necessary with different irrigation rates and applicators. Economic considerations for the use of PAM have been developed for Malheur County (28). From 1990 to 1999 irrigation systems serving approximately 3500 acres of cropland have been treated with PAM via cost sharing.

II. A. 1. f. Sedimentation basins and pump back systems

Some of the first sedimentation basins promoted by the SCS in the county were more demonstration-education systems. They demonstrated to grower the dimensions of their irrigation-induced erosion problem. Many functional sedimentation basins with pump back features were built in the late 1980's and 1991 and 1992 with active participation of the SCS, ASCS, and SWCD. From 1990-1999 cost share assistance has been provided for approximately 15 tail-water recovery sediment basin systems with water savings of 0.5 ac-ft/ac irrigated under each system.

II. A. 1. g. Demonstration of weed screens

With trash in the water, gates in gated pipe have to be set wider open and larger siphon tubes have to be used to help assure that the trash passes through the gate or tube. Under the circumstances of trashy water, more water has to be set on a field than is really necessary, hence more water is present in many furrows than required to irrigate the row. The extra water promotes irrigation induced erosion and excessive leaching of nitrate to groundwater. The cleaner the water, the greater accuracy that gates and siphon tubes can be set, with assurance that the furrow irrigation will continue to run as set.

Herb Futter of the SCS visited the AS field day in Kimberly, ID and was impressed by at turbulent fountain weed screen (bubbler weed screens) demonstrated by J.A. Bondurant. Mr. Bondurant donated a portable weed screen to Herb and he installed it at the Malheur Experiment Station through the cooperation of Dwayne Buxton. The second screen at the experiment station in 1984 was on the main water supply of the station, and it was excellent for demonstration purposes, but it was insufficient in allowing adequate water to irrigate the station. During the winter of 84-85 the water delivery system was rebuilt with a much larger weed screen at the experiment station. In 1986 three mobile small screens built and were installed at the station on gated pipe delivery lines. These smaller screens were highly visible near other trials and helped show the advantages. Adoption of weed screens after Herb Futter used the screens at the Malheur Experiment Station in a 1985 Field Day to promote the use of bubbler weed screens to remove weed seed and trash from irrigation water. Growers started building and installing weed screens on their own, with fabrication by local irrigation dealers. Especially noteworthy were the efforts of Dale Cruson in Ontario, who gave a big boost to screen adoption by manufacturing many of the screens.

In 1990 cost sharing was implemented to promote weed screens. By 1999 the practice had become wide spread enough that cost share incentives are only being used in large scale projects where the size of the weed screen might be cost prohibitive.

II. A. 2. Changes in irrigation systems

II. A. 2. a. Sprinkler irrigation

Prior to 1985, very little sprinkler irrigation was being done on row crop ground in Malheur County. Herb Futter had a gravity pressured system designed in the mid 1980's for the South Board of Control to serve about 20 growers. The demonstration project was envisioned capturing the potential energy of the water in high elevation canals to provide pressurized sprinkler irrigation at lower elevations without pumping. It was an ambitious project, but it did not get off the ground. Dick Tipton visited Herb when he was working on the South Board of Control project. Dick Tipton spearheaded a large scale demonstrating project sponsored by the SCS, SWCD and ARS on Morgan Avenue demonstrated the potential to use sprinkler irrigation for a range of crops. Alfalfa, small grains, pasture, and sugar beets were successfully grown by the project. Other gravity pressured systems were built. In 2002-2003 a gravity pressured system to power sprinkler irrigation was installed by the South Board of Control and cooperating growers.

Research and demonstrations were conducted in 1987 and 1988 to compare the efficiency of sprinkler irrigation to surface irrigation and the effectiveness of sprinkler irrigation in producing better quality potatoes. Water was used more efficiently and potato quality was improved through the use of sprinkler irrigation (29). Solid set sprinkler systems were a means to cool the potato plant during hot weather and decrease water and nutrients form the plant's root zone. From 1990-1999 approximately 16,000 acres of cropland were converted from furrow irrigation to sprinkler irrigation through cost share programs.

Micro sprinklers have been used effectively in experiments (30) and in growers fields for poplar production.

II. A. 2. b. Drip irrigation

Starting in 1992, drip irrigation, sprinkler irrigation, and furrow irrigation were compared for onion bulb production on sites that were difficult to irrigate (31, 32, 33). Drip irrigation was very promising in terms of bulb yield, bulb quality, water use efficiency, and apparent N fertilizer use efficiency. The success of these efforts prompted further research later to optimize the irrigation criteria for drip-irrigated onions (34), determine the duration of irrigation sets (35) and use ideal plant populations and N fertilizer rates with drip irrigation (36, 37, 38, 39).

Even though the concept of drip irrigation is relatively new in the region, by 2004 approximately 3,000 acres of onions are drip-irrigated in Malheur County and adjoining areas of Idaho. Preliminary work on other crops has examined potato variety performance with drip irrigation (40, 41), irrigation criteria for drip-irrigated potato, and potato plant populations and planting configurations under drip (42). Drip irrigation can be used effectively for poplar production (43, 44, 45) and alfalfa seed production (46, 47).

II. A. 3. Irrigation scheduling

Growers have irrigated using one of several criteria: intuition, calendar days since the last rainfall or irrigation, crop evapotranspiration, or soil water. Measurements of soil water or crop evapotranspiration provide objective criteria for irrigation management.

In 1984 irrigation scheduling was based exclusively on intuition and a calendar, the number of days. since the last irrigation. Although growers had tried to use tensiometers, no instruments were used to measure soil moisture to assure that irrigations were applied at the right time. Watermark soil moisture sensors Model 200 were introduced at the Malheur Experiment Station in 1986, but due to placement in the middle of furrow-irrigated beds at 6 inches depth, the readings were erratic due to the uncertainty of the wetting front from the furrow irrigation to uniformly reach the sensors. Starting in 1987 we started placing the sensors 4 inches from the middle of the bed and centered 8 inches deep, a location in the root zone of the potato that always got wet when the potatoes were furrow-irrigated.

II. A. 3. a. Comparative performance of soil moisture monitoring devices.

In 1987 and 1988, studies were initiated comparing various soil moisture monitoring techniques. Tensiometers were compared with Watermark soil moisture sensors (GMS), neutron probes, and gravimetric measurements (48). Work in 1991-1994 compared GMS to tensiometers, gypsum blocks, and gravimetric soil water content (49, 50). Also from 1991-1994 innovative new GMS designs were evaluated at the Malheur Experiment Station. In 2001 and 2002 GMS were compared to AquaFlex, Gopher, Gro-Point sensors, Measure-Point, Tensiometers, Neutron Probe and gravimetric soil moisture calculations (51). Work in 1987 through 1991 demonstrated the usefulness of GMS for irrigation scheduling for potatoes.

The use of GMS proved to be helpful for irrigation scheduling in Malheur County (52), especially with site specific calibrations (48, 49). Sensor placement was studied for potatoes (53) and other crops. For the purposes of crop research, GMS readings could readily be automated and used to control irrigation (54, 55). These automated systems used expensive data loggers and peripheral equipment too costly for most growers.

Lower cost logging of GMS has been accomplished by numerous companies. These systems proved to be effective and reasonably easy for growers to use (56, 57, 58). Automated data loggers to record soil water conditions are now used frequently in drip irrigated onion.

II. A. 3. b. How irrigation scheduling has evolved

Soil water can be measured by the methods that determine the soil water content or the soil water potential. Soil water content is the amount of water per volume of soil or weight of dry soil. Soil water potential is the force necessary to remove the next increment of water from the soil.

Different measurement methods have particular strengths and weaknesses. For example the gravimetric method is very accurate, but it is very slow and many samples are needed for each field and site specific interpretations are necessary.

The use of soil water potential measurements with tensiometers or granular matrix sensors provides a measurement analogous to the force (suction) necessary to extract water from the soil. The force is transmitted from the atmosphere through the plant to the roots.

Until recently growers had only tensiometers to accurately measure soil water potential.

Growers have often been unwilling to properly manage tensiometers. Granular matrix

sensors (Watermark Soil Moisture Sensor Model 200SS, Irrometer Co., Riverside, CA), a relatively new product on the market, could provide growers with an accurate and stable means to determine soil water potential for Malheur County soils in eastern Oregon. At the Malheur Experiment Station, we have successfully automated GMS to control drip irrigation.

Granular matrix sensors (GMS) represent an option for measuring soil water to schedule irrigation. Irrigation of crops highly sensitive to water stress, like potatoes, onions, and many other horticultural crops require precision irrigation scheduling, determining both irrigation frequency and duration.

Granular matrix sensor technology reduces the problems inherent in gypsum blocks (i.e., loss of contact with the soil by dissolving, and inconsistent pore size distribution) by use of a granular matrix mostly supported in a metal or plastic screen. Granular matrix sensors operate on the same electrical resistance principle as gypsum blocks and contain a wafer of gypsum imbedded in the granular matrix . The electrodes inside the GMS are imbedded in the granular fill material above the gypsum wafer. The gypsum wafer slowly dissolves, to buffer the effect of salinity of the soil solution on electrical resistance between the electrodes. According to Larson (59), particle size of the granular fill material and its compression determines the pore size distribution in GMS and their response characteristics.

For many soil types, growers have found that GMS are a useful tool to schedule irrigations. as plants use water from the soil, the soil dries and water is drawn out of the sensor. Sensor resistance increases. Upon irrigation or rainfall, the GMS takes up water and the resistance decreases.

GMS can substitute for tensiometers in irrigation management when irrigation criteria based on soil water potential have been established. Because GMS do not require periodic maintenance during the growing season, they are ideally suited for sensing soil water potential to automatically start an irrigation system as we have been doing since 1995. GMS have advantages of low unit cost and simple installation procedures, similar to those used for tensiometers. Data acquisition with GMS can be remote from the measurement site by use of electrical wires, so the plants and soil at the measurement site remain relatively undisturbed.

Tensiometer and GMS are used in the following way. Starting in 1988, after the initiation of a successful research program at the Malheur Experiment Station, GMS soil water potential readings made in growers fields were used to schedule irrigations. In the beginning the potato extension specialist, Lynn Jensen lead the program. The program has evolved to the point where 87 Malheur County potato fields were monitored in 1995 by the Soil Water Conservation District under the management of

Ron Jones. The cost is paid for by the growers. Actual readings are made by student

summer labor using a Model 30KTCD digital meter (Irrometer Co., Riverside, CA).

Six to twelve GMS are used to characterize the soil water potential in each field.

An area of the field are chosen by the grower based on irrigation experience. Sometimes both a typical area and a difficult (usually drier) area are chosen. Six GMS are distributed widely across each area and each GMS is connected by up to 150 ft of 18 gauge speaker wire to terminal strips. All sensors in a given area are wired to a single location for rapid reading. For each area, all but one of the sensors are installed at 8 inch depth (depth to the top of the sensor) in the shoulder of the potato hill and a single sensor is installed at the 16 inch depth. Responsive GMS placement had been determined (53).

Sensors are read daily at about the same time of day and the soil water potential data is plotted daily. Copies of the data plotted stay in a news paper box at the site and with the person making the readings. The data is plotted for immediate interpretation and use by the grower. The average readings at 8 inch m depth and the single reading at 16 inch depth in each area is plotted. Also the soil water potential of the driest sensor at 8 inch depth is plotted. The graphs are designed to help the grower to irrigate at -50 kPa avoiding to let the soil dry beyond -60 kPa.

In sprinkler-irrigated fields, information from the 16 inch depth helps avoid over irrigation which would keep the deeper part of the soil profile saturated. Irrigating at the correct time is achieved by not allowing the soil in Malheur County, Oregon to become drier than -60 kPa. Irrigation with the right amount of water is possible using sprinkler irrigation, by only applying the amount of water necessary to refill the soil's water holding capacity in the root zone.

As the experimental trials went forward, Lynn Jensen started demonstrating the effectiveness of these scheduling practices on grower fields through funding from the USDA. This effort was later expanded by Ron Jones of the SWCD through funding from the Oregon DEQ. Eventually the Malheur County Potato Growers Association directed the program in conjunction with their potato integrated pest management program until the growers were familiar enough with the program to conduct irrigation scheduling on their own.

The original program involved using extension and 319 grant funds to hire students to install, read and graph the sensors on a daily or every other day basis. Irrigation refill points were marked on the graph so a grower would know when the next irrigation was needed. After two years of providing the services through agents, the participants were asked to pay half of the costs for the program. Two years after that the total cost of the program was provided through user fees.

The advent of the Hansen Meter, where a series of Watermark Sensors could be attached to the meter and would then be read and graphed three times per day eliminated the need for students to manually read and graph soil moisture. The process was simplified to the point that a grower could readily install the sensors and meter, and track soil moisture with a minimum of training. Currently most soil moisture monitoring is being conducted by growers, especially those using drip irrigation.

II. A. 3. c. Determination of the ideal criteria for irrigation

Irrigation scheduling consists of applying the right amount of water at the right time. With water stress sensitive crops, growers have incentives to make irrigation scheduling work well. For example, potatoes have a low tolerance for water stress. Tuber market grade, tuber specific gravity, and tuber processing quality for French fries are all closely related to even low levels of water stress during tuber bulking. All these potato characteristics are closely related to the maintenance of soil water potential within a narrow range of values. Incentives to growers for precise irrigation scheduling include the following:

1. Under-irrigation leads to a loss in market grade, tuber quality, and contract price.

2. Over-irrigation leads to a loss in water, electricity for pumping, leaching of nitrogen, and wastes time. Over-irrigation increases crop N needs, fertilizer costs, and nitrogen losses to groundwater. Soil losses can be aggravated.

3. Under-irrigation and over-irrigation can occur during the same season in a given field.

Relation of GMS readings to potato quality

Potato yields and quality can improve with control of soil water. Moderate water stress causes little damage to potatoes before tuber initiation (60) but during tuber development, small amounts of water stress result in decreased tuber grade, decreased specific gravity, or increased incidence of dark-end fry colors (61, 62, 63, 64). Research supported by the Oregon Potato Commission and completed by Eric Eldredge in his October 1991 Ph.D. thesis proved that a single, short duration water stress can lead to a reduction in tuber grade and dark fry colors. While these results are of critical importance to potato growers and processors, growers cannot easily implement these experimental results without quick and reliable field determination of soil water potential.

Work by Lynn Jensen and others has proven that GMS sensors are useful in managing soil water for potato production in Malheur County. When the soil was maintained moist the rest of the growing season, Eric Eldredge proved that a single episode of water stress as measured by GMS did not reduce Russet Burbank tuber yield, but tuber grade and specific gravity were reduced and dark-ends were increased (62, 63). A single episode of water stress where GMS readings became drier than -60 kPa or drier was associated with a progressive loss in U.S. No. 1 tubers, increases in U.S. No. 2 tubers, and losses in tuber solids. A single episode of GMS readings in the range of -100 kPa or drier was associated with increased incidence of USDA #3 and #4 dark-ends (61, 63). These guidelines for quality tuber production on silt loam soil would need to reevaluated so that they are useful in other soil types and climatic situations.

Relation of GMS readings to the responses of onion and poplar trees

Furrow-irrigated onions lost yield and grade when the soil was allowed to become drier than -27 kPa between irrigations (65). Drip-irrigated onions lost yield and grade when the soil was allowed to become drier than -20 kPa between irrigations (34), and this wet criterion needed to be maintained to the end of the irrigation season (66). Poplar trees were sensitive to the loss of tree growth with soil water drier than -25 kPa, as determined by GMS (30).

II. A. 3. d. Crop evapotranspiration; the checkbook method

Crop evapotranspiration is a fancy word for the consumptive use of water. Consumptive water use is composed of evaporation of water off of the soil surface and transpiration of water through plant tissue to the air. Crop evapotranspiration is calculated using a specialized weather station or an atmometer. Excellent estimates of crop water use can be provided by automated weather stations and local knowledge about when crops emerged, how quickly they developed, and when they matured.

Due to the absence of a local station for evapotranspiration measurements, we installed an AgriMet station in 1992 at the Malheur Experiment Station. The annual maintenance costs are paid by the agricultural experiment station. The data are especially useful for sprinkler an drip irrigation. The grower needs to be concerned with keeping a checking account balance of the estimated evapotranspiration and the measured rainfall in the potato fields.

In 1996 we established a Malheur Experiment Station world wide web site and put the water use estimates on the internet at **http:// www.cropinfo.net**. We put the daily crop water use estimates on a computer bulletin board long before there was much grower interest. The daily evapotranspiration estimates are provided on the AgriMet and station web sites.

The use of the check book method is pretty straight forward, but the grower has to have

access to the following information:

1. A local weather station estimating potato crop ETc based on the crop's coefficients and correct crop development data,
2. A rain gauge placed in each production field or group of closer adjacent fields,
3. A good estimate for the allowable depletion of water for each soil.

Acquiring all three of these needed pieces of information is feasible. The potato plant's

water use is well known given weather data and the stage of development. But someone manually or automatically must calculate the daily potato ETc at each important weather station location. The allowable soil water depletion for potatoes can be calculated by extension agents, crop consultants, and growers. The calculation requires knowledge of the potato plants' effective rooting depth in a given soil and that soil's water retentive characteristics in the range where the potato plant does not suffer water stress. Potatoes are very sensitive to water stress, and caution is needed to avoid over estimation of a soil's allowable depletion.

II. B. Nutrition Management

Nitrogen fertilizing practices have changed in Malheur County. These changes have come about due to the research and outreach / demonstration projects completed by the OSU Malheur Experiment Station (MES), the OSU Cooperative Extension Service (CES), Malheur County Soil & Water Conservation District (SWCD), National Resource Conservation Service (NRCS), the Malheur Watershed Council, the Owyhee Watershed Council, United States Department of Agriculture programs such as Environmental Quality Improvement Program (EQIP) administered by the Farm Service Agency (FSA) and NRCS, and others. The economics of fertilization and the cooperation of the local fertilizer dealers have played an important roles in these changes. These changes would not have occurred without cooperative the financial and educational help from many partners, including. Some of those partners include EPA, DEQ, CES, MES, ODA, SWCD, Farm Service Agency (FSA), NRCS, the watershed councils, and the local fertilizer dealers.

The improvements in nutrient management can be summarized as reducing the amount of nitrogen fertilizer used, budgeting the nitrogen, and utilizing deep- rooted crops planted in rotation with shallow-rooted crops (Shock et al. 1993, 1988a, 2000a). A brief description of each practice follows:

(a) Reducing the amount of nitrogen fertilizer used – The amount of nitrogen fertilizer can be reduced through determination and utilization of optimal:

- timing,
- placement, and
- rate of fertilizer application (36, 37, 38, 39, 67).

(b) Budgeting the nitrogen – Budgeting the nitrogen allows a better match of the amount applied to the amount used by the crop. To do this, the growers incorporate:

- soil testing results,
- plant tissue testing results, and
- nitrogen mineralization into the budget (39, 68, 69, 70, 71, 72).

(c) Utilizing deep rooted crops – Utilizing deep rooted crops (e.g., sugar beets and wheat after onions and potatoes) allows the deeper rooted crops to recover residual soil nitrate and mineralized nitrogen (68, 69, 70).

Very little, if any, nitrogen is now applied in the fall because fall nitrogen is more apt to be leached and interfere with crop seeding establishment . Soil samples are now commonly analyzed prior to any fertilization application; and the amount of residual nitrogen in the soil nitrate and ammonium is factored into the total amount of fertilizer to be applied to the next crop. Fertilizer applications are typically applied in the spring, with a split application starting in March and ending in July. After the plants reach a prescribed size certain maturity, tissue samples are taken to see if more nutrients are needed for the plant to continue to be productive through reach full maturity. Petiole samples are taken from potato and sugar beet, root samples are taken from onion, and flag leaf samples are taken from wheat.

The Ontario HUA Final Report indicates that nitrogen application rates had been reduced by 1997 (73). The report also indicates nitrogen is being applied more efficiently and at rates closer to plant needs. Since 1990, information and education activities targeting awareness of how much nitrogen is needed for crops as well as more efficient application methods have resulted in dramatic increases in practices such as soil testing, petiole testing, side dressing, banding, split applications and converting from fall to spring nitrogen applications. Field acres where nutrient management practices are being applied steadily increased throughout the seven-year period of the HUA project from less than 5,000 in 1991 to over 44,000 acres by 1997; representing approximately 28% of the 157,000 acres in the HUA (73, 74).

Since wheat and sugar beets are deeply rooted and are grown in rotation with shallow rooted crops such as onion and potato, the deeply rooted crops might have the potential to recover residual nitrate left in the soil. Sugar beets following onion fertilized with 200 lb N/acre or more, required little or no N fertilizer. When these small plot observations were demonstrated on a large scale in grower's fields, the same reality emerged. Beets often required no additional N fertilizer.

Sugar beets, wheat, and barley were proven efficient scavengers of naturally occurring plant available-N at the station and in "on farm" trials (68, 69, 70). Where sugar beets or wheat followed onions receiving 200 lb N/ac, yields were high without any N fertilizer during the crop year. Recoverable sugar or wheat grain yields were higher following onions that received 200 lb N/ac than following onions that received 400 lb N/ac (sugar beets and wheat were not fertilized in these trials). We are showing that reduced N in Treasure Valley growers fields will maintain wheat yields and increase sugar yields.

Research at the station and "on farm" trials proved that crops grown in Malheur County without N fertilizer consistently obtained more natural N from the soil environment than predicted by soil tests. Conventional nitrate soil analyses greatly underestimate the natural available-N supply to plants. The discrepancy in estimate is not caused by nitrate analysis errors, but by major naturally available-N sources not routinely calculated in fertilizer recommendations (39, 67, 68, 69, 70, 71, 72). These natural sources turn out to be very important in Malheur County. They include:

a) Organic matter mineralization, ranging from 50 to 250 lb N/ac,

b) Ammonium-N in the crop root zone, ranging from 5 to 200+ lb N/ac,

c) Previous crop residue decomposition, ranging from -10 to 60 lb N/ac, and

d) N in the irrigation water, ranging from 2 to 60+ lb N/ac.

Large amounts of naturally occurring available-N complicate N fertilizer recommendations because we don't know how to predict them and use them in fertilizer recommendations. These natural N sources are generally not included in Pacific Northwest fertilizer guides. We are conducting "on farm" N mineralization research and introducing an available-N accounting approach to growers. We hope to reduce crop production costs, increase profits, and reduce nitrate leaching. Since large natural N supplies can occur, crop responses to N fertilizer may be small. Some of the growers are adjusting N application rates downward.

Efficient use of soil nitrate and the other available N sources listed above depends on irrigation being roughly in balance with crop water needs so that nitrate leaching is minimal or only moderate. We have worked intensively to determine soil moisture criteria for irrigating potatoes and onions. The goal is the right amount of water added at the right time. Dozens of growers have adopted the soil moisture criteria and soil moisture sensors. Irrigation management has improved and is continuing to improve. This methodology is spreading across southern Idaho from west to east on areas of silt loam soils.

Summary of N Management Practices

Fertilizer and chemical application practices in Malheur County have changed significantly over the past 22 years. In the early 80’s it was common practice for farms to have their secret crop mix made up of 1000 to 1500 lb of triple 16 per acre for fall fertilizer. A lot of these fall fertilizer mixes contained 150 to 200 lb/acre of nitrogen, which were followed up in the spring with another 150 to 300 lb/acre of nitrogen sidedressed.

In the mid 80’s farmers started soil sampling and tailored their fertilizer rates according to the soil sample recommendations. This cut down on the amount of fertilizer applied in the Fall. In the Spring, they put the rest of their fertilizer needs on by sidedressing three times. Farmers also started banding all the post emergent chemicals on onions. Dacthal was applied banded at 4-6 lb per acre.

In the early 1990’s farmers cut out all fall nitrogen except for the nitrogen required to break-down crop stubble. The remainder of the fertilizer was spoon fed over three sidedress applications determined by petiole sampling before each application. Dacthal herbicide application was cut out all together.

Today, one acre grids are being soil sampled in the fall to determine what each acre's fertility needs are. GPS technology is used to help variable fertilizer applicators apply only what each acre's needs are. Nitrogen is put on in very limited amounts, just enough to keep the carbon to nitrogen ratio in line to break-down stubble. In the Spring, petiole sampling is done to determine fertilizer needs and then sidedressing small amounts of fertilizer three times to spoon feed the crop.

These two practices are closely linked, and trying to manage one without the other becomes self-defeating. Nitrogen only leaches when excess water is applied and conversely excess water can only leach if nitrogen is available to be leached from the soil profile. The goal is to have enough nitrogen available to maximize crop growth, but not excess, and enough water in the soil profile to keep crop growth adequate without pushing water through the soil profile.

There are some obvious and some not so obvious methods of dealing with these two issues. First, nitrogen management. Ideally, having just enough nitrogen available in the soil solution to meet the plants immediate needs would be an ideal goal. Practically speaking, that is not possible, but growers have made great strides towards this goal. For example, onion growers have gone from applying all of their nitrogen in the fall, where it is subject to leaching by winter rains or early irrigations. Nitrogen is now applied with a small amount as a starter, then sidedressed two or three times during the growing season. The first irrigation has the most potential to leach because of the high infiltration rate and dry subsoil. Applying nitrogen after the first irrigation dramatically reduces the potential to leach. This technique has allowed onion growers to reduce nitrogen applications by 25% without reducing yield or quality. The money spent in additional sidedress applications is offset by the nitrogen saved.

II. C. Use of Crop Residues

Organic agricultural wastes are recycled foe their nutrient and soil conditioning benefits. Potato and onion wastes from processing facilities were not being utilized as fertilizer until recently. Nitrogen release curves were developed for potato and onion sludge by local OSU extension and research. These materials are now being used in partial substitution for commercial fertilizers. Following testing by the Malheur Experiment Station and Oregon Trail Mushrooms (Vale, Oregon) alfalfa seed screenings were no longer hauled to the land fills, but are being used as an ingredient in the compost to grow mushrooms. Spent mushroom compost is no longer accumulating, but is being utilized as a soil conditioner, largely for landscape purposes. Animal manures from confined animal feeding operations are being used extensively for their nutrients in crop and pasture production, through well defined nutrient management plans.

II. D. Cultural Practices

II. D.1. Tillage Practices

For the Treasure Valley silt loam soils, fall bedding conserves winter soil moisture and fall soil tillage operations helps preserve soil tilth --- because spring tillage occurs when the soil profile is wet and damages soil structure. Tillage practices are evolving towards fewer tractor passes.

II. D. 2. Weed Control

Weed control practices have been developed to be compatible with fall bedding.

II. D. 3. Transformations in agricultural chemical use

Agricultural chemistry and its use has been transformed in the entire Snake River plain. From the inception of modern agriculture through the 1950's, little attention was paid to the persistence and unintended effects of pest control problems. In recent decades the pesticide industry has been transformed by the adoption of products with much narrower specificity and short half lives. With three quarters of a million cultivated and irrigated acres in the Treasure Valley in Idaho and Oregon, we know of no currently used agriculture pesticide that is reaching the streams, rivers, or groundwater.

Onion is one of the most important irrigated crops in this valley. Onions compete poorly with weeds and efficient weed control is essential to maintain an economically viable onion industry. DCPA (sold as Dacthal) is an effective herbicide to control weeds in onion fields and was commonly used. DCPA metabolites, however, have been found in shallow aquifers underlying parts of the intensively farmed areas of Malheur County, Oregon (3, 75).

All pesticides sold or distributed in the U.S. must be registered by the United States Environmental Protection Agency (EPA), based on scientific studies showing that they can be used without posing unreasonable risks to people or the environment. Because of advances in scientific knowledge, the law requires that pesticides that were registered before November 1, 1984 be re-registered to ensure that they meet the current, more stringent, standards.

DCPA was first registered as a pesticide in the U.S. in 1958 as a selective preemergence herbicide for weed control on turf grasses. Following a June 1987 evaluation, EPA issued a Registration Standard for DCPA in June 1988. Based on human health risk assessment calculations summarized in the November 1998 DCPA Reregistration Eligibility Decision document, EPA concluded that “DCPA and its metabolites do not currently pose a significant cancer or chronic non-cancer risk from non-turf uses to the overall U.S. population from exposure through contaminated drinking water”.

In 1990, a third of growers using DCPA were banding the product on the uncultivated parts of the bed, saving 2/3rds of the DCPA expense (76). We examined banding and substitution of DCPA. Due to concerns about residues of DCPA & metabolites in surface water and sediment runoff from furrow-irrigated crop land, as well as through deep percolation through the soil profile, intensive studies were conducted to trace the fate of DCPA & metabolites losses with banding or broadcast of DCPA. This work was conducted in 1991, with results distributed to the growers at that time and documented by Shock et al. in 1998 (77). Without straw mulch, DCPA & metabolites in transported sediment was 33% less when banded than when broadcast; and 41% less in surface water runoff. For both banded and broadcast applications, straw mulch reduced DCPA & metabolites losses in transported sediment by about 90%. Straw mulch also reduced DCPA & metabolite losses in surface water runoff by 30% for banded application and by 50% for broadcast application. The benefits of straw mulch were primarily through reductions in soil erosion and runoff volume.

Even without a product to substitute for DCPA, it was possible to lower the amount of chemical loading by banding DCPA in a narrow band directly where the onions would grow, rather than broadcast DCPA over all of the soil surface. The area of soil between the banded DCPA did not need the product because weeds were controlled there by cultivation. Growers were quick to adopt the banding of DCPA, because costs were reduced with no loss in weed control.

Conclusions from these studies included that omitting DCPA or banding DCPA during onion production immediately reduced the losses of DCPA residues through downward leaching or runoff. Additional research at the MES demonstrated that other products with shorter half-lives could control weeds in onions on a wide range of sites at lower cost (78, 79). The use of DCPA was no longer necessary. With the registration of pendimethalin (sold under the trade name of Prowl) in about 1993 or 1994, growers rapidly switched to pendimethalin because it was lower in cost, more effective, and did not have the undesirable environmental effects of DCPA. DCPA inventories in Malheur County were depleted by the 1998-growing season. One objective of the

Ontario HUA had been to reduce DCPA application by 30%. Surveys conducted by the Malheur Extension Service showed that this goal was easily met by the end of 1997.

Instrumental in the adoption of DCPA were the "on farm" demonstrations by Lynn Jensen of OSU Cooperative Extension, who demonstrated the general effectiveness of pendimethalin and it's ability to control dodder. This was an easy sell. The loss of DCPA market share by may have been a factor in the end of its manufacture in the US. The work conducted by Jensen and Stanger was supported by the Idaho Eastern-Oregon Onion Committee. Both the adoption of banding over broadcast DCPA and the substitution of pendimethalin for banded DCPA took place at the voluntary initiative of growers.

Zeneca took over ISK in about 1997, and they may have decided to discontinue DCPA production at that time. Manufacture of DCPA continues in Japan. Although there were still stocks of DCPA around to buy and apply in the US in 1997, use had dropped to almost nothing, and the groundwater trends were already evident. Groundwater has been monitored over the past decade through the efforts of the ODEQ, the Malheur County SWCD, and NRCS employees in Ontario. The DCPA and DCPA residue analyses were conducted by the ODA Laboratory Services Division in Portland under the leadership of Norma Corristan. The overall downward trends in the groundwater are now unmistakable (1).

II. D. 4. Reductions in Hand Labor

Labor has become less available and more costly, forcing growers to rely more extensively on mechanical and chemical means of weed control. The relative value of farm products to the consumer price index and input costs has continued to decline (1), forcing economies of many kinds.

III . Notes on the Implementation of New Practices

The primary method of water application for Treasure Valley crops is furrow irrigation.

Furrow irrigation is a method that is fairly easy to use, has been used for many years, and has some large advantages associated with it when applied to certain crops. In the past hundred years, large investments have been made in the effort to improve furrow irrigation. The use of field leveling, control structures, and water conveyance techniques, are just a few examples of the progress that has been made and is being made.

Many BMPs have been implemented in the Northern Malheur County GWMA that are protective of groundwater quality. Some of this progress is documented in the Ontario Hydrologic Unit Area (HUA) Final Report 1990 - 1997 (73).

Major changes in agricultural practices have occurred since groundwater contamination was identified in the Malheur River area in the late 1980s. The method of nitrogen application in this area has been changed. Reduced nitrogen loading has been accomplished by changes in the timing and the application of nitrogen as well as the rate of application. Plant tissue and soil sampling have also played a major role in modifying practices for the application of nitrogen and other nutrients, enabling producers to apply only the amount of nutrient needed and only when that nutrient is needed. Changes in irrigation management practices have also occurred that increase the protection of groundwater quality.

Table 3-1 identifies the extent of specific implemented practices between 1990 and 1997 for groundwater protection, surface water protection, erosion protection, irrigation water management, and animal waste management through SWCD and NRCS programs. Other improvements have occurred before and after this time. Activities conducted exclusively through private efforts are not included.

Best Management Practice	**Extent of Implementation**
Conservation Cropping Sequence	27,5764 acres
Grasses & Legumes in Rotation	1,231 acres
Irrigation Water Management	46,891 acres
Pasture / Hay Land Management	676 acres
Pasture / Hay Land Planting	285 acres
Nutrient Management	44,010 acres
Waste Utilization	1,670 acres
Soil Testing	35,595 acres
Fertilizer Application Timing	21,324 acres
Tissue Analysis	19,098 acres
Split Application of Nitrogen	15,125 acres
Banding of Nutrients	7,625 acres
Surge Irrigation	160 acres
Irrigation Scheduling	18,053 acres
Sprinkler Irrigation	6,737 acres
Filter Strip	618 acres
Tail Water Recovery System	16 systems
Irrigation Land Leveling	1,587 acres
Straw Mulching	5,490 acres
Polyacrylamide (PAM)	16,725 acres
Sediment Basins	8 basins
Irrigation Water Conveyance – Ditches	117,646 feet
Irrigation Water Conveyance - Pipe	373,178 feet
Structures for Water Control	330 structures

Weed screens	386 structures
Waste Management System	11 systems
Waste Storage Structure	4 structures
Waste Treatment Lagoon	2 lagoons
Waste Storage Pond	5 ponds

Number of Producers Adopting Farm Plans

Water quality farm plans are viewed as a set of progressive steps utilizing BMPs that lead to implementation of a Resource Management System. Plans are periodically reviewed and updated to include the newest BMPs available. Nearly all water quality plans written in the HUA include irrigation water management, nutrient management, and pesticide management as basic plan recommendations. Additional practices are included on a case-by-case basis and plans are tailored to individual farm requirements.

The number of water quality farm plans completed through the seven-year period of the HUA project and beyond indicates continued interest and involvement by the local growers. The total number of plans completed is as follows: 9 plans by 1991, 39 plans by 1992, 69 plans by 1993, 98 plans by 1994, 121 plans by 1995, 146 plans by 1996, and 156 plans by 1997. The 157 plans completed by 1997 represent approximately 44,000 acres, or about 28% of the total irrigated acres in the GWMA.

From 1997 through 2000, 65 new water quality farm plans were completed (averaging 12 to 15 per year).

Shortage of Federal Support for Farm Plans

Numerous growers seek cost share support for adoption of farming practices with positive environmental effects. Although approximately 70 and 170 applications were filed in Malheur County during the last two years, less than 10 percent of growers seeking cost share support have garnered support. It is probable that even more producers would apply if the probability of success were greater. Both profitability of agricultural production and scarcity of public resources currently limit the adoption of new farming practices.

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Owyhee Subbasin Plan

Appendix 4: Appendices for the Owyhee Subbasin Management Plan (Chapter 4)

Prepared By:

The Shoshone-Paiute Tribes,

Contract Administrator and Owyhee Coordinating Committee Member

and

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Prepared for:

The Northwest Power and Conservation Council

Final Draft May 28, 2004

Steven C. Vigg,
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Editor and Project Coordinator

Disclaimer:

Final approval by the Northwest Power and Conservation Council is contingent upon a favorable review by the Independent Scientific Review Panel and meeting requirements for adoption as an amendment to the Council's Fish & Wildlife Program.

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Appendix 4. Owyhee Subbasin Plan

Appendices for Chapter 4 Owyhee Subbasin Management Plan

Appendix 4.1. References.

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[Although this draft document states that it should not be cited or quoted, some of the material in the report is an important improvement to Lazorchak et al. (1998). By not citing the document, it may give the appearance that I improved some of the methods outlined in the Lazorchak et al. report. To avoid this, I feel it necessary to offer credit where credit is due.]

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Appendix 4.2. Cross-reference between technical analysis – Qualitative Habitat Analysis (QHA) for redband trout – and the development of objectives and strategies for the management plan.

§ 4.2.1 Idaho Portion of the Owyhee Subbasin

AppendixTable 4.2.1.1 Idaho QHA link ~ Protection Objectives and Strategies: {Reaches with Quartile 1 and Quartile 2 Protection Scores}

4th Field HUC/ Reach Name	Description	Q-tile	Protection Objectives	Protection Strategies	Min. QHA Score ↦ Limiting Factor(s)
HUC 17050108					
Jordan Cr.-6	BLM boundary upstream of Louse Cr. To BLM boundary section	**2**	Pol II Rip I	1. IIA 2. IA 3. IB	1.0: Pollutants
Jordan Cr.-8	State linelands boundary to headwaters of Jordan Cr.	**1**	Pol II Rip I	1. IIA 2. IA 3. IB 4. IC	1.0: Pollutants
Williams Cr.	BLM segments	**1**	Rip I	1. IA 2. IB 3. IC	2.0: C. Stability H. Diversity ~~L. Flow~~ L. Temp. H. Temp.
Williams Cr.	Including Pole Bridge Cr. And West Cr.	**1**		1. 2. 3.	2.0 H. Diversity L. Temp. H. Temp.
South Mountain Creek	Lower BLM upper put state includes Howl Cr. Cyote Cr.	**2**	Rip I	1. IA 2.IB 3.IC	1.0: H. Diversity

Flint Cr.1	Lower	**2**	Rip I Pol II	1. IC 2.IB 3. IIA	1.5: F. Sediment Pollutants
Flint Cr.2	Upper Includes East Cr.	**2**	Rip I Pol II	1. IC 2. IB 3. IIA	1.5: F. Sediment Pollutants
South Boulder Cr.	From confluence with North Boulder Cr. To confluence with Mill Cr.	**1**	Rip I	1.IA 2.IB 3.IC	1.5: H. Temp.
Bogus Cr.	Upper above section 10 and above	**2**	Rip I	1.IA 2.IB 3.IC	2.5: Riparian C. Stability H. Diversity F. Sediment H. Temp.
Combination Cr.	Lower reach of stream	**2**	Rip I	1. IA 2.IB 3.IC	1.5: Riparian Oxygen
Rose Cr.	Up to state section.	**1**	Rip I	1. IB 2.IC 3.	2.0: Oxygen
Josephine	includes Wickiup and Long Valley and Headwater Josephine	**2**	Rip I	1.IA 2.IB 3.IC	1.5: H. Flow
Lower Rock Cr.-1	From confluence of North Boulder to Meadow Creek.	**1**	Rip I	1. IC 2.IA 3.IB	1.5: H. Flow L. Flow
Rock Cr.-3	BLM portion in Section 26	**1**	Rip I	1.IA 2.IB 3.	1.5: H. Flow L. Flow
Deer Cr.	Confluence with Big Boulder to	**2**	Rip I	1.IA	2.0: F. Sediment

	state section 36			2.IB 3.IC	
Owl Cr.	Includes Minear Cr. (Confluence of Lone Tree to headwaters)	**2**		1. 2. 3.	2.0: H. Diversity F. Sediment
North Boulder-1	From confluence with Big Boulder; BLM reach to Private	**1**	Rip I	1. IA 2.IB 3.IC	2.0: H. Temp.
North Boulder-2	From confluence with Mamouth Cr. To headwaters	**1**		1. 2. 3.	2.0: H. Temp.
Louse Cr.	Includes Cottonwood Cr. From confluence of Jordan Cr. To headwaters	**2**	Rip I Flow IV	1. IVA 2.IB 3.IC	1.0: H. Diversity L. Flow
Upper Trout Cr.	From Split Rock Canyon to headwaters, including Nichols, Wood Canyon creeks	**2**	Rip I	1. IA 2.IB 3.	1.5: L. Flow
Cow Cr.-2	From confluence with Wildcat Canyon Cr. To headwaters	**1**	Pol II Rip I	1.IIA 2.IA 3.IB	2.0: Riparian C. Stability H. Diversity F. Sediment H. Temp. Pollutants
Soda Cr.	From confluence of Cow Cr. To headwaters	**1**	Pol II Rip I	1.IIA 2.IC 3.IB	2.0: H. Diversity F. Sediment Oxygen H. Temp. Pollutants
HUC 17050107					
NF Owyhee 1	Lower; From the Oregon State line to the confluence of Juniper Cr.	**1**	Flow IV Rip	1. IVA 2. IB 3.IA	2.0: L. Flow H. Temp.

NF Owyhee 2	Upper; Headwaters of North Fork , Lower Noon Cr. And Lower Pleasant Valley Cr.	**1**	Flow IV Rip I	1.IVA 2.IA 3.IB	2.5: L. Flow H. Temp.
Upper Pleasant Valley Cr.	From the top of Sec. 7 to headwaters	**2**	Rip I	1.IA 2.IB 3.IC	1.0: C. Stability
Cabin Cr.	From the confluence with Juniper Cr. To the headwaters	**1**	Rip I	1.IA 2.IB 3.IC	2.0: Riparian C. Stability F. Sediment H. Temp. ~~Pollutants~~
Juniper Cr. 1	From the confluence with the North Fork Owyhee to lower private boundary	**1**	Rip I	1.IA 2.IB 3.	2.0: H. Temp. ~~Pollutants~~
Juniper Cr. 2	From the start of the private up to the headwaters	**2**		1. 2. 3.	1.0: L. Flow
Lone Tree Cr.	From Oregon State line to headwaters	**2**	Rip I	1.IA 2.IB 3.IC	1.5: H. Diversity
Cottonwood Cr.	From the upper private boundary (section 18) to headwaters	**2**	Flo IV Rip	1.IVA 2.IA 3.IB	1.5: L. Flow
Squaw Cr. 1	From Oregon State line to lower private boundary (section 13)	**1**	Rip I	1.IA 2.IB 3.	2.0: H. Temp.
Squaw Cr. 2	From the start of private in section 14 to the BLM in the northwest corner of section 31	**1**		1. 2. 3.	2.0: L. Flow H. Temp.

Squaw Cr. 3	From private to headwaters	**1**	Flow IV Rip I	1.IVA 2.IA 3.IB	2.0: Riparian C. Stability H. Diversity F. Sediment L. Flow H. Temp.
Pole Cr.	Oregon State line to headwaters	**2**	Rip I	1.IA 2.IB 3.	2.5: F. Sediment
HUC 17050106					
No quartile #1 and #2 scores for protection objective and strategies in this HUC.					
HUC 17050105					
No quartile #1 and #2 scores for protection objective and strategies in this HUC.					
HUC 17050104					
Shoofly Cr.-1	Confluence to BLM boundary	**--**		1. 2. 3.	1.0: Riparian H. Diversity L. Flow
Shoofly Cr.-2	Private/BLM boundary to Bybee reservoir	**--**	Obs III	1. IIID 2. 3.	1.0: H. Flow L. Flow Obstruction
Owyhee River	DV reservoir border to confluence	**2**	Rip I	1.IA 2.IB 3.	2.0: H. Temp.
Owyhee River DVIR portion	Mouth of canyon to NV state line	**--**		1. 2. 3.	1.0: Riparian C. Stability H. Diversity L. Flow H. Temp.
Battle Cr.-3	State section 36 to headwaters	**--**		1. 2. 3.	1.0: H. Diversity L. Flow
Dry Cr.-1	confluence to reservoir	**--**	Pol II Rip I	1.IIA 2.IA	2.0: Riparian C. Stability H. Diversity F. Sediment

				3.IB	H. Flow L. Flow Oxygen L. Temp. H. Temp. Pollutants
Dry Cr.-2	Reservoir to headwaters	--	Obs III Rip I	1.IIID 2.IIIA 3.IA	1.0: Riparian C. Stability H. Diversity L. Flow H. Temp. Obstruction
Deep Cr.-4	headwaters including:	1	Rip I	1.IA 2.IB 3.IC	1.0: Riparian C. Stability F. Sediment
Stoneman Cr.	Confluence to headwaters	2	Flo IV Rip I	1.IVA 2.IA 3.	1.0: C. Stability L. Flow
Nickel Cr.	Confluence to headwaters including:	2	Rip I	1.IA 2.IB 3.IC	1.0: F. Sediment
Smith Cr.	Confluence to headwaters including:	2	Rip I	1.IA 2.IB 3.IC	1.0: F. Sediment
Beaver Cr.	Confluence to headwaters including:	1	Flo IV Rip I	1.IVA 2.IB 3.IC	2.0: Riparian F. Sediment L. Flow
Red Canyon Cr.	Confluence to headwaters including:	1	Rip I	1.IA 2.IB 3.	1.0: H. Temp.
Pole Cr.-1	Confluence to Camas Cr. Confluence including Camel Cr.	2	Rip I	1.IA 2.IB 3.IC	1.0: H. Temp.

AppendixTable 4.2.1.2 Idaho QHA link ~ Restoration Objectives and Strategies: {Reaches with Quartile 1 and Quartile 2 Restoration Scores}

4th Field HUC/ Reach Name	Description	Q-tile	Restoration Objectives	Restoration Strategies	Min. QHA Score ↦ Limiting Factor(s)
HUC 17050108					
Jordan Cr.-1	Jordan Cr. From OR Boundary to BLM boundary section	**1**		1. 2. 3.	1.0: Riparian C. Stability H. Diversity L. Flow Oxygen L. Temp. H. Temp. Pollutants
Jordan Cr.-2	From end of #2 to Rail Creek	**1**	Pol II	1.IIA 2. 3.	1.0: H. Diversity Pollutants
Jordan Cr.-3	Rail Cr. Confluence to BLM boundary	**2**		1. 2. 3.	1.0: L. Flow Pollutants
Jordan Cr.-4	BLM boundary near Buck Cr. to BLM boundary	**1**	Pol II	1.IIA 2. 3.	1.0: H. Diversity Pollutants
Jordan Cr.-5	BLM boundary section line to BLM boundary upstream of Louse Cr.	**2**		1. 2. 3.	1.0: Pollutants
Williams Cr.	BLM segments	**2**	Rip I	1. IA 2. IB 3.IC	2.0: C. Stability H. Diversity ~~L. Flow~~ L. Temp. H. Temp.
Duck Cr.	All	**1**	Rip I	1.IA	1.5: Riparian C. Stability

				2.IB 3.IC	F. Sediment
South Mountain Creek	Lower BLM upper put state includes Howl Cr. Cyote Cr.	**1**	Rip I	1.IA 2.IB 3.IC	1.0: H. Diversity
Rail Cr.	All	**2**	Rip I	1.IA 2.IB 3.IC	2.0: Riparian C. Stability H. Diversity F. Sediment H. Temp. Pollutants
Indian Cr.	Bogus Cr. (Lower) - confluence with South Fork Boulder to Section 10	**1**	Flo IV	1.IVA 2. 3.	1.0: L. Flow
Combination Cr.	Lower reach of stream	**2**	Rip I	1.IA 2.IB 3.IC	1.5: Riparian Oxygen
Louisa Cr.	From confluence with Rock Cr.	**1**	Obs III	1.IIID 2. 3.	1.0: Obstruction
Rock Cr.-2	From Meadow Creek to BLM	**1**	Flo IV	1.IVA 2. 3.	1.0: Riparian C. Stability H. Diversity L. Flow Oxygen L. Temp. H. Temp.
Rock Cr.-4	From BLM/PVT boundary in Sec. 26 to above Triangle Reservoir.	**1**		1. 2. 3.	1.0: Riparian C. Stability H. Diversity L. Flow Oxygen L. Temp. H. Temp.
Meadow Cr.	Headwaters to confluence with Rock Cr.	**2**	Rip I	1.IA 2.IB	1.0: H. Diversity

				3.IC	
Louse Cr.	Includes Cottonwood Cr. From confluence of Jordan Cr. To headwaters	**1**	Rip I Flo IV	1.IVA 2.IB 3.IC	1.0: H. Diversity L. Flow
Upper Trout Cr.	From Split Rock Canyon to headwaters, including Nichols, Wood Canyon creeks	**2**	Protection objectives	1. 2. 3.	1.5: L~~. Flow~~
HUC 17050107					
Upper Pleasant Valley Cr.	From the top of Sec. 7 to headwaters	**2**	Rip I	1.IA 2.IB 3.IC	1.0: C. Stability
Cottonwood Cr.	From the upper private boundary (section 18) to headwaters	**2**	Flo IV	1.IVA 2. 3.	1.5: L. Flow
Middle Fork Owyhee	Oregon State line to headwaters	**2**	Rip I	1.IA 2.IB 3.	0.5: Riparian
HUC 17050106					
Little Owyhee	From the Nevada State line to the confluence with South Fork Owyhee	**2**	Pol II Rip I	1.IIA 2.IA 3.IB	1.0: H. Diversity Oxygen L. Temp. H. Temp. Pollutants
HUC 17050105					
South Fork Owyhee	From Nevada State line to the confluence with Owyhee River		Flow IV Rip I	IVA IA IB	1.5: L. Flow H. Temp
HUC 17050104					
Blue Cr.-3	Blue Cr. Reservoir to headwaters	**2**	Flow IV	1.IVA	1.0: L. Flow

				2. 3.	
Shoofly Cr.-1	Confluence to BLM boundary	**1**		1. 2. 3.	1.0: Riparian H. Diversity L. Flow
Shoofly Cr.-2	Private/BLM boundary to Bybee reservoir	**2**	Obs III	1.IIID 2. 3.	1.0: H. Flow L. Flow Obstruction
Owyhee River DVIR portion	Mouth of canyon to NV state line	**1**		1. 2. 3.	1.0: Riparian C. Stability H. Diversity L. Flow H. Temp.
Battle Cr.-2	Section 10 to above state section 36	**1**		1. 2. 3.	1.0: H. Temp.
Battle Cr.-3	State section 36 to headwaters	**1**		1. 2. 3.	1.0: H. Diversity L. Flow
Dry Cr.-1	confluence to reservoir	**1**	Pol II Rip I	1.IIA 2.IA 3.IB	2.0: Riparian C. Stability H. Diversity F. Sediment H. Flow L. Flow Oxygen L. Temp. H. Temp. Pollutants
Dry Cr.-2	Reservoir to headwaters	**1**	Obs III Rip I	1. IIID 2.IIIA 3.IA	1.0: Riparian C. Stability H. Diversity L. Flow H. Temp. Obstruction
Big Springs Cr.-1	confluence to reservoir	**2**	Rip I	1.IA 2.IB	1.0: H. Temp.

				3.	
Big Springs Cr.-3	BLM boundary to private	**2**	Rip I	1.IA 2.IB 3.IC	1.0: Riparian H. Temp.
Deep Cr.-1	Confluence to private	**2**	Rip I	1.IA 2.IB 3.IC	1.0: F. Sediment Oxygen H. Temp.
Deep Cr.-2	Private to mid section 10	**1**	Rip I	1.IA 2.IB 3.IC	1.0: F. Sediment Oxygen H. Temp.
Deep Cr.-3	section 10 to Stoneman Cr. Confluence	**2**	Rip I	1. IA 2.IB 3.IC	1.0: F. Sediment
Deep Cr.-4	headwaters including:	**1**	Rip I	1.IA 2.IB 3.IC	1.0: Riparian C. Stability F. Sediment
Stoneman Cr.	Confluence to headwaters	**2**	Flo IV Rip I	1.IVA 2.IA 3.	1.0: C. Stability L. Flow
Current Cr.	Confluence to headwaters	**1**	Flo IV Rip I	1.IVA 2.IA 3.IB	1.0: C. Stability L. Flow
Smith Cr.	Confluence to headwaters including:	**2**	Rip I	1.IA 2.IB 3.IC	1.0: F. Sediment
Castle Cr.	Confluence to headwaters including:	**1**	Obs III Rip I	1.IIID 2.IA 3.IB	1.0: Riparian F. Sediment H. Flow L. Flow H. Temp. Obstruction

Red Canyon Cr.	Confluence to headwaters including:	**2**	Rip I	1.IA 2.IB 3.	1.0: H. Temp.
Petes Cr.	Confluence to headwaters including:	**1**	Rip I	1.IA 2.IB 3.	1.0: H. Temp.
Pole Cr.-2	Camas confluence to headwaters	**2**		1. 2. 3.	1.0: L. Flow H. Temp.

§ 4.2.2 Nevada Portion of the Owyhee Subbasin

Appendix Table 4.2.2.1 Nevada QHA link to Protection Objectives and Strategies: {Reaches with Quartile 1 and Quartile 2 Protection Scores} Key: Q1= top 25% of rank protection score; Q2= second 25%; Q3= third 25%; Q4= bottom 25%.

4th Field HUC/ Reach Name	Description	Q	Protection Objectives	Protection Strategies	Limiting Factor(s)
HUC 17050104					
Skull Cr		**2**	Rip I	1. ID	Riparian
N.F. of Skull Cr		**2**	Rip I	1. ID	Riparian
E.F. of Skull Cr		**2**	Rip I	1. ID	Riparian
Fawn Cr	USFS RBT occupied for sure 4.8miles	**2**	Rip I	1. IA 2.ID	Riparian H. Temp.
E.F. Owyhee Duck Valley Indian Res border to Patsville (Mill Cr)	U.S.F.S.	**3**	Poll II	1.IIA	Pollutants
Slaughter House Cr	Occupied RBT 2 miles	**1**	Rip I Obs III	1.IA 2.IIIA	C. Stability H. Diversity F. Sediment Obstruction
Brown's Gulch (Slaughter house Trib	2.4 miles RBT occupied	**1**	Rip I	1.IA	C. Stability H. Diversity F. Sediment ~~Obstruction~~
Miller Cr.	3 mile occupied RBT	**2**	Rip I	1.IA	C. Stability H. Diversity F. Sediment ~~Obstruction~~
West Fr. (of Slaughterhouse Cr)	1.5 miles occupied RBT	**1**	Rip I	1.IA	C. Stability

4th Field HUC/ Reach Name	Description	Q	Protection Objectives	Protection Strategies	Limiting Factor(s)
					H. Diversity F. Sediment ~~Obstruction~~
North Fr (trib of California Cr)	No RBT, lack of flow(Drought yr)	**2**	Rip I	1.IA 2. 3.	H. Temp.
Dip Cr	1 mile RBT occupied	**1**	Obs III Rip I	1.IIIB 2.IA	C. Stability H. Diversity F. Sediment Obstruction
Big Springs Cr	Unoccupied (insufficient flow)	**1**	Rip I	1.IA	C. Stability H. Diversity F. Sediment ~~Obstruction~~
South Fr.	2 mile RBT occupied	**2**	Rip I	1.IA	Riparian
Pixley	1 mile RBT occupied	**2**	Poll III	1.IIIB	Obstruction
Upper Mill Cr to Rio tinto Mine	occupied RBT whole distance in none drought years	**1**	Rip I	1.IA	Riparian C. Stability H. Diversity F. Sediment
McCall Cr.	5.5 miles occupied RBT	**1**	Rip I	1.IA	Riparian C. Stability H. Diversity F. Sediment
Trail Cr	8.2 occupied RBT, Brook Trout(MGT concern)	**2**	Obs III	1.IIIA	L. Flow Obstruction

4th Field HUC/ Reach Name	Description	Q	Protection Objectives	Protection Strategies	Limiting Factor(s)
Van Duzer Cr. (Trib to Trail Cr)	5 mile occupied, Brook Trout (MGR concen)	**2**	Obs III	1.IIIA	L. Flow Obstruction
Lime Cr (trib to Van Duzer)	.3 occupied by RBT, Brook Trout prsnt	**1**	Rip I	1.IA	C. Stability
Cobb Cr (trib to Van Duzer)	4.5 RBT occupied	**1**	Rip I	1.IA	Riparian C. Stability H. Diversity F. Sediment
Wood Gulch	Mine prsnt, 2 mile RBT occupied	**1**	Rip I	1.IA	Riparian C. Stability H. Diversity F. Sediment ~~Obstruction~~
Hutch Cr	1mile RBT occupied, Brook Trout	**2**	Obs III	1.IIIB	Obstruction
Timber Gulch	0.35 RBT occupied, Brook Trout	**2**	Obs III	1.IIIB	Obstruction
Sheep cr	2 mile RBT occupied, Brook Trout	**1**	Rip I	1.IA	Riparian C. Stability H. Diversity F. Sediment ~~Obstruction~~
Road Canyon	1.2 RBT occupied	**2**	Rip I	1.IA	Riparian C. Stability H. Diversity F. Sediment ~~Obstruction~~

4th Field HUC/ Reach Name	Description	Q	Protection Objectives	Protection Strategies	Limiting Factor(s)
Gravel Cr	Lower 0.1 RBT occupied (spawning ground)	**2**	Rip I	1.IA	Riparian
Badger Cr.	7 miles RBT occupied, some livestock concerns, fair condition, 1600 fish	**1**	Rip I	1.IA	Riparian C. Stability
Beaver Cr.	All occupied by RBT	**1**	Rip I	1.IA 2. 3.	Riparian C. Stability
Penrod	RBT occupied entire way	**2**	Rip I	1.IC	Riparian C. Stability
Martin Cr. (trib to Penrod)	4.5 RBT occupied, Brook Trout	**1**	Rip I	1.IA	C. Stability
Gold Cr. (trib to Martin Cr)	1.8 RBT occupied	**1**	Rip I	1.IA 2.IC	Riparian C. Stability
HUC 17050105					
T41N R49E sec4 to Head Waters	Occupied by RBT year round, 3miles of reach occupied	**2**	Rip I Obs III	1.IC 2.IIIA 3.	C. Stability Obstruction
Indian Cr. (Trib to S.F. Owyhee)	Occupied RBT through National Forest	**2**	Rip I Obs III	1.IC 2.IA 3.IIIA	~~Pollutants~~ Riparian Obstruction
Winters Cr. Trib to Indian Cr	2 miles occupied RBT through National Forest	**2**	Rip I	1.IA 2.IC 3.IIIA	Obstruction Riparian
Mitchell Cr. Trib to Indian Cr	2 miles occupied RBT through National Forest	**2**	Rip I Obs III	1.IA 2.IC 3.IIIA	Obstruction Riparian

4th Field HUC/ Reach Name	Description	Q	Protection Objectives	Protection Strategies	Limiting Factor(s)
Wall Cr. Trib to Indian Cr	1 Mile occupied RBT through National Forest	**2**	Rip I Obs III	1.IA 2.IC 3.IIIA	Obstruction Riparian
Silver Cr. (Trib to S.F. Owyhee)	2 miles occupied RBT through National Forest	**2**	Obs III Rip I	1.IIIA 2.IC 3.IA	Obstruction Riparian
Breakneck Cr	2 miles occupied RBT	**2**	Rip I	1.IC 2.IA 3.	~~Obstruction~~ Riparian
Cap Winn Cr	Occupied RBT,	**2**	Rip I Obs III	1.IA 2.IC 3.IIIC	C. Stability H. Diversity Obstruction
Doby George	Occupied RBT,	**2**	Rip I Obs III	1.IA 2.IC 3.IIIC	C. Stability H. Diversity Obstruction
Columbia Cr	Occupied RBT, Low number (200's), Brook Trout abundant	**1**	Rip I Obs III	1.IA 2.IC 3.IIIC	Obstruction Riparian
Blue Jacket Cr	Occupied RBT (700), Brook Trout	**1**	Obs III Rip I	1.IIIC 2.IC 3.IA	Obstruction Riparian
Harrington Cr	Unsurveyed, Prvt Land, Probable RBT	**2**	Obs III	1.IIIA	Obstruction
Marsh Cr.	Occupied RBT	**1**	Obs III	1.IIIA	Obstruction
Boyd Cr	Occupied RBT	**1**	Obs III	1.IIIA	Obstruction
Scoonover Cr.	Occupied RBT	**1**	Obs III Rip I	1.IIIB 2.IA	Obstruction Riparian
Dorsey	Occupied RBT	**1**	Obs III	1.IIIB	Obstruction

4th Field HUC/ Reach Name	Description	Q	Protection Objectives	Protection Strategies	Limiting Factor(s)
Coffin Cr.	Occupied RBT	1	Obs III	1.IIIB	Obstruction
Jack Cr	Occupied RBT, no brook trout surveyed in last 2yrs(used to be abundant)	1	Obs III	1.IIIA 2.IIIB	Obstruction
Chicken Cr	Occupied RBT,	1	Obs III	1.IIIB	Obstruction
Mill Cr	Occupied RBT, Brook trout, included 3 forks	1	Obs III Rip I	1.IIIB 2.IA	Obstruction Riparian
Snow Canyon Cr	Occupied RBT, 5 mi occupied	1	Obs III	1.IIIA	Obstruction
Burns Cr.(Trib to Jarritt Canyon0	1.5 mile occupied on National Forest, Trout Prsnt	1	Obs III	1.III	Obstruction
Schmidtt Cr.	4 miles occupied	1	Obs III	1.IIIA	Obstruction
McCann Cr	5 mile occupied RBT, low desnity RBT	2	Rip I Obs III	1.IC 2.IB 3.IIIA	C. Stability H. Flow Obstruction
Taylor Canyon Cr (trib to S.F. Owyhee)	2 miles occupied RBT, BT common	2	Obs III	1.IIIA 2.IIIB	Obstruction
Water Pipe Canyon (trib to Taylor Canyon)	2.5 mile occupied RBT	2	Obs III Rip I	1.IIIB 2.IC	Obstruction Riparian

Appendix Table 4.2.2.2 Nevada QHA link to <u>Restoration</u> Objectives and Strategies: {Reaches with Quartile 1 and Quartile 2 Protection Scores} Key: Q1= top 25% of rank protection score; Q2= second 25%; Q3= third 25%; Q4= bottom 25%.

4th Field HUC/ Reach Name	Description	Q	Restoration Objectives	Restoration Strategies	Limiting Factor(s)
HUC 17050104					
E.F. Owyhee ID-NV state line to Paradise Point Diversion	Irrigated hay fields, No RBT habitat	**2**	Rip I Obs III Poll II Obs III	1.ID 2.IIID 3.II 4.IIIC	C. Stability L. Flow Pollutants Obstruction
E.F. Owyhee Paradise Point to Duck Valley Indian Res border	DVIR	**2**	Rip I	1.ID	C. Stability H. Diversity
Skull Cr		**1**	Rip I	1.ID	Riparian
N.F. of Skull Cr		**1**	Rip I	1.ID	Riparian
E.F. of Skull Cr		**1**	Rip I	1.ID	Riparian
Jones Cr		**1**	Rip I	1.ID	Riparian
Granite	probably fishless	**1**	Rip I	1.ID.	Riparian
E.F. Owyhee Duck Valley Indian Res border to Patsville (Mill Cr)	U.S.F.S.	**1**	Poll II Obs III	1.IIA 2.IID 3.	Pollutants
California Cr	Min. occupied RBT by headwater of Cr.	**1**	Obs III	1.IIID	L. Flow
North Fr (trib of California Cr)	No RBT, lack of flow(Drought yr)	**1**	Obs III	1.IA	H. Temp.
E.F. Owyhee Mill Cr.to Badger Cr	U.S.F.S.	**1**	Rip I	1.IC	H. Diversity
Lower Mill Cr to S.F Owyhee River	Unoccupied, pollution, mine tailings	**1**	Poll II	1.IIA	Riparian H. Diversity Pollutants
Allegheny	Native Dace only	**1**	Rip I	1.IA	L. Flow

4th Field HUC/ Reach Name	Description	Q	Restoration Objectives	Restoration Strategies	Limiting Factor(s)
				2.IC	
Cold Spring (trib to Allegheny)	Native Dace only	1	Rip I	1.IA	L. Flow
Trail Cr	8.2 occupied RBT, Brook Trout(MGT concern)	2	Obs III	1.IIID	L. Flow Obstruction
Van Duzer Cr. (Trib to Trail Cr)	5 mile occupied, Brook Trout (MGR concen)	2	Obs III	1.IIID	L. Flow Obstruction
Hutch Cr	1mile RBT occupied, Brook Trout	2	Obs III	1.IIIB	Obstruction
Timber Gulch	0.35 RBT occupied, Brook Trout	2	Obs III	1.IIIB	Obstruction
E.F. Owyhee Badger Cr. To Wildhorse Res.	U.S.F.S.	2	Obs III	1.IIID	Obstruction
Wildhorse Res		1	Obs III	1.IIID	L. Flow Obstruction
Hay meadow Cr	only native dace present	1	Rip I	1.IC 2.IB	L. Flow
Thompson Cr (hay meadow trib)	no fish present in drough yrs	2	Rip I	1.IC	L. Flow
Sweet Cr	0.5 RBT occupied	1	Rip I	1.IC	L. Flow
Rosebud Cr	Native Dace only	1	Rip	1.IC	L. Flow
Deep Cr trib to Wildhorse (E.F. Owyhee)	1.5 miles occupied RBT, some on prvt land?	2	Obs III	1.IIID	L. Flow
Clear Cr trib to (Deep Cr)	no fish present in drough yrs	2	Obs III	1.IIID	L. Flow
Riffe Cr (Deep Cr)	3 mile occupied RBT, beaver ponds	2	Rip I	1.IA	L. Flow
N.F. of Deep Cr	No RBT, lack of flow(Drought yr)	2	Rip I	1.IA 2.IC	L. Flow
Middle Fork of Deep Cr	2 mile occupied RBT	2	Rip I	1.IA 2.IC	L. Flow

4th Field HUC/ Reach Name	Description	Q	Restoration Objectives	Restoration Strategies	Limiting Factor(s)
S.F of Deep Cr	3 miles RBT occupied	2	Rip I	1.IA 2.IC	L. Flow
E. F. Owyhee Above Wildhorse Res to head waters	Spotted Frog habitat	1	Rip I	1.IC 2.IB	F. Sediment
Hanks Cr trib to Upper E.F Owyhee	Dace prsnt, habitat concerns (livestocke) no RBT	1	Rip I	1.IC	Riparian
HUC 17050105					
Lower boundry of Petan Ranch to Red Cow Cr.	Red Band prsnt seasonally(Spring) during good water yrs when sutiable water temps	2	Rip I Obs III	1.IC 2.IB 3.IIID	Riparian C. Stability ~~H. Flow~~ Obstruction
From Red Cow to Hot cr.	RBT Occupied yr round, low density	2	Rip I	1.IC 2.IB	~~H. Flow~~ ~~Obstruction~~
hot creek to McCann	Prvt Land, Brook Trout prsnt in Spring Heads, RBT are seasonal, White Fish yr round	2	Obs III Non IV	1.IIID 2.IVA	Obstruction
T41N R49E sec4 to Head Waters	Occupied by RBT year round, 3miles of reach occupied	2	Rip I Obs III	1.IC 2.IB 3.IIIA 4.IIID	C. Stability Obstruction
Winters Cr.	Recently occupied, but not currently, historic habitat (no record), stocked in 1972 with RBT, ceased in 2000due to fire/livestock grazing	1	Rip I	1.IC	C. Stability H. Temp. Obstruction
Sheep Cr. Res to T46n R51E sec 11	Int/Dry, no RBT, spring down	2		1.	Obstruction

4th Field HUC/ Reach Name	Description	Q	Restoration Objectives	Restoration Strategies	Limiting Factor(s)
	migration			2. 3.	
T46n R51e sec 11 to head waters		1		1. 2. 3.	Obstruction
Indian Cr. (Trib to S.F. Owyhee)	Occupied RBT through National Forest	2	Rip I	1.IC	Pollutants
Silver Cr. (Trib to S.F. Owyhee)	2 miles occupied RBT through National Forest	2	Obs III	1.?	Obstruction
White Rock Cr.	Unoccupied, probably historic, mining influence	2	Obs III	1.?	Obstruction
Cottonwood Canyon Cr.	Unoccupied, probably historic, mining influence	2		None	Obstruction
Bull Run Cr.-S.F. Owyhee to Bull Run Canyon	Diverted for Agriculture use	2		None	Obstruction
Mouth of Bull Run Canyon to Cap Winn Cr.	probably recruitment from upstream tribs	2		None.	Obstruction
Frost Cr.	Low number of RBT	1	Rip I	1.IC 2.IA	C. Stability H. Diversity Obstruction
Cap Winn Cr	Occupied RBT,	2	Rip I	1.IC 2.IA	C. Stability H. Diversity Obstruction
Doby George	Occupied RBT,	2	Rip I	1.IA 2.IC	C. Stability H. Diversity Obstruction
Deep Cr. Trib to S.F. Owyhee		1	Rip I	1.IC	H. Diversity
S.F Owyhee to Head Waters	Unoccupied, RBT probably present historically	1			N/A (no scores)

4th Field HUC/ Reach Name	Description	Q	Restoration Objectives	Restoration Strategies	Limiting Factor(s)
Red Cow Cr.	Occupied 1mile by RBT	**1**	Rip I	1.IC	C. Stability
Amazon	Ephemerial, no record of RBT, probably historic	**1**	Rip I	1.IC 2.IB	C. Stability Obstruction
Big Cottonwood Trib	1mile occupied by RBT	**1**	Rip I	1.IC 2.IB	C. Stability
McCann Cr	5 mile occupied RBT, low desnity RBT	**1**	Rip I Obs III	1.IC 2.IB 3.IIID	C. Stability L. Flow Obstruction
Water Pipe Canyon (trib to Taylor Canyon)	2.5 mile occupied RBT	**2**	Obs III Rip I	1.IIIB 2.IC	Obstruction Riparian

§ 4.2.3 Oregon Portion of the Owyhee Subbasin

Appendix Table 4.2.3.1 Oregon QHA link to Protection Objectives and Strategies.

4th Field HUC/ Reach Name	Description	Q	Protection Objectives	Protection Strategies	Limiting Factor(s)
Owyhee R-1	Mouth to Owyhee Ditch Co Dam (RM14)	- -	Private land (CT) No RedBand Trout present (RP)		Oxygen (CT)
Owyhee R-2	DC Dam to RM28	- -	Grazing management may include season of use, fencing, and rest. (CT) No RedBand Trout present (RP)	1. Implement grazing management appropriate for riparian pastures (CT).	H. Temp. (CT)
Owyhee R-3	Dam to Upstream High Water (RM80)	4	Reservoir		N/A No scores
Dry Creek	Dry Creek upstream to Crowley Road	2	Grazing management may include season of use, fencing, and rest. (CT) Grazing management may include season of use, fencing, and rest. (RP)	1. Implement grazing management appropriate for riparian pastures (CT). 2. Improve riparian to increase vegetative shading. (RP) 3.Improve riparian to increase bank stability (RP)	H. Temp. (CT) C Stability (RP) H diversity (RP) F sediment (RP)
Owyhee R-4	High Water upstream to Jordan Cr	3	Appropriate grazing management has been implemented on BLM reaches. (CT) Appropriate grazing management has been implemented on BLM reaches. (RP)	1. Implement grazing management appropriate for riparian pastures. (CT)	F. Sediment (CT) H. Temp. (CT) Pollutants

4th Field HUC/ Reach Name	Description	Q	Protection Objectives	Protection Strategies	Limiting Factor(s)
					(CT) H diversity (RP) H Flow (RP) L Flow (RP)
Rinehart Creek	Mouth to falls	**1**	No RedBand Trout present (CT) Limiting factors result from natural processes (CT)		F. Sediment (CT)
Jordan Creek	Mouth to State Line	**3**	Primarily private land and agricultural use. (CT) Grazing management may include early season use, fencing, and rest. (CT) Grazing management may include season of use, fencing, and rest. (RP)	1. Implement grazing management appropriate for riparian pastures. (CT) 2. Improve riparian to provide vegetative shading and bank stability.(RP) 3. Screen irrigation diversions. (RP) 4. Passage at irrigation structures. (RP)	L. Flow (CT) H. Temp. (CT) C stability (RP) H diversity (RP) H Flow (RP)
Cow Creek	Mouth to State Line	**3**	Primarily private land and agricultural use. (CT) Grazing management may include early season use, fencing, and rest. (CT) Grazing management may include season of use, fencing, and rest. (RP)	1. Implement grazing management appropriate for riparian pastures. (CT) 2. Improve riparian to provide vegetative shading and	Riparian (CT) L. Flow (CT) H. Temp. (CT) H flow (RP)

4th Field HUC/ Reach Name	Description	Q	Protection Objectives	Protection Strategies	Limiting Factor(s)
				bank stability (RP) 3. Screen irrigation diversions. (RP) 3. Passage at irrigation structures. (RP)	C stability (RP) H diversity (RP)
Owyhee R-5	Confl. Jordan Creek upstream to Sline	**2**	Appropriate grazing management has been implemented on BLM reaches. (CT) Appropriate grazing management has been implemented on BLM reaches (RP)	1. Implement grazing management appropriate for riparian pastures. (CT)	H. Temp. (CT) H diversity (RP) C stability (RP) Riparian C (RP)
NF Owyhee	Mouth to Sline	**2**	Grazing management may include early season use, fencing, and rest. (CT) Grazing management may include season of use, fencing, and rest. (RP)	1. Implement grazing management appropriate for riparian pastures. (CT) 2. Improve riparian to increase vegetative shading. (RP) 3. Improve riparian to increase bank stability. (RP)	Riparian (CT) H. Temp. (CT) H diversity (RP) L flow (RP) C stability (RP)
Middle Fork	Idaho Segment (?)	**2**	Primarily private land. (CT) Grazing management may include season of use, fencing, and rest. (RP)	1. Improve riparian to increase vegetative shading. (RP) 2. Improve riparian to increase bank stability. (RP)	Riparian (CT) C stability (RP) H diversity (RP) L flows (RP)

4th Field HUC/ Reach Name	Description	Q	Protection Objectives	Protection Strategies	Limiting Factor(s)
Antelope Creek R-1	Mouth upstream to corrals (~8 mi)	**1**	No RedBand Trout present (CT) Limiting factors result from natural processes. (CT) Grazing management may include season of use, fencing, and rest. (RP)	1. Improve riparian to increase vegetative shading. (RP) 2. Improve riparian to increase bank stability. (RP)	F. Sediment (CT) H diversity (RP) C stability (RP) Riparian C (RP)
Antelope Creek R-2	Corrals upstream to Star Valley Road (dry segment)	**3**	No RedBand Trout present (CT) Limiting factors result from natural processes (lack of perennial flow). (CT) Grazing management may include season of use, fencing, and rest. (RP)	1. Improve riparian to increase vegetative shading (RP) 2.Improve riparian to increase bank stability (RP)	F. Sediment (CT) Obstructio ns (RP) H flows (RP) L flows (RP)
Antelope Creek R-3	SV Road upstream to Headwater s	**4**	Grazing management may include early season use, fencing, and rest. (CT) Grazing management may include season of use, fencing, and rest. (RP)	1. Implement grazing management appropriate for riparian pastures. (CT) 2. Improve riparian to increase vegetative shading (RP) 3.Improve riparian to increase bank stability (RP)	Riparian (CT) H. Diversity (CT) Oxygen (CT) H. Temp. (CT) Obstructio ns (RP) H flows (RP) L Flows (RP)
WLO R-1	Mouth upstream to Anderson Crossing	**1**	Appropriate grazing management has been implemented (exclusion). (CT)	1. Implement grazing management appropriate for riparian	F. Sediment (CT) H. Temp.

4th Field HUC/ Reach Name	Description	Q	Protection Objectives	Protection Strategies	Limiting Factor(s)
			Appropriate grazing management has been implemented on BLM reaches (RP)	pastures. (CT) 2. Improve riparian to increase vegetative shading (RP) 3. Improve riparian to increase bank stability (RP)	(CT) H diversity (RP) C stability (RP) Riparian C (RP)
WLO R-2	Anderson Crossing to headwaters	**1**	Appropriate grazing management has been implemented (exclusion). (CT) Grazing management may include season of use, fencing, and rest. (RP)	1. Implement grazing management appropriate for riparian pastures. (CT) 2.Improve riparian to increase vegetative shading (RP) 3.Improve riparian to increase bank stability (RP)	H. Temp. (CT) C stability (RP) Riparian C (RP) H diversity (RP)

Appendix Table 4.2.3.2 Oregon QHA link to <u>Restoration</u> Objectives and Strategies.

4th Field HUC/ Reach Name	Description	Q	Restoration Objectives	Restoration Strategies	Limiting Factor(s)
Owyhee R-1	Mouth to Owyhee Ditch Co Dam (RM14)	**3**	No RedBand Trout present (RP)		Oxygen (CT)
Owyhee R-2	DC Dam to RM28	**4**	No RedBand Trout present (RP)		H. Temp. (CT)
Owyhee R-3	Dam to Upstream High Water (RM80)	**2**	Reservoir (RP)		N/A (CT) No scores (CT) N/A (RP) No scores (RP)
Dry Creek	Dry Creek upstream to Crowley Road	**1**	Grazing management may include early season use, fencing, and rest. (CT) Grazing management may include early season use, fencing, and rest. (RP)	1. Implement grazing management appropriate for riparian pastures (CT) 2. Improve riparian to increase vegetative shading (RP) 3. Improve riparian to increase bank stability (RP)	H. Temp. (CT)
Owyhee R-4	High Water upstream to Jordan Cr	**4**	Appropriate grazing management has been implemented on BLM reaches (RP)	1. Improve riparian to increase vegetative shading (RP) 2.Improve riparian to (RP)increase bank stability	F. Sediment (CT) H. Temp. (CT) Pollutants (CT)

4th Field HUC/ Reach Name	Description	Q	Restoration Objectives	Restoration Strategies	Limiting Factor(s)
					F sediment (RP) C complexity (RP) H temps (RP)
Rinehart Creek	Mouth to falls	**2**	No RedBand Trout present (CT) Limiting factors result from natural processes (CT) Appropriate grazing management has been implemented on BLM reaches (RP)		F. Sediment (CT) F sediment (RP) C stability (RP) Riparian c (RP)
Jordan Creek	Mouth to State Line	**1**	No RedBand Trout present (CT) Primarily private land and agricultural use (CT) Grazing management may include early season use, fencing, and rest. (RP) Restore passage for fish movement through this reach (RP)	1.Improve irrigation efficiency (RP) 2. Improve Riparian to stabilize banks (RP) 3.Increase vegetative shading (RP)	L. Flow (CT) H. Temp. (CT) L. Flow (RP) C stability (RP) H. Temp (RP)
Cow Creek	Mouth to State Line	**1**	Primarily private land and agricultural use (CT) Grazing management may include early season use, fencing, and rest. (CT) Grazing management may include early season use, fencing, and rest. (RP) Restore passage for fish movement through this reach (RP)	1. Implement grazing management appropriate for riparian pastures. (CT) 2. Improve irrigation efficiency (RP) 3. Improve riparian condition (RP) 4. Improve	Riparian (CT) L. Flow (CT) H. Temp. (CT) L flows (RP) Riparian (RP) C

4th Field HUC/ Reach Name	Description	Q	Restoration Objectives	Restoration Strategies	Limiting Factor(s)
				Riparian to channel complexity (RP)	complexity (RP)
Owyhee R-5	Confl. Jordan Creek upstream to Sline	**3**	Appropriate grazing management has been implemented (exclusion) (CT) Appropriate grazing management has been implemented on BLM reaches (RP)	1. Implement grazing management appropriate for riparian pastures (CT) 2. Increase vegetative shading (RP) 3. Improve Riparian to channel complexity (RP) 4. Improve Riparian to channel form (RP)	H. Temp. (CT) H. Temp (RP) C complexity (RP) C form. (RP)
NF Owyhee	Mouth to Sline	**3**	Grazing management may include early season use, fencing, and rest. (CT) Grazing management may include early season use, fencing, and rest. (RP)	Implement grazing management appropriate for riparian pastures (CT) 2. Improve riparian condition (RP) 3. Increase vegetative shading (RP) 4. Improve Riparian to channel complexity (RP)	Riparian (CT) H. Temp. (CT) Riparian C (RP) H. Temp (RP) C complexity (RP).
Middle Fork	Idaho Segment (?)	**1**	Primarily private land (CT) Grazing management may include early season use,	1. Improve riparian condition (RP)	Riparian (CT) Riparian C

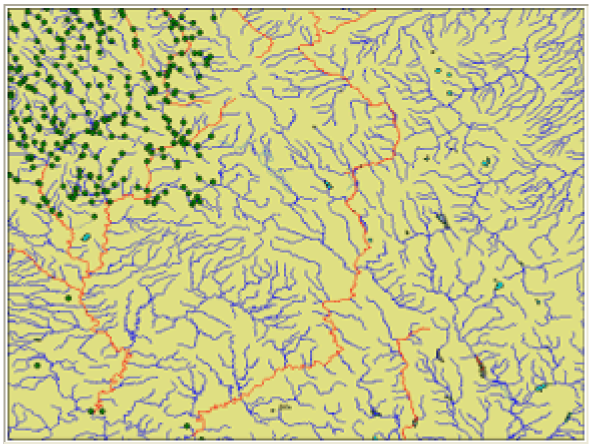
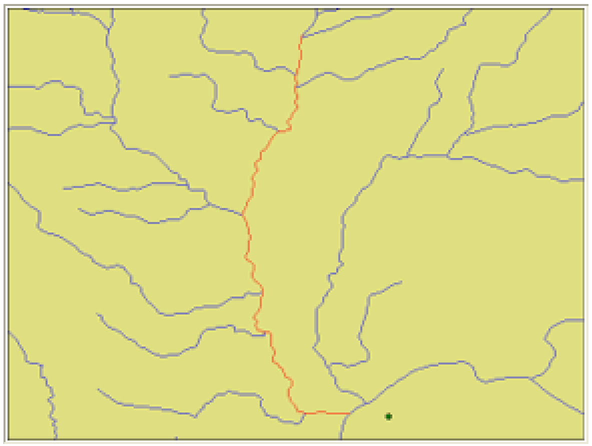
4th Field HUC/ Reach Name	Description	Q	Restoration Objectives	Restoration Strategies	Limiting Factor(s)
			fencing, and rest. (RP)	2. Improve Riparian to reduce sedimentation (RP) 3. Increase vegetative shading (RP)	(RP) F sediment (RP) Oxygen (RP)
Antelope Creek R-1	Mouth upstream to corrals (~8 mi)	**3**	No RedBand Trout present (CT) Limiting factors result from natural processes (CT) Grazing management may include early season use, fencing, and rest. (RP)	1. Improve Riparian to reduce sedimentation 2. Increase vegetative shading (RP)	F. Sediment (CT) F. Sediment (RP) L flow (RP) Oxygen (RP)
Antelope Creek R-2	Corrals upstream to Star Valley Road (dry segment)	**4**	No RedBand Trout present (CT) Limiting factors result from natural processes (lack of perennial flow) (CT) Natural conditions (RP) Grazing management may include early season use, fencing, and rest. (RP)	1. Improve Riparian to reduce sedimentation (RP) 2. Increase vegetative shading (RP)	F. Sediment (CT) H flows (RP) L flows (RP)
Antelope Creek R-3	SV Road upstream to Headwater s		Grazing management may include early season use, fencing, and rest. (CT) Grazing management may include early season use, fencing, and rest. (RP)	1.Implement grazing management appropriate for riparian pastures (CT) 2. Improve Riparian to reduce sedimentation (RP) 3. Increase vegetative shading (RP)	Riparian (CT) H. Diversity (CT) Oxygen (CT) H. Temp. (CT) C complexity (RP)

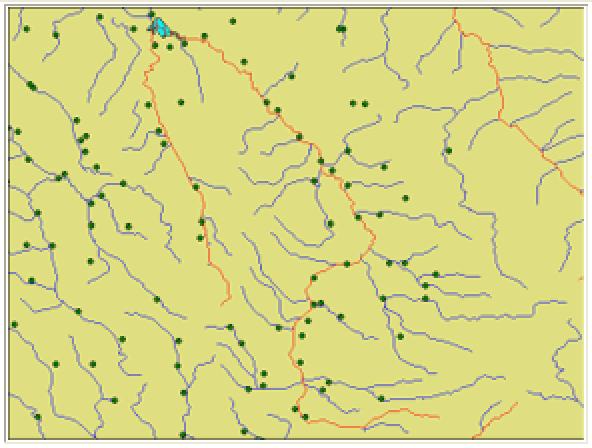
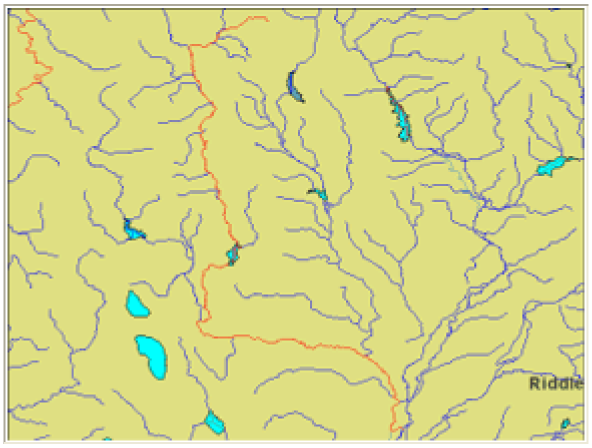
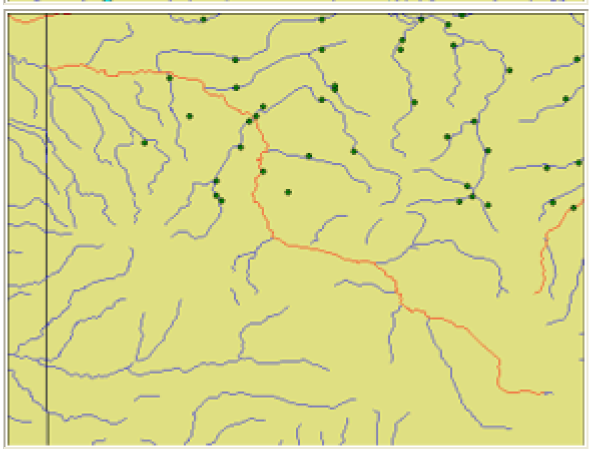
4th Field HUC/ Reach Name	Description	Q	Restoration Objectives	Restoration Strategies	Limiting Factor(s)
					Oxygen (RP) H. Temp. (RP)
WLO R-1	Mouth upstream to Anderson Crossing	**2**	Appropriate grazing management has been implemented (exclusion) (CT) Appropriate grazing management has been implemented on BLM reaches (RP)	1. Implement grazing management appropriate for riparian pastures (CT) 2. Improve Riparian to reduce sedimentation (RP) 3. Increase vegetative shading (RP)	F. Sediment (CT) H. Temp. (CT) F. Sediment (RP) H. Temp (RP) C complexity (RP).
WLO R-2	Anderson Crossing to headwaters	**2**	Appropriate grazing management has been implemented (exclusion) (CT) Grazing management may include early season use, fencing, and rest. (RP)	1. Implement grazing management appropriate for riparian pastures (CT) 2. Improve Riparian to reduce sedimentation (RP) 3. Increase vegetative shading (RP)	H. Temp. (CT) H. Temp (RP) C form (RP) Riparian C. (RP)

Appendix 4.3. Summary of 303(d) waters in the Owyhee Subbasin by 4th Field HUC: Upper Owyhee HUC 17050104; South Fork Owyhee HUC 17050105; East Little Owyhee HUC 17050106; Mid Owyhee HUC 17050107; Jordan HUC 17050108, Crooked Rattlesnake HUC 17050109; and Lower Owyhee HUC 17050110.

Appendix Table 4.3.1. Upper Owyhee HUC 17050104

(Source: http://oaspub.epa.gov/pls/tmdl/waters_list.control?huc=17050104)

State/ Waterbody Name/ LOCATION	**Map of 303(d) Listed Waters (red line)** {Source: **http://oaspub.epa.gov/pls/tmdl** }	**State Identified Impairment(s)**
Idaho BATTLE CREEK HEADWATERS TO OWYHEE RIVER		• BACTERIA Sources of Impairment: 1.
Idaho RED CANYON HEADWATERS TO OWYHEE RIVER		• FLOW ALTERATION • SEDIMENT • TEMPERATURE Sources of Impairment: 1.

Idaho [ROCK CREEK] HEADWATERS TO TRIANGLE RESERVOIR		• FLOW ALTERATION • SEDIMENT • TEMPERATURE Sources of Impairment: 1.
Idaho [SHOOFLY CREEK] HEADWATERS TO BLUE CREEK		• BACTERIA Sources of Impairment: 1.
Idaho [SQUAW CREEK] HEADWATERS TO OREGON LINE		• FLOW ALTERATION • SEDIMENT • TEMPERATURE Sources of Impairment: 1.
Idaho [SNAKE RIVER BASIN: OWYHEE R. ABOVE MILL CK.]	No map available	• TURBIDITY • IRON • TOTAL PHOSPHORUS • TSS Sources of Impairment: 1.

Idaho SNAKE RIVER BASIN: OWYHEE R. AT BONEY LANE	No map available	• TURBIDITY • IRON • TOTAL PHOSPHORUS • TSS Sources of Impairment: 1.
Idaho SNAKE RIVER BASIN: OWYHEE R. AT CHINA DAM	No map available	• TURBIDITY • TOTAL PHOSPHORUS • TSS Sources of Impairment: 1.

1. There were no potential sources of impairment reported to EPA by the state.

Appendix Table 4.3.2. South Fork Owyhee HUC 17050105

(Source: **http://oaspub.epa.gov/pls/tmdl/waters_list.control?huc=17050105**)

List of Impaired Waters: There were no waters found for the listed criteria.

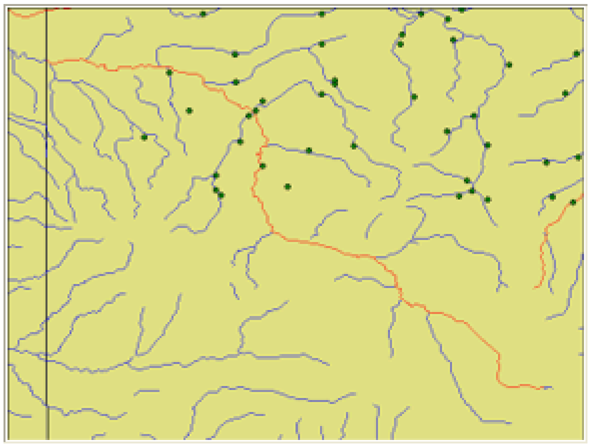
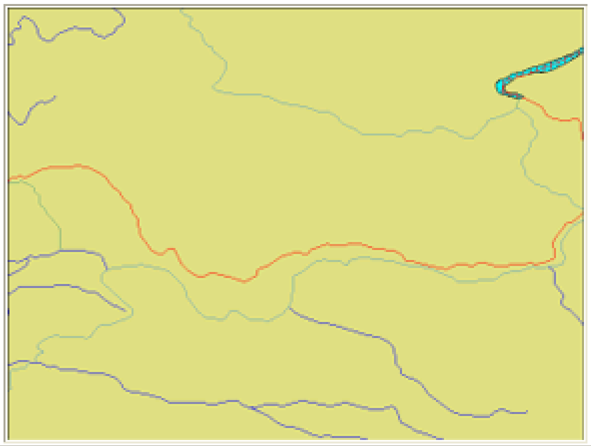
Appendix Table 4.3.3. East Little Owyhee HCC 17050106

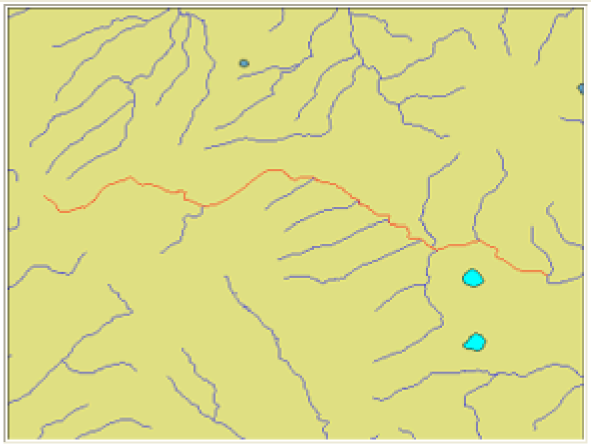
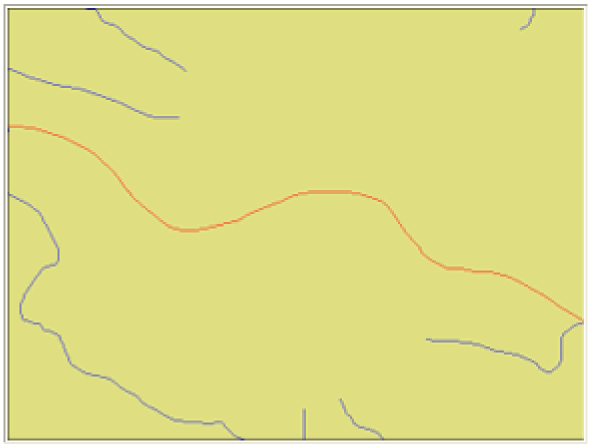
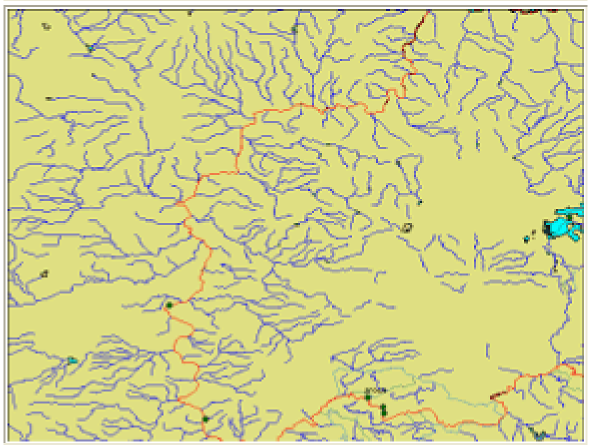
(Source: **http://oaspub.epa.gov/pls/tmdl/waters_list.control?huc=17050106**)

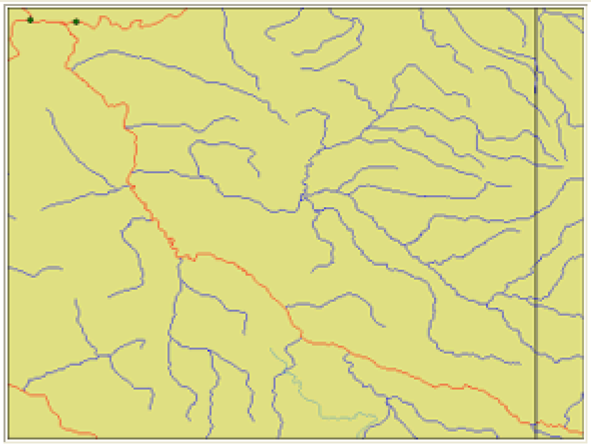
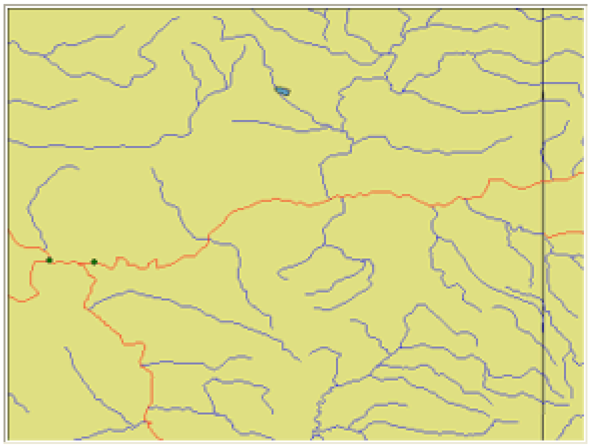
List of Impaired Waters: There were no waters found for the listed criteria!

Appendix Table 4.3.4. Mid Owyhee HUC 17050107

(Source: http://oaspub.epa.gov/pls/tmdl/waters_list.control?huc=17050107)

State/ Waterbody Name/ LOCATION	**Map of 303(d) Listed Waters (red line)** {Source: http://oaspub.epa.gov/pls/tmdl }	**State Identified Impairment(s)**
Idaho SQUAW CREEK HEADWATERS TO OREGON LINE		• FLOW ALTERATION • SEDIMENT • TEMPERATURE Sources of Impairment: 1.
Oregon JORDAN CREEK MOUTH TO HEADWATERS		• FCA(MERCURY) Sources of Impairment: 1.

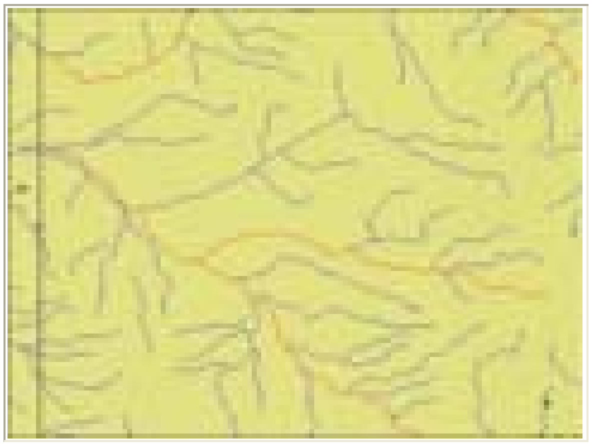
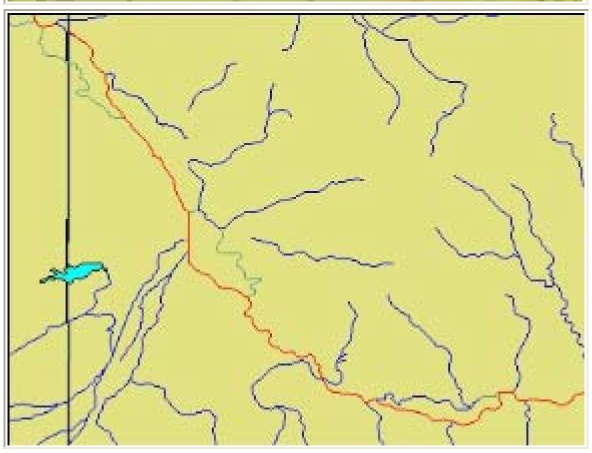
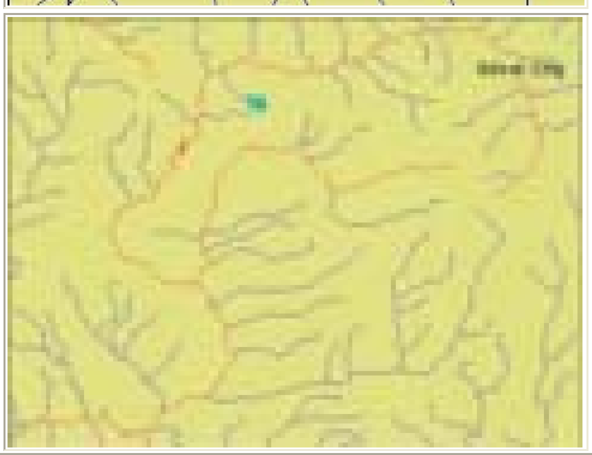
Oregon LITTLE OWYHEE RIVER, WEST RIVER MILE 45 TO HEADWATERS		• TEMPERATURE Sources of Impairment: 1.
Oregon OWYHEE RIVER ROME TO IDAHO BORDER		• TEMPERATURE Sources of Impairment: 1.
Oregon OWYHEE RIVER OWYHEE RESERVOIR TO ROME		• MERCURY • TEMPERATURE Sources of Impairment: 1.

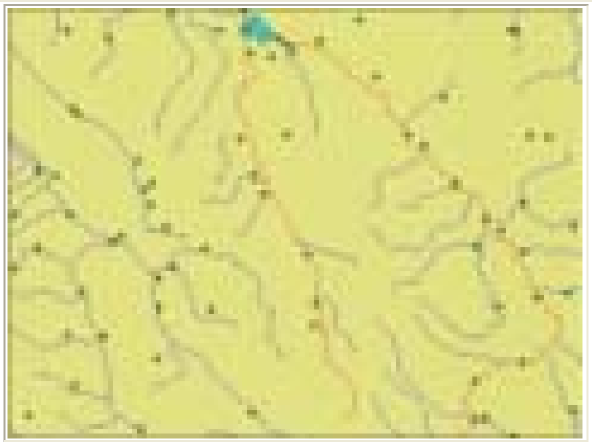
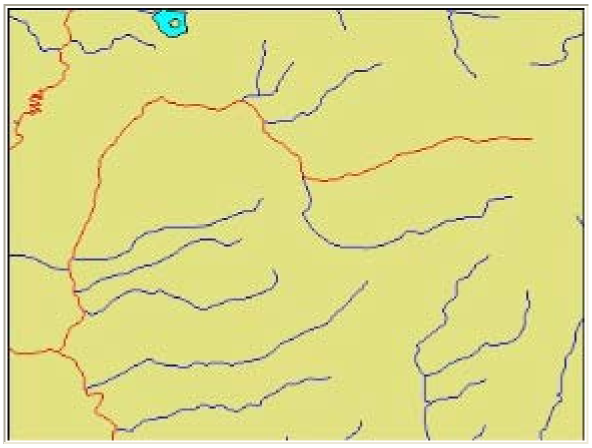
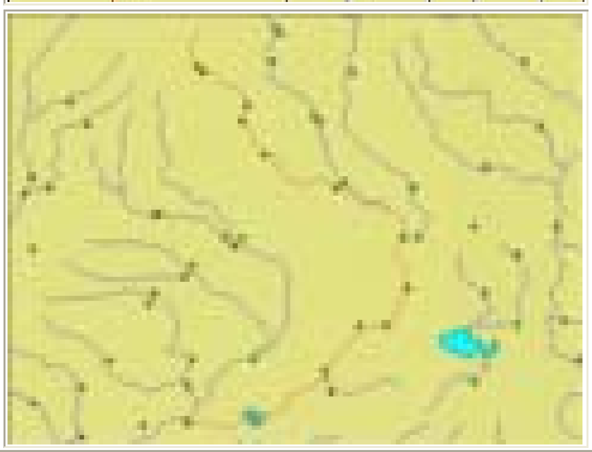
Oregon OWYHEE RIVER, MIDDLE FORK MOUTH TO IDAHO BORDER		• TEMPERATURE Sources of Impairment: 1.
Oregon OWYHEE RIVER, NORTH FORK MOUTH TO IDAHO BORDER		• TEMPERATURE Sources of Impairment: 1.

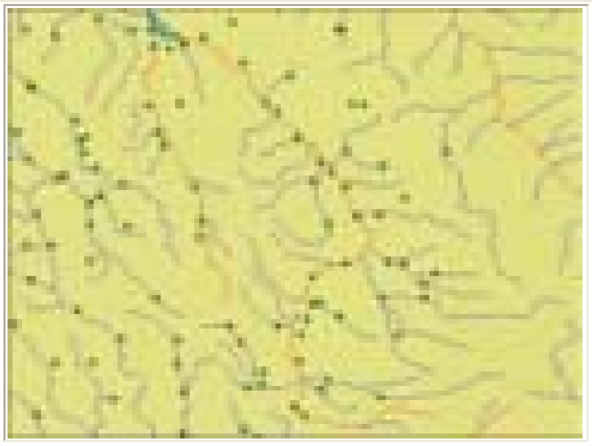
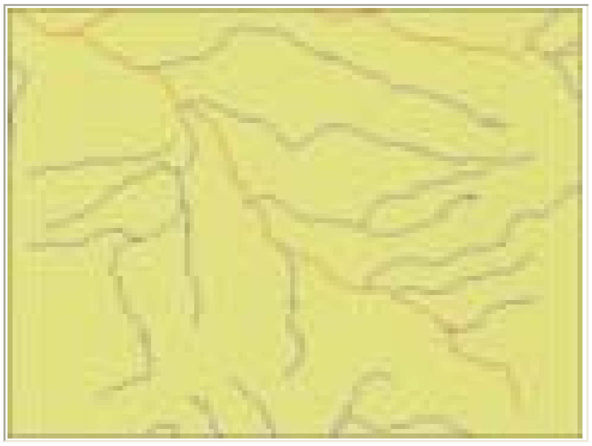
1. There were no potential sources of impairment reported to EPA by the state.

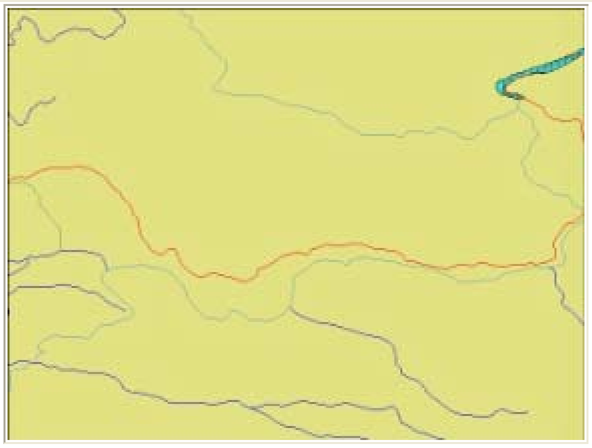
Appendix Table 4.3.5. Jordan HUC 17050108

(source: http://oaspub.epa.gov/pls/tmdl/waters_list.control?huc=17050108 .)

State/ Waterbody Name/ LOCATION	**Map of 303(d) Listed Waters (red line)** {Source: http://oaspub.epa.gov/pls/tmdl }	**State Identified Impairment(s)**
Idaho COW CREEK – HEADWATERS TO OREGON LINE		• FLOW ALTERATIONS • SEDIMENT • TEMPERATURE Sources of Impairment: 1.
Idaho JORDAN CREEK WILLIAMS CREEK TO OREGON LINE		• PESTICIDES • BACTERIA/ PATHOGENS • METALS - MERCURY • OIL/GASOLINE • SEDIMENT • TEMPERATURE Sources of Impairment: 1.
Idaho JORDAN CREEK HEADWATERS TO WILLIAMS CREEK		• PESTICIDES • BACTERIA • METALS - MERCURY • OIL/GASOLINE • SEDIMENT • TEMPERATURE Sources of Impairment: 1.

Idaho LOUISA CREEK HEADWATERS TO TRIANGLE RESERVOIR		• FLOW ALTERATIONS • SEDIMENT • TEMPERATURE Sources of Impairment: 1.
Idaho LOUSE CREEK HEADWATERS TO JORDAN CREEK		• METALS • PH • FLOW ALTERATIONS • SEDIMENT Sources of Impairment: 1.
Idaho MEADOW CREEK HEADWATERS TO ROCK CREEK		• FLOW ALTERATIONS • TEMPERATURE Sources of Impairment: 1.

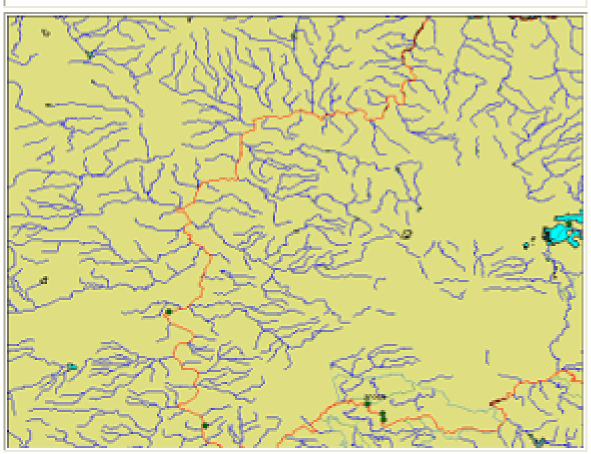
Idaho ROCK CREEK HEADWATERS TO TRIANGLE RESERVOIR		• FLOW ALTERATIONS • SEDIMENT • TEMPERATURE Sources of Impairment: 1.
Idaho SODA CREEK HEADWATERS TO COW CREEK		• SEDIMENT • TEMPERATURE Sources of Impairment: 1.
Oregon ANTELOPE RESERVOIR RESERVOIR		• FCA (MERCURY) • FISH CONSUMPTION ADVISORY Sources of Impairment: 1.

Oregon [JORDAN CREEK] MOUTH TO HEADWATERS		• FCA (MERCURY) • FISH CONSUMPTION ADVISORY Sources of Impairment: 1.

1. There were no potential sources of impairment reported to EPA by the state.

Appendix Table 4.3.6. Crooked Rattlesnake HUC 17050109

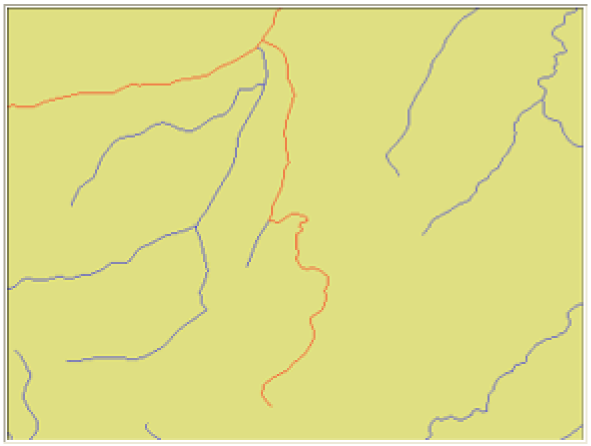
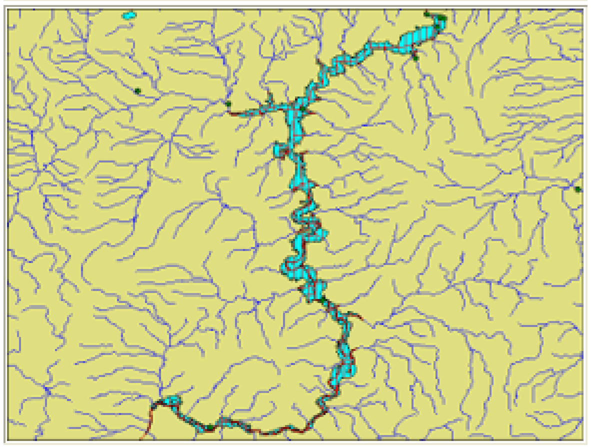
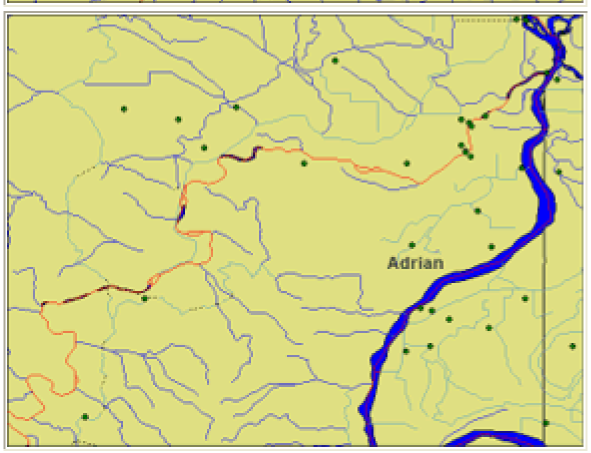
(source: http://oaspub.epa.gov/pls/tmdl/waters_list.control?huc=17050109 .)

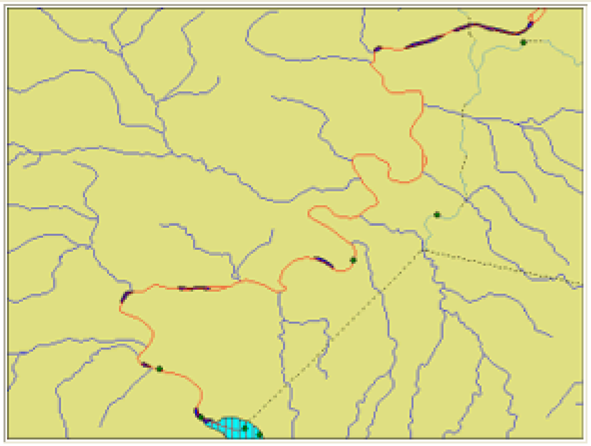
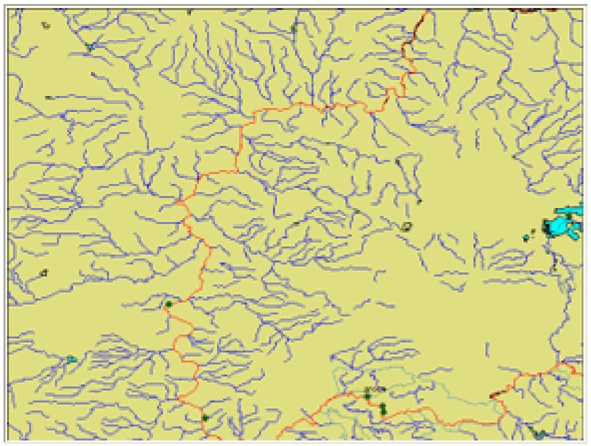
State/ Waterbody Name/ LOCATION	**Map of 303(d) Listed Waters (red line)** {Source: http://oaspub.epa.gov/pls/tmdl }	**State Identified Impairment(s)**
Oregon [OWYHEE RIVER] OWYHEE RESERVOIR TO ROME		• MERCURY • TEMPERATURE Sources of Impairment: 1.

1. There were no potential sources of impairment reported to EPA by the state.

Appendix Table 4.3.7. Lower Owyhee HUC 17050110

(source: http://oaspub.epa.gov/pls/tmdl/waters_list.control?huc=170501010 .)

State/ Waterbody Name/ LOCATION	**Map of 303(d) Listed Waters (red line)** {Source: http://oaspub.epa.gov/pls/tmdl }	**State Identified Impairment(s)**
Oregon ALDER CREEK (COTTONWOOD CREEK) MOUTH TO HEADWATERS		• TEMPERATURE Sources of Impairment: 1.
Oregon OWYHEE RESERVOIR RESERVOIR		• FCA(MERCURY) Sources of Impairment: 1.
Oregon OWYHEE RIVER MOUTH TO BLACK WILLOW CREEK		• DDT • DIELDRIN • BACTERIA • CHLOROPHYLL A Sources of Impairment: 1.

Oregon OWYHEE RIVER BLACK WILLOW CREEK TO OWYHEE RESERVOIR		• DISSOLVED OXYGEN Sources of Impairment: 1.
Oregon OWYHEE RIVER OWYHEE RESERVOIR TO ROME		• MERCURY • TEMPERATURE Sources of Impairment: 1.

1. There were no potential sources of impairment reported to EPA by the state.

Appendix 4.4. Objectives and strategies excerpted from federal, state, and inter-agency fish, wildlife and resource management plans relevant to the Owyhee Subbasin.

Appendix Table 4.4.1 Bureau of Land Management (BLM) – Resource Southeastern Oregon Management Plan

I. Objectives for Habitats/Species

Rangeland Vegetation

Objective 1: Restore, protect, and enhance the diversity and distribution of desirable vegetation communities including perennial native and desirable introduced plant species. Provide for their continued existence and normal function in nutrient, water, and energy cycles.

Objective 2: Manage big sagebrush cover in seedings and on native rangeland to meet the life history requirements of sagebrush-dependent wildlife.

Forest and Woodlands

Objective 1: Manage forests to maintain or restore ecosystems to a condition in which biodiversity is preserved and occurrences of fire, insects, and disease do not exceed levels normally expected in a healthy forest. Increase the dominance of ponderosa pine, Douglas fir, and western larch on appropriate sites in mature forests. Decrease the amount of Douglas fir, white fir, and grand fir where they were not historically maintained by the dominant fire regime. Manage forests for long-term, healthy habitat for animal and plant species. Provide for timber production where feasible and compatible with forest health.

Objective 2: Restore productivity and biodiversity in western juniper and quaking aspen woodland areas. Manage western juniper areas where encroachment or increased density is threatening other resource values. Retain old growth characteristics in historic western juniper sites not prone to frequent fire. Manage quaking aspen to maintain diversity of age classes and to allow for species reestablishment.

Water Resources and Riparian/Wetland Areas

Objective 1: Ensure that surface water and ground water influenced by BLM activities comply with or are making progress toward achieving State of Oregon water quality standards for beneficial uses as established per stream by the Oregon Department of Environmental Quality (ODEQ).

Objective 2: Restore, maintain, or improve riparian vegetation, habitat diversity, and associated watershed function to achieve healthy and productive riparian areas and wetlands.

Fish and Aquatic Habitat

Objective: Restore, maintain, or improve habitat to provide for diverse and self-sustaining communities of fishes and other aquatic organisms.

Wildlife and Wildlife Habitat

Objective 1: Maintain, restore, or enhance riparian areas and wetlands so they provide diverse and healthy habitat conditions for wildlife.

Objective 2: Manage upland habitats in forest, woodland, and rangeland vegetation types so that the forage, water, cover, structure, and security necessary for wildlife are available on the public land.

Special Status Animal Species

Objective 1: Manage public land to maintain, restore, or enhance populations and habitats of special status animal species. Priority for the application of management actions would be: (1) Federal endangered species, (2) Federal threatened species, (3) Federal proposed species, (4) Federal candidate species, (5) State listed species, (6) BLM sensitive species, (7) BLM assessment species, and (8) BLM tracking species. Manage in order to conserve or lead to the recovery of threatened or endangered species.

Objective 2: Facilitate the maintenance, restoration, and enhancement of bighorn sheep populations and habitat on public land. Pursue management in accordance with the 1997 "Oregon's Bighorn Sheep Management Plan" (OBSMP) in a manner consistent with the principles of multiple use management.

Rangeland/Grazing Use

Objective: Provide for a sustained level of livestock grazing consistent with other resource objectives and public land use allocations.

II. Strategies (Alternatives) from SE-OR-RMP for the above objectives

Rangeland Vegetation

Based on public and internal comment, the sagebrush desired range of future condition (DRFC's) was redefined by Appendix F (Wildlife Habitat Descriptions and Considerations), and Alternative E was changed to include management to control noxious weeds the same as all other alternatives.

Forest and Woodlands

- Changes from the preferred Alternative C to the Proposed RMP alternative:
  - This section was amended to include that all management tools be available (including harvest) on all acres to achieve forest health, although intensive commercial harvest would be unlikely in ACEC's, WSA's and NWSR's.
  - For the management of western juniper and quaking aspen, all tools, including chemical control, cutting, burning, and other means, would be available.

Special Status Plants

- Alternative D2:
  - Livestock grazing would be removed from selected Mulford's milkvetch sites.

Water Resources and Riparian/Wetland Areas

- Common to all alternatives:
  - Updated information on water quality management plans (WQMP's), total maximum daily loads (TMDL's), and water quality restoration plans (WQRP's) from the perspective of (BLM) policy of conducting WQRP's.
- Alternative D2:
  - Added narrative for Alternatives D2 and Proposed RMP for Objectives 1 and 2.
  - Livestock grazing would be removed from streams where PFC ratings are functioning at risk with downward trend, or not properly functioning, until appropriate livestock management actions can be implemented and a condition of functioning at risk with an upward trend is attained.
- Alternative E:
  - Was edited to reflect changes in alternative emphasis.
- Appendices:
  - Modified as follows: the Riparian Management Objective (RMO) section of Appendix D, Riparian/Wetland Areas, was edited for reference to the 1996 "Inland Native Fish Strategy" (INFISH) and tables were updated to reflect data gathered from 1996–1999; the Total Maximum Daily Load section was changed to the Water Quality Restoration Plan heading to reflect new U.S. Forest Service (USFS) and BLM policy and to incorporate TMDL's and WQMP into WQRP concepts. Appendix O, Best ManagementPractices, was edited to reflect comments and moved the

Wildlife Habitat andProtection section to Appendix F, Wildlife Habitat Descriptions and Considerations.

Fish and Aquatic Habitat

- Alternative D2:
  - Livestock would be removed from stream segments with Federally listed, proposed, or candidate species, and those with "strongholds" of Great Basin and inland redband trout and spotted frog.
  - Livestock would be removed from stream segments where PFC ratings are functioning at- risk with a downward trend, or not properly functioning until systems improve.

Wildlife and Wildlife Habitat

- Alternative D2:
  - Livestock grazing would be removed from selected habitat of sagebrush-dependant species, using sage grouse as an indicator species.
- Appendix F, Wildlife Habitat Descriptions and Considerations:
  - Changes were made to add wildlife DRFC, and to include additional information concerning management of sage grouse habitat.

Special Status Animal Species

- Updated special status fish component of riparian tables.
- Information was added for sage grouse management.
- Alternative D2:
  - Livestock grazing would be removed from selected habitat of sagebrush-dependant species, using sage grouse as an indicator species.

Appendix Table 4.4.2 Bureau of Land Management (BLM) – Owyhee Resource Area – Resource Management Plan

Purpose and Synopsis
The Owyhee Resource Management Plan (RMP) was prepared to provide the Bureau of Land Management, Lower Snake River District with a comprehensive framework for managing public lands administered by the Owyhee Resource Area. The purpose of the RMP is to ensure public land use is planned for and managed on the basis of multiple-use and sustained yield in accordance with the Federal Land Policy and Management Act of 1976 (FLPMA).

The Owyhee Resource Area, located in southwestern Idaho's Owyhee County, encompasses 1,779,492 acres. This total includes the following:

- 1,320,032 acres administered by BLM, Idaho

- 136,936 acres administered by the State of Idaho
- 319,777 acres of private lands
- 2,747 acres of water, primarily the Snake River

The area is bounded on the west by Oregon, on the south by Nevada, on the north by the Snake River and on the east by Castle Creek, Deep Creek, the Owyhee River, and the Duck Valley Indian Reservation. Most of the public lands are contiguous with only a few scattered or isolated parcels. The resource area contains the northern extent of the Owyhee Mountain Range and lies within what is often referred to as the Columbia Plateau. The Columbia Plateau is an elevated plateau with mountains which are separated by canyons draining to the Pacific Ocean via the Snake and Columbia Rivers. This broad regional landform and vegetative classification is known as the Intermountain Sagebrush Province/ Sagebrush Steppe Ecosystem.

Objectives, Management Actions and Allocations
Fishery Habitat
Objective:
FISH 1: Improve or maintain perennial stream/riparian areas to attain satisfactory conditions to support native fish.

Rationale: BLM Wildlife and Fisheries Management Manual Section 6500 directs BLM to maintain the continued effectiveness of habitat improvements and to maintain and enhance important resident fisheries resources. BLM Manual Section 6840 directs BLM to ensure that the crucial habitats of sensitive animals will be managed and conserved to minimize the need for listing as threatened or endangered under the Endangered Species Act. The Federal Water Pollution Control Act (Clean Water Act) of 1977, as amended, requires the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters.

Monitoring:
• Monitoring includes collection of rangeland health assessment, utilization, trend, climate, water quality and fish habitat data by various methods. See Appendix MONT-1 for details concerning procedures.

Management Actions and Allocations:
1. In pastures containing riparian areas categorized as unsatisfactory, non-functioning, or functional-atrisk, implement grazing practices that make progress towards achieving proper functioning condition and satisfactory riparian condition. These grazing practices will, at a minimum, comply with the Idaho Standards for Rangeland Health and Guidelines for Livestock Grazing Management, and BMPs and component practices approved in the Idaho Agricultural Pollution Abatement Plan or subsequent plans. See Table RIPN-1 and Map RIPN-1 for affected areas. Future inventory or monitoring may indicate additional pastures to which this management action will apply.

2. Improve or maintain herbaceous vegetation species to attain composition, density, canopy and ground cover, and vigor appropriate for the site. Adequate residual stubble height in an amount appropriate for the site, will be present throughout the grazing treatment and overwinter. This pertains to those key sedge and rush forage species which are excellent streambank stabilizers.

3. Improve or maintain woody riparian vegetation species to attain composition, density, canopy and ground cover, structure, and vigor appropriate for the site. Woody riparian vegetation utilization levels will be established to promote species reflective of the site potential.

4. Improve or maintain streambank and channel stability appropriate for the site by managing grazing to limit annual trampling impacts to 10% or less of linear bank length.

5. Implement a juniper abatement plan for appropriate sites on which juniper is invading.

6. Implement management practices addressing non-grazing impacts to riparian areas where needed and appropriate.

7. Provide a minimum of two growing seasons rest from livestock grazing following fires.

Objective:
FISH 2: Improve reservoir fisheries, when appropriate, in consultation with State agencies and adjacent landowners.

Rationale: BLM Wildlife and Fisheries Management Manual Section 6500 directs BLM to maintain the continued effectiveness of habitat improvements and to maintain and enhance important resident fisheries resources. BLM Manual Section 6840 directs BLM to ensure that the crucial habitats of sensitive animals will be managed and conserved to minimize the need for listing as threatened or endangered under the Endangered Species Act. The Federal Water Pollution Control Act (Clean Water Act) of 1977, as amended, requires the restoration and maintenance of the chemical, physical, and biological integrity of the nations water at a level of quality which provides protection for fish and wildlife.
Monitoring:
• Monitoring includes collection of rangeland health assessment, utilization, trend, climate, water quality and fish habitat data by various methods. See Appendix MONT-1 for details concerning procedures.

Management Actions and Allocations:
1. In pastures containing wetland areas categorized as unsatisfactory, non-functioning, or functional-atrisk, implement grazing practices that make progress towards achieving proper functioning condition and satisfactory riparian condition. These grazing practices will, at a minimum, comply with the Idaho Standards for Rangeland Health and Guidelines for Livestock Grazing Management, and BMPs and component practices approved in the Idaho Agricultural Pollution Abatement Plan or subsequent plans.
See Table RIPN-1 and Map RIPN-1 for affected areas. Future inventory or monitoring may indicate additional pastures to which this management action will apply.

2. Improve or maintain herbaceous vegetation species to attain composition, density, canopy and ground cover, and vigor appropriate for the site. Adequate residual stubble height in an amount appropriate for the site, will be present throughout the grazing treatment and overwinter. This pertains to those key sedge and rush forage species.

3. Improve or maintain woody riparian vegetation species to attain composition, density, canopy and ground cover, structure, and vigor appropriate for the site. Woody riparian vegetation utilization levels will be established to promote species reflective of the site potential.

4. Improve or maintain shoreline and soil surface stability appropriate for the site by managing grazing to limit annual trampling impacts to 10% or less of the linear shoreline length.

5. Implement a juniper abatement plan for appropriate sites on which juniper is invading.

6. Implement management practices addressing non-grazing impacts to riparian areas where needed and appropriate.

7. Provide a minimum of two growing seasons rest from livestock grazing following fires.

Wildlife Habitat
Objective:
WDLF 1: Maintain or enhance the condition, abundance structural stage and distribution of plant communities and special habitat features required to support a high diversity and desired populations of wildlife.

Rationale: Section 102.8 of The Federal Land Policy and Management Act states that it is policy of the United States that public lands be managed in a manner that will protect the quality of multiple resources and will provide food and habitat for fish and wildlife and domestic animals. The Public Rangelands Improvement Act (PRIA) directs improvement of rangeland conditions and provides for rangeland improvements including providing habitat for wildlife. The Memorandum of Understanding between the BLM and IDF&G states that the two agencies will work for the common purpose of maintaining, improving and managing wildlife resources on public lands.

Monitoring:
• Monitoring includes collection of utilization, trend, climate, rangeland health assessment, and other data to assess vegetation characteristics as they apply to wildlife species and wildlife habitat objectives.

• Additional monitoring includes use of appropriate techniques such as pellet group counts or breeding bird transects, lek counts, etc. which are applicable to specific types of wildlife. See Appendix MONT-1 for details concerning procedures for various methods.

• Periodically inspect/monitor authorized BLM activities including, but not limited to, range improvement projects, ROWs, OHMV use areas and woodcuts to insure compliance with wildlife stipulations and document observed habitat and animal disturbance.

Management Actions and Allocations:

- Ensure that all activity plans include objectives for maintaining or enhancing habitat for those wildlife species known or likely to occur within the planning area.

- Limit the adverse impacts of various land use activities, management actions and land tenure adjustments to wildlife populations and habitats through implementation of management actions identified in objectives FORS 2, WHRS 1, LVST 1, FIRE 1-4, LAND 1-6, LOCM 1, FLUM 1, MMAT 1, RECT 1 and HAZM 1.

- Protect and enhance habitat for a diversity of wildlife through implementation of management actions identified in objectives SOIL 1 and 2, WATR 1 and 2, VEGE 1, RIPN 1, FORS 1 and 2, FISH 1 and 2, RECT 3, WNES 1 and 2, HAZM 1 and ACEC 1.

- Adjust overall grazing management practices to ensure that adequate upland forage and cover remains to accommodate the needs of wildlife. Specifically:
  • limit utilization of key browse species, as measured in the fall, to a maximum of 30% within all deer winter habitat and 50% within all other habitats.
  • limit utilization of key upland herbaceous forage species to a maximum of 50% at the time of livestock removal from a pasture. More restrictive utilization standards may be imposed where necessary to accomplish specific wildlife or other resource objectives.

- Design and implement vegetation treatments to improve habitat where juniper or shrub density is contributing to unsatisfactory habitat conditions. All treatments will be designed to protect scarce, unique and highly productive wildlife habitat types, retain large interconnected blocks of more common habitat types and accommodate specific wildlife habitat requirements including migration corridors for big game. Reseed burns with a variety of shrubs, forbs and grasses. Rest all burns and seedings from livestock grazing for a minimum of two growing seasons following treatment.

- Ensure water availability for wildlife by providing unrestricted access to all livestock waters, requiring that where necessary, waters are left on following removal of livestock and constructing additional water developments where water is determined to be limiting. Ensure that water is available at intervals of no more than three miles apart in big game habitat.

- Retain all public land within crucial and other high quality wildlife habitats unless exchanging for land of equal or higher value and acquire additional high quality habitat through purchase or exchange with willing landowners. These include but are not limited to wetland/riparian habitats, crucial big game winter habitat and isolated tracts and shrublands adjacent to agricultural areas that provide important cover for upland game. Isolated tracts will be grazed only if needed to maintain or improve wildlife habitat.

- Minimize barriers to big game movement by constructing new fences and modifying existing fences to meet or exceed Boise District Fence Policy standards for the species present.
- Protect and enhance habitat for wildlife at all developed springs and selected undeveloped springs, wet meadows, reservoirs and stream riparian reaches by fencing to exclude livestock. Close all exclosures to livestock grazing for the life of this plan except where it is determined that controlled grazing is necessary to achieve a specific resource objective.

- Where feasible, enhance waterfowl nesting habitat by ensuring waterfowl benefits are incorporated into reservoirs with the potential to support nesting waterfowl. Enhancement may include fencing, construction of nesting islands and/or other structures and planting food and cover species.

- Develop cooperative wildlife habitat/farming development (Sikes Act) agreements designed to enhance habitat for upland game and other wildlife.

- Protect raptor nests and manage adjacent vegetation to ensure adequate habitat for prey species. Authorize no human caused disturbance within a 0.5 mile radius of any known golden eagle nest between February 1 and June 30 and other species' nests between March 15 and June 30. Disturbance is defined as any activity which could result in frequent flushing of adults or young, nest abandonment or significant loss of prey base.

- Ensure that all power poles on public land are designed to prevent raptor electrocution.

- Ensure that management to maintain or improve habitat for raptors and their prey species receives priority consideration within the Snake River Birds of Prey National Conservation Area as detailed in the SRBOPNCA Management Plan. See Map NCA-1.

- Install gates at entrances to caves and abandoned mine shafts where disturbance to bat populations is determined to be a problem.

Appendix Table 4.4.3 Bureau of Land Management (BLM) – Proposed Elko/Wells Resource Management Plans – Fire Management Amendment and Final Assessment

Subbasin	Habitat/Species	Objective	Strategies
Owyhee (Elko Nevada)	Low Sagebrush and Desert Shrub	• To maintain the native community, to provide for livestock and wildlife forage. Some of the areas are important for winter antelope habitat.	• Prevent annual vegetation or non-native plant incursion into this vegetation type resulting from disturbance of the existing community. • Maintain native vegetation composition.
	Aspen Areas	• Maintenance and restoration of the aspen stands.	• Maintain healthy aspen stands with appropriate stand age class diversity. • Maintain and improve riparian integrity.
	Seral Sagebrush Grasslands	• Maintain and improve native vegetation conditions, limit the spread of annual invasive species and noxious weeds, protect critical watersheds, provide wildlife and livestock forage and provide woodland products from higher elevations.	• Maintain and/or improve sagebrush/perennial grass diversity. • Prevent further encroachment of annual and non-native vegetation in the area.
	Mountain Mahogany/Juniper	• Management objectives are for woodland products and big game habitat.	• Maintain woodlands.
	Mixed Conifer	• Restore the health of the forest community.	• Healthy mosaic of uneven aged conifer stands with reduced fuel loadings.

Appendix Table 4.4.4 Objectives and strategies proposed for rainbow trout (hatchery) and redband trout (native) in various subbasins of the upriver-interior ecological Provinces of the Columbia and Snake Basins {source: Fisheries Management Plan 2001-2006; Idaho Department of Fish and Game}.

Drainage	Species	Objectives	Strategies
KOOTENAI RIVER DRAINAGE	Redband Trout and Hatchery Rainbow Trout	• Restore sport fish populations in the Kootenai River to self-sustaining levels capable of supporting an improved sport fishery.	• Implement and evaluate in-river flows designed to provide spawning and recruitment of white sturgeon and burbot (ling). Continue research to identify the flow needs of other native species (rainbow, cutthroat, bull trout and whitefish) and modify Libby Dam operations to restore ecosystem function. • Evaluate the experimental release of nutrients and the effects on the fish community with emphasis on rainbow trout, bull trout and mountain whitefish. • Assess catch, catch rates and harvest of trout and modify regulations if required to improve the fishery.
		• Minimize impacts to and enhance trout spawning and rearing habitat.	• Work with government agencies, the Kootenai Tribe, private developers, interested angling groups and local schools to make protection and enhancement of fisheries habitat a primary concern in land use decisions.
		• Improve the efficiency of hatchery put-and-take trout stocking programs.	• Evaluate rate of return, catch rate, and angler use on put-and-take trout fisheries through a routine data collection system. • Adjust rate, timing or location of trout stocking to improve rate of return to the creel. • Inform anglers of hatchery supported trout fishing opportunities through maps, brochures, media coverage and signing to improve

			return to the creel. • Discontinue put-and-take trout stocking in waters where a 40% or greater by number or 100% or greater by weight return to the creel cannot be met by the end of this planning period. Provide alternative fisheries to maintain angling opportunity. • Develop and utilize disease free, sterile stocks of rainbow and cutthroat trout to address concerns about potential impacts to wild trout.
		• Provide diverse angling opportunities in lowland lakes.	• Continue periodic surveys of fish populations to monitor population status and fish growth in relation to physical and biological conditions and fishing regulations. Manage some lakes for specific fish species in order to maximize angling opportunity. • Maintain maximum harvest opportunity for warmwater species and stocked trout in most lakes while providing quality or trophy management fisheries in a few lakes where biological and physical conditions, and public support provide the right set of conditions for special management. • Continue maintenance stocking of tiger muskies and channel catfish to maintain popular fisheries. Evaluate channel catfish harvest to determine if harvest restrictions are needed to maintain this hatchery-supported fishery. Establish bluegill sunfish in select waters to diversify panfish populations.
		• Improve fishing and boating access	• Develop or enhance fishing and boating access areas through easements, cooperative agreements or purchase. Utilize funds to

			build fishing docks for shoreline anglers.
		• Curtail illegal introductions of fish. Illegal introductions of exotic fishes threaten the stability of other established fisheries.	• Develop informational programs to educate anglers and the public to risks of random introductions of exotic species. Through planning, use enforcement efforts to curtail illegal introductions
PEND OREILLE RIVER DRAINAGE	Rainbow Trout	• Restore the trophy rainbow trout fishery of Pend Oreille Lake once kokanee populations are at a level to sustain additional predation.	• Modify fishing regulations to achieve trophy trout management goals established by the public. • Enhance the genetic makeup of Pend Oreille Lake rainbow trout by obtaining pure strain Gerrard rainbow trout from Kootenay Lake British Columbia. Work with Montana to avoid introductions of other stocks of rainbow trout in the Clark Fork River reservoirs above Pend Oreille Lake.
		• Improve the efficiency of hatchery put-and-take trout stocking programs.	• Evaluate rate of return, catch rate, and angler use on put-and-take trout fisheries through a routine data collection system. • Adjust rate, timing or location of trout stocking to improve rate of return to the creel. • Inform anglers of hatchery supported trout fishing opportunities through maps, brochures, media coverage and signing to improve return to the creel. • Discontinue put-and-take trout stocking in waters where a 40% or greater by number or 100% or greater by weight return to the creel cannot be met by the end of this planning period. Provide alternative fisheries to maintain angling opportunity. • Develop and utilize disease

			free, sterile stocks of rainbow and cutthroat trout to address concerns about potential impacts to wild trout.
SPOKANE RIVER DRAINAGE		• Minimize impacts of land use and development on fishery habitat in streams.	• Work with the Forest Service, other agencies, private developers and landowners and interested angling groups to make protection of fisheries habitat a primary concern in land use decisions. Incorporate evaluations of existing habitat in survey projects whenever possible. Develop a data base to demonstrate the magnitude of habitat loss and more effectively influence land use decisions. Work with the Forest Service, Department of Transportation, Silver Valley Natural Resource Trustees, Environmental Protection Agency, Department of Lands, Department of Environmental Quality and others to insure mitigation of habitat loss or restoration of habitat whenever possible. • Participate in the relicensing of the Avista owned Post Falls Dam to insure construction, inundation and operational impacts of the dam are properly mitigated.
		• Minimize impacts to lake fisheries due to lakeshore encroachment, pollution and nutrient loading.	• Work with county planners and Idaho Department of Lands to make protection of fish habitat and water quality a primary concern in land use decisions.
		• Improve the efficiency of hatchery put-and-take trout stocking programs.	• Evaluate rate of return, catch rate, and angler use on put-and-take trout fisheries through a routine data collection system. • Adjust rate, timing or location of trout stocking to improve rate of return to the

			creel. • Inform anglers of hatchery supported trout fishing opportunities through maps, brochures, media coverage and signing to improve return to the creel. • Discontinue put-and-take trout stocking in waters where a 40% or greater by number or 100% or greater by weight return to the creel cannot be met by the end of this planning period. Provide alternative fisheries to maintain angling opportunity. • Develop and utilize disease free, sterile stocks of rainbow and cutthroat trout to address concerns about potential impacts to wild trout.
		• Provide diverse angling opportunities in lowland lakes.	• Continue periodic surveys of fish populations to monitor population status and fish growth in relation to physical and biological conditions and fishing regulations. Manage some lakes for specific fish species in order to maximize angling opportunity. • Maintain maximum harvest opportunity for warmwater species and stocked trout in most lakes while providing quality or trophy management fisheries in a few lakes where biological and physical conditions, and public support provide the right set of conditions for special management. • Continue maintenance stocking of tiger muskies and channel catfish to maintain popular fisheries. Evaluate channel catfish harvest to determine if harvest restrictions are needed to maintain this hatchery supported fishery. Establish bluegill sunfish in select waters to diversify panfish populations.

		• Improve fishing and boating access.	• Develop or enhance fishing and boating access areas through easements, cooperative agreements or purchase. Utilize the funds to build fishing docks for shoreline anglers.
		• Curtail illegal introductions of fish. Illegal introductions of exotic fishes threaten the stability of other established fisheries.	• Develop informational programs to educate anglers and the public to risks of random introductions of exotic species. Through planning, use enforcement efforts to curtail illegal introductions.
PALOUSE RIVER DRAINAGE	Hatchery Rainbow Trout	• Improve fish habitat.	• Work with U.S. Forest Service, Department of Lands, University of Idaho, and private landowners to protect and improve habitat.
		• Increase fishing opportunities with small reservoirs.	• Work with public and private landowners to identify potential new small reservoir sites and initiate process for construction.
SNAKE RIVER AND MINOR TRIBUTARIES IDAHO/WASHINGTON BORDE-R TO HELLS CANYON DAM	Native Rainbow Trout, Hatchery Rainbow Trout	• Improve juvenile fish migration survival to lower Granite Dam.	• Establish long-term total dissolved gas monitoring stations below Hells Canyon Dam. Collect data on anadromous and resident fish populations, including mortality and gas bubble incidence during periods of high gas levels and correlate with anadromous adult returns. Coordinate all activities with Idaho Power Company. Develop and work to obtain flow regimes in the Snake River that maximize survival of migrating juvenile and adult anadromous fish. Continue to develop smolt timing and relative abundance indices to aid control of flow augmentation and water storage management. • Document impacts of fluctuating water levels on fall chinook survival, spawning

			success, and ecology. Work with Idaho Power Company and federal regulatory agencies to minimize flow fluctuations from Hells Canyon Dam to enhance fall chinook survival.
		• Enhance game fish production below Hells Canyon Dam.	• Document impacts of fluctuating water levels on game fish with emphasis on smallmouth bass and white sturgeon, survival, spawning success, and ecology. Work with Idaho Power Company and federal regulatory agencies to minimize flow fluctuations from Hells Canyon Dam to enhance resident game fish survival.
		• Manage mountain lakes within productivity and user preference constraints of individual lakes.	• Continue mountain lakes investigations in cooperation with USFS to collect biological, physical and chemical characteristics of each lake. Using acquired information, develop management plans.
CLEARWATER RIVER DRAINAGE	Native Rainbow Trout , Hatchery Rainbow Trout	• Maintain and improve fish habitat and water quality within the Clearwater drainage.	• Continue working with land management agencies (Forest Service, Bureau of Land Management, State Department of Lands) and private land owners to inform, educate and assist with land management planning for protecting fish habitat and water quality. Emphasize the need for riparian habitat protection and enhancement. Encourage containment of sediment production areas, including old mining sites. Oppose land use activities that degrade quality of natural production areas.
		• Maintain a diversity of fishing opportunity in the Clearwater River drainage to meet angler demand.	• Within the biological constraints of the fish resource, provide an array of lake and stream fishing opportunities including: a. High yield kokanee fisheries. b. Yield fisheries on

			catchable and fingerling released trout. c. Fishing (catch-and-release) for trophy-sized rainbow trout, cutthroat trout, and steelhead trout. d. Yield and trophy fisheries for smallmouth and largemouth bass. e. Yield fisheries for brook, cutthroat trout and rainbow trout in mountain lakes. f. Opportunities to harvest hatchery steelhead trout, and hatchery chinook salmon and coho salmon when run size permits.
		• Develop strategies including a funding source to construct a new reservoir in the Clearwater drainage.	• Construct Deer Creek Reservoir near Headquarters, Idaho. Funding secured in 2000 to begin planning, with completion in 2003.
		• Increase fishing access.	• As opportunities allow, acquire additional fishing access sites.
		• Maintain existing natural spawning populations of chinook salmon and steelhead trout.	• Continue Idaho Supplementation studies to evaluate supplementation strategies. • Work with the Nez Perce Tribe to develop hatchery fish release programs that preserve and protect genetic resources of naturally spawning chinook salmon and steelhead trout populations. Mark hatchery smolts released for harvest opportunities.
		• Support anadromous objectives with flood control releases and other available storage from Dworshak Reservoir.	• Work with Corps of Engineers and other action agencies to utilize flood control releases and other available storage (in Dworshak, Brownlee reservoirs) as necessary to achieve a flow objective of 100 kcfs at Lower Granite Dam during the spring

			migration period when migrants are present premised on shifts in flood control operations. Support managing existing flow augmentation volumes for summer migrants subordinate to flow augmentation operations during the spring migration period. Support use of Dworshak Reservoir flow later in the summer season to enhance juvenile fall chinook rearing and migration. Support use of Dworshak Reservoir flow to enhance adult steelhead return, when possible. Support flow modification to facilitate salmon and steelhead fishing in the North Fork and lower Clearwater when feasible. Evaluate effects of reservoir operation modifications on resident fisheries.
		• Work with private landowners to enhance fishing opportunities in private farm ponds.	• Continue consultation with private fishpond permittees to provide fisheries in farm ponds. Provide warm water fish for give-a-ways as lowland lake populations allow.
		• Manage mountain lakes within productivity and user preferences constraints of individual lakes.	• Continue mountain lake investigations in cooperation with USFS to collect biological, physical and chemical characteristics of each lake. Use acquired information to develop management plans.
SALMON RIVER DRAINAGE - MOUTH TO HORSE CREEK	Native Rainbow Trout , Hatchery Rainbow Trout	• Maintain maximum potential for fishery and recreational values in the Salmon River from mouth to Horse Creek.	• Work with land managers to ensure adequate riparian and water quality protection along the Salmon River corridor between Hammer and Vinegar creeks. Oppose land use activities that degrade quality of natural production and migration areas.

		• Maintain and improve habitat quality of tributary production areas.	• Oppose land use activities that further degrade the quality of natural production areas. Encourage implementation of grazing management plans, which eliminate negative grazing impacts to fishery productivity and survival.
		• Increase fishing access.	• Develop small outboard and float boat launch facilities where possible.
		• Manage mountain lakes within productivity and user preference constraints of individual lakes.	• Continue mountain lakes investigations in cooperation with USFS to collect biological, physical and chemical characteristics of each lake. Use acquired information to develop management plans.
LITTLE SALMON RIVER DRAINAGE	Native Rainbow Trout , Hatchery Rainbow Trout	• Improve water quality and fish habitat upstream of the barriers near Round Valley Creek.	• Work with the landowners to participate in state and federal programs to improve grazing, irrigation, and farming practices to improve riparian condition and water quality.
SOUTH FORK SALMON RIVER DRAINAGE	Native Redband Trout Hatchery Rainbow	• Maintain and improve habitat quality of mainstem and tributary production areas.	• Oppose land use activities that further degrade the quality of natural production areas. Participate in timber management proposals. Encourage implementation of grazing management plans, to eliminate negative grazing impacts to fishery productivity and survival. Participate in interagency mining oversight committees to review operating plans and work with regulatory agencies to require strict compliance with mining laws to protect water quality and fish populations. Develop monitoring programs for fish populations and fish habitat relative to land management activities, if needed. Continue to monitor and evaluate benefits from habitat improvement projects.
		• Provide information	• Continue to develop and distribute fisheries

		and education of fisheries management objectives for the drainage.	information and regulation signs to increase compliance and support.
SALMON RIVER DRAINAGE – HORSE CREEK TO NORTH FORK	Native Rainbow Trout	• Maintain and improve habitat quality of tributary production areas.	• Oppose land use activities that further degrade the quality of natural production areas. Participate in allotment management plan review. Encourage implementation of grazing management plans that eliminate negative grazing impacts to fishery productivity and survival. Participate in interagency mining oversight committees to review operating plans and work with regulatory agencies to require strict compliance with mining laws to protect water quality and fish populations. Develop monitoring programs for fish populations and fish habitat relative to mining activities, if needed. Implement rehabilitation measures for Panther Creek drainage.
		• Correct passage problems such as irrigation diversions, road culverts, and dewatered stream segments that restrict anadromous and resident fish access to spawning tributaries.	• Cooperate with Lemhi County and the USFS in identifying and constructing fish passage improvement structures for culverts. Identify and screen or repair irrigation diversions where needed. Work with the Upper Salmon River Model Watershed Project to reconnect tributary streams.
MIDDLE FORK SALMON RIVER DRAINAGE	Hatchery Rainbow Trout	• Preserve genetic integrity of wild native salmon, steelhead, and trout.	• anage hatchery supplemented Salmon River anadromous stocks to minimize straying into the Middle Fork Salmon River. • Designated wild anadromous fish sanctuary. No stocking of hatchery fish into the

			stream environment. • Continue to work with other state and federal agencies to improve juvenile downstream and adult upstream passage to and from the Middle Fork Salmon River.
		• Manage resident fisheries for low angler density fishing experiences and high catch rates and fish size.	• Maintain catch-and-release regulations for native trout in the mainstem Middle Fork Salmon River and its tributaries. • Maintain cutthroat trout harvest restrictions in the main Salmon River to protect Middle Fork Salmon River cutthroat trout that emigrate there to overwinter.
		• Maintain and improve habitat and water quality of key tributary fish production areas.	• Work with Forest Service and permittees to establish healthy riparian vegetation. • Work with the Forest Service to establish stream substrate objectives for sediment that would maintain high productivity of aquatic habitat. • Screen all identified irrigation diversions where needed. • Participate in interagency mining oversight committees to review operating plans and work with regulatory agencies to require strict compliance with mining laws to protect water quality and fish populations. Develop monitoring programs for fish populations and fish habitat relative to mining activities, if needed. • Participate in grazing allotment management plan reviews. Eliminate negative grazing impacts to fishery productivity and survival.
		• Maximize recruitment of native trout to the main river from tributaries.	• Continue restrictive regulations in tributaries. Continue monitoring juvenile densities by snorkeling once every three years.
		• Re-establish anadromous	• Continue to work with other state and federal agencies to

		runs to the numbers necessary to fully utilize available spawning and rearing habitat.	improve juvenile downstream and adult upstream passage to and from the Middle Fork Salmon River.
		• Develop methodologies for making accurate estimates of anadromous spawning escapement to the Middle Fork Salmon River.	• Work with other agencies to initiate research aimed at making chinook and steelhead escapement estimates to the Middle Fork Salmon River. Continue parr density monitoring once every three years and redd counts annually.
		• Increase ability of anglers to properly identify fish species.	• Provide fish identification signs and posters to increase recognition of bull trout. Encourage harvest of brook trout.
SALMON RIVER – NORTH FORK TO HEADWATERS	Hatchery Rainbow Trout	• Improve the quality of resident trout fishing in the mainstem Salmon River during the summer months.	• Continue protective fishing regulations on cutthroat trout, bull trout and rainbow trout.
		• Maintain and improve habitat quality of mainstem and tributary production areas.	• Work cooperatively with willing landowners through the Upper Salmon River Model Watershed Project, in priority areas, to maintain and enhance critical spawning and rearing areas for resident and anadromous fishes. Encourage land management activities on public and private properties that further improve the quality of natural production areas. Participate in grazing allotment management plan review. Encourage implementation of grazing management plans that eliminate negative grazing impacts to fishery productivity

			and survival. Participate in interagency mining oversight committees to review operating plans and work with regulatory agencies to require strict compliance with mining laws to protect water quality and fish populations. Develop monitoring programs for fish populations and fish habitat relative to mining activities, if needed. Continue to monitor and evaluate benefits from habitat projects.
		• Continue improving the return rate of stocked, catchable sized rainbow trout to the creel.	• Maintain high stocking frequency in heavily used areas between Hell Roaring Creek and Rough Creek bridge. Pursue the construction of a fishing pond in the Stanley vicinity to outplant catchable trout for better return to the creel.
		• Improve anadromous juvenile and adult fish passage in the Salmon River.	• Work with Federal Land Managers and private irrigators to alleviate passage problems in main river and tributaries due to irrigation diversions and dewatering. Screen and consolidate identified irrigation diversions by 2003.
LEMHI RIVER DRAINAGE	Native Rainbow Trout	• Improve angler access to the Lemhi River, trophy rainbow trout fishery.	• Negotiate with landowners to establish fishing by permission, easements or purchases.
		• Improve flows in lower river during peak irrigation season.	• Continue to participate and support efforts through the Upper Salmon River Model Watershed Program to transfer or purchase water rights to provide adequate flows through the seasonally dewatered portion of the river. Continue to investigate methods such as improved irrigation delivery systems, ditch consolidations, permanent head gates, and stream channel improvements, to provide

			safe passage through the lower river.
		• Maintain and improve habitat quality of the throughout the Lemhi River drainage.	• Continue to work cooperatively with willing landowners through the Upper Salmon River Model Watershed Project, in priority areas, to maintain and enhance critical spawning and rearing areas for resident and anadromous fishes. Pursue the reconnection of tributaries through improved irrigation delivery systems.
		• Improve the quality of cutthroat trout fishing in the mainstem Lemhi River. Maintain quality of trophy rainbow trout population.	• Maintain restrictive fishing regulations on all cutthroat trout and rainbow trout.
PAHSIMEROI RIVER DRAINAGE	Hatchery Rainbow Trout	• Maintain existing natural spawning populations of salmon and steelhead.	• Allow natural production to sustain existing, naturally producing populations. Limit outplanting of hatchery fish, other than direct hatchery releases, to support supplementation research and areas devoid of naturally producing salmon and steelhead.
		• Improve angler access to the Pahsimeroi River.	• Negotiate with landowners to establish fishing by permission, easements or purchases.
		• Minimize loss of juvenile salmon and steelhead to irrigation diversions on streams.	• Continue to upgrade existing screens, pursue consolidations, and install screens in remaining unscreened ditches.
		• Maintain and improve habitat quality of the throughout the Pahsimeroi	• Continue to work cooperatively with willing landowners through the Upper Salmon River Model Watershed Project, in priority areas, to maintain and

		River drainage.	enhance critical spawning and rearing areas for resident and anadromous fishes. Pursue the reconnection of tributaries through improved irrigation delivery systems.
		• Manage for quality resident trout fishing in the mainstem Pahsimeroi River.	• Maintain protective fishing regulations on all cutthroat trout and rainbow trout less than 14 inches in the mainstem river.
EAST FORK SALMON RIVER DRAINAGE	Native Rainbow Trout	• Maintain existing natural spawning populations of salmon and steelhead.	• Allow natural production to sustain existing, naturally produced populations. Limit outplanting of hatchery fish, other than direct hatchery releases, to support supplementation research and areas devoid of naturally producing populations of salmon and steelhead.
		• Maintain and improve fish habitat and water quality.	• Encourage land use activities that improve the quality of natural production areas. Participate in allotment management plan review. Work with landowners, the Shoshone-Bannock Tribes, and land management agencies to improve grazing practices, fence riparian areas, and take other actions to reduce erosion and eliminate negative grazing impacts to fishery productivity and survival. • Continue to work cooperatively with willing landowners through the Upper Salmon River Model Watershed Project, in priority areas, to maintain and enhance critical spawning and rearing areas for resident and anadromous fishes.
		• Improve the quality of resident trout fishing in the mainstem East Fork Salmon.	• Maintain restrictive fishing regulations for cutthroat trout in the mainstem river.

		• Improve anadromous juvenile and adult fish passage in the Salmon River.	• Work with landowners to alleviate passage problems due to irrigation diversions. Identify and screen irrigation diversions or repair screens by 2003.
YANKEE FORK SALMON RIVER DRAINAGE	Native Rainbow Trout, Hatchery Rainbow Trout	• Preservation of chinook and steelhead by harvest closures.	• Coordinate efforts with Shoshone-Bannock Tribes to protect existing chinook salmon spawners.
		• Maintain and improve fish habitat and water quality.	• Continue to actively pursue funding with the Shoshone-Bannock Tribes, U. S. Forest Service. J.R. Simplot Co., and others, to reestablish the dredged portion of the Yankee Fork mainstem to a natural state. • Reduce impacts of mining activity to fish populations and habitat by continuing to work with agencies such as the U.S. Forest Service and Department of Water Resources, mining companies, and private consultants to provide adequate protective measures in licensing and permitting agreements.
		• Improve resident fishery in the Yankee Fork system.	• Maintain harvest closures on cutthroat trout in the mainstem Yankee Fork.
SNAKE RIVER DRAINAGE FROM HELLS CANYON DAM to C.J. STRIKE RESERVOIR	Native Redband Trout	• Protect native bull trout and redband trout populations in the Snake River tributaries.	• Further define distribution and abundance of tributary populations of bull trout and redband trout. • Offer appropriate and accurate responses to proposed land management activities of private, state and federal entities.
WEISER RIVER DRAINAGE	Native Redband Trout, Hatchery Rainbow Trout	• Obtain stream resource maintenance flows to enhance the native fish populations.	• Quantify and apply for minimum stream flows where unallocated flows are available. • Work with Soil Conservation Service, Idaho Department of Health and Welfare, and

			landowners to utilize more efficient irrigation systems. • Evaluate the potential to enlarge Lost Valley Reservoir to provide summer flows in the Weiser River for eventual delivery to Weiser area irrigators or hydropower interests. Emphasis must include protection and mitigation of impacts to the Northern Idaho Ground Squirrel colony.
		• Improve methods to control flooding and erosion.	• Work with Soil Conservation Service, Idaho Department of Health and Welfare, and Idaho Department of Water Resources to have environmentally acceptable methods used for stream channel alterations and riparian vegetation restoration.
		• Preserve redband trout genetic integrity and population abundance.	• Limit hatchery trout to reservoirs and limited stream sections near major access points, such as campgrounds. Use sterile rainbow trout stocks. • Retain springtime fishing closures in the Adams County portions of the drainage to protect naturally spawning fish from harvest during this period of concentration and vulnerability.
		• Create local small fishing ponds in cooperation with local city or county governments.	• Utilize federal aide funds for "seed monies" to construct small local fishing ponds in the Weiser drainage.
PAYETTE RIVER DRAINAGE	Native Rainbow Trout	• Provide a diversity of fishing opportunities within the Payette River drainage.	• Zone the stream areas to concentrate hatchery catchable stocking in locations where the highest return-to-creel will occur. • Manage for wild trout where habitat and fish populations will sustain an acceptable fishery. • Manage for increased catch

			rates and size in selected stream reaches using quality trout regulations. • Stock appropriate strains of trout in natural production areas to better utilize the rearing capacity and provide larger and more desirable fish. • Stock adult steelhead directly downstream from Black Canyon Dam as these fish are available. Low river flow and ample notification of anglers must be accomplished to be successful. • Increase warm water angling opportunity by acquiring access or title to ponds in the Lower Payette River drainage. • Seek funding construction of new ponds near urban areas. • Improve land-use management through working with federal, state, and private land owners on proper land uses to increase soil stability in the drainage. • Monitor angler use of trophy trout waters. When use becomes moderate to heavy develop additional trophy trout waters.
		• Assess the potential for securing stream maintenance flows to protect fisheries on the North Fork Payette River, Lake Fork Creek, and other tributaries.	• Gather needed biological and economic information for the Idaho Water Resource Board to justify pursuing stream maintenance flows for fish and wildlife protection.
		• Maintain riparian and floodplain values for fish and public	• Work with Valley County to limit residential development in the floodplain. • Work with Valley County and landowners to provide public

		access.	access to the North Fork Payette River.
		• Maintain/enhance the large-size, mature nature of the lake trout population in Payette Lake.	• Maintain trophy regulations for lake trout to maximize numbers of large, mature fish. • Begin lake trout stocking program to replace old growth fish.
		• Provide a diversity of alpine lake fishing opportunities.	• Monitor existing trophy alpine lakes. • Investigate additional alpine lakes for different management opportunity.
BOISE RIVER DRAINAGE	Native Rainbow Trout, Hatchery Rainbow Trout	• Provide a diversity of fishing opportunities within the Boise River drainage.	• Zone the stream areas to concentrate hatchery catchable stocking in the locations where the highest return to the creel will occur. • Manage for wild trout where habitat and fish populations will sustain acceptable fisheries. • Manage for increase catch rates and fish size in selected stream reaches with quality and trophy trout regulations. • Develop ponds in the upper South Fork Boise River and Smoky Creek drainages for planting catchable rainbow trout.
		• Seek better land management practices that significantly improve fishery habitats.	• Provide sediment objectives/standards to land management agencies where sediment is the limiting factor in aquatic habitats. • Provide riparian vegetation objectives to land management agencies where grazing, development, or other activities have degraded riparian zones.
		• Monitor effects of land management activities, fishery regulations, and other fishery management	• Collect common data base information on habitat and fish populations throughout the Boise River drainage. • Examine changes and trends in common data base information and attempt to determine causes for any changes that are noted.

		activities on fish habitat and fish populations.	
		• Seek improved reservoir management and stream flows.	• Pursue development of a minimum pool in Arrowrock Reservoir. • Study water management at Lake Lowell to determine the relationship between fish production and water levels. • Monitor Arrowrock Dam valve replacement project. Maintain involvement in multi-agency fishery mitigation team. • Determine which water levels in Anderson Ranch Reservoir result in downstream losses of bull trout. Develop reservoir management plans to avoid or mitigate losses.
		• Create local small fishing ponds in cooperation with local city or county governments.	• Utilize federal aid funds for "seed monies" to construct small local ponds where there is demand and appropriate sites in the drainage.
		• Provide a diversity of alpine lake fishing opportunities.	• Investigate alpine lakes for opportunities to create trophy management.
OWYHEE RIVER DRAINAGE, BRUNEAU RIVER DRAINAGE, AND MINOR TRIBUTARIES SOUTH OF SNAKE RIVER	Native Redband Trout, Hatchery Rainbow Trout	• Manage stream and reservoir fisheries to preserve the genetic integrity of native desert redband trout.	• Stock other species of fish only in reservoirs that will not pose a threat to preserving redbands and use only sterile rainbow trout. • Restock streams with depleted populations where habitat conditions have been restored with redbands by collecting fish or eggs from adjacent areas that contain native redband trout.
		• Work cooperatively with state and federal land management agencies and grazing	• Establish riparian vegetation objectives in management plans that annually provide 80% of the potential, riparian vegetation mass to be in place prior to high flows occurring.

		permittees to improve riparian and aquatic habitats.	• Monitor stations on major tributaries of the Owyhee and Bruneau river systems to determine trends in riparian conditions, aquatic habitat, and fish production.
		• Increase reservoir fishing opportunities.	• Seek opportunities to construct new fishing reservoirs in cooperation with federal, state, and private landowners. • Seek cooperative agreements with private landowners to gain access to existing reservoirs. • Restock reservoirs with appropriate stocks of fish when drought conditions cause fish kills or de-watering. • Renovate reservoirs with rough fish populations that limit the fishery.
MAIN SNAKE RIVER - C.J. STRIKE RESERVOIR TO LAKE WALCOTT	Native Rainbow trout	• Improve water quality in the Snake River for fish spawning and rearing and for recreational uses.	• Work with regulatory and land management agencies, irrigation companies, municipalities, Watershed Advisory Groups (WAG's), and private owners to improve water quality in the Snake River. • Assist in the development of wetlands at the ends of irrigation drains and other nutrient rich water sources to filter sediments and nutrients from irrigation returns. Identify 319 grant funding opportunities and provide technical assistance to WAG.
		• Improve water quantity in the Snake River for fish spawning and rearing and for recreational uses.	• Work with regulatory agencies, Bureau of Reclamation and irrigation companies to improve water management in the Snake River to improve flows during white sturgeon spawning periods. • Work with Idaho Power Company and FERC to reduce or eliminate load following practices at Lower

			Salmon Falls Dam to improve fish rearing habitat down river to CJ Strike Reservoir. • Work with Idaho Dept. of Water Resources to define conditions under which water can be diverted for aquifer recharge while not impacting fish or riparian resources.
		• Return the trout fishery in Lower Salmon Falls Reservoir to the excellent fishery it has been in the past.	• Attempt to determine the reasons for the decline of this fishery and build the fishery back to its former level. Determine if the lack of fishery is water quality, water quantity or fish stocking related and manage accordingly.
		• Maintain existing and recover lost spring habitat along the Snake River in the Snake River aquifer area for Shoshone sculpin and redband trout spawning and rearing habitat.	• Continue strong efforts to preserve undeveloped natural springs with significant fishery values. • Work with Idaho Power Company and other private developers to reestablish natural spring habitat at Banbury Springs and other sites at the opportunity arises. • Work with Idaho Department of Parks and Recreation to develop a management plan for Box Canyon to maintain native habitat and fish species
		• Increase opportunity for warmwater and coldwater fishing in the Magic Valley area to meet increased demand.	• Acquire and develop fishing opportunities at the Clear Lakes Grade ponds.
		• Improve fishing in ponds along the Interstate in the Burley/Rupert area.	• Work with local officials and the public to develop a management plan to reduce common carp in the ponds. • Work with USFWS on controlling or managing fish eating birds at the ponds or develop a species or trout

			size stocking program to provide a fishery under current conditions.
BIG WOOD RIVER DRAINAGE	Native Rainbow Trout, Hatchery Rainbow Trout	• Maintain existing and improve degraded stream habitats in the Big and Little Wood river drainages.	• Work closely with county planning and zoning agencies and IDWR to prevent channel and riparian degradation and development in natural flood plains. • Work with land management agencies and livestock owners to implement grazing strategies, which will allow for the recovery of riparian systems along streams.
		• Reestablish stream connectivity between the upper Big Wood River and Magic Reservoir in good water years to take advantage of the surplus wild trout production in the river.	• Work with IDWR, water rights holders and interest members of the public to acquire sufficient water rights from willing sellers to maintain flows between Glendale Diversion and Stanton Crossing during average or better water years. If flows are acquired, implement best methods of diverting lost production in irrigation diversions into the river and Magic Reservoir.
		• Improve returns of hatchery fish and reduce impacts on wild trout populations in streams.	• Work with the USFS and the public to develop new fish out ponds and improve conditions on existing ponds in high use areas of the upper Big Wood River drainage.
		• Improve fish habitat and riparian ecosystem in the Little Wood River between Carey and Shoshone.	• Work with the Little Wood River Irrigation District on the development of an irrigation system which would provide flows in the river between Carey and Silver Creek in good water years.
		• Install fish ladders on irrigation and other barriers between the Dietrich	• Work with state and federal agencies, irrigation districts and landowners on developing wetlands on irrigation returns to improve water quality in irrigation

		Diversion and Shoshone to create connectivity between isolated fish populations in the Little Wood River.	returns. • Work with BLM and the public on reestablishing native riparian shrubs and trees along the Little Wood River between Silver Creek and Richfield to reduce water temperatures during summer months.
		• Improve reservoir fishing opportunity for both quality and harvest fisheries.	• Investigate the desirability and feasibility of reducing smartweed in Mormon Reservoir to improve boating access. • Continue to evaluate rainbow trout stocking program in Mormon Reservoir to determine effects of stocking timing and fish size on survival from bird predation. Also evaluate yellow perch population recovery. • Investigate economic and physical feasibility of increasing the height of the dam on Thorn Creek Reservoir. • Negotiate with the owners of Cow Creek Reservoir near Hill City on acquiring public access for fishing.
SALMON FALLS CREEK, GOOSE CREEK, ROCK CREEK, AND RAFT RIVER DRAINAGES	Native Rainbow Trout, Hatchery Rainbow Trout	• Improve water quality for fish habitat in lower reaches of streams in section.	• Work with regulatory agencies and landowners to reduce sediment and nutrient loads in streams flowing into the Snake River.
SNAKE RIVER-LAKE WALCOTT TO CONFLUENCE OF SOUTH FORK AND HENRYS FORK	Native Rainbow Trout, Hatchery Rainbow Trout	• Maintain quality trout fishery from Eagle Rock to American Falls Dam.	• Seek improved minimum flow. Biologically, a minimum flow of 20% (1,791 cfs) of the mean annual flow would be appropriate in this reach. However water managers currently reduce winter flow to as low as 300 cfs during low water years to maximize potential of reservoir refill.
		• Maintain boating access and an adequate minimum conservation	• Work with the Bureau of Reclamation, Department of Water Resources and Bonneville Power Administration to obtain a minimum conservation pool

		pool in American Falls Reservoir.	of 340,000 acre-feet (20% of full-pool). This level would keep at least one boat ramp accessible for anglers and maintain enough depth and surface area to reduce entrainment loss of trout and bass. This level would also minimize water quality impacts from sediment entrainment. This volume would also maintain some rocky habitat to encourage smallmouth bass to stay in the reservoir.
		• Increase catch rate to 0.3 trout/hour.	• Increase number of fish stocked by decreasing average size.
PORTNEUF RIVER DRAINAGE	Native Rainbow Trout, Hatchery Rainbow Trout	• Improve water quality and trout habitat in Portneuf River from Pocatello upriver to Lava Hot Springs, including Marsh Creek.	• eek participants in NRCS Continuous Signup Conservation Reserve Program. Participate in the Portneuf River Watershed Council.
		• Improve conditions for wild trout in the Portneuf River from Lava Hot Springs to Chesterfield Reservoir.	• Maintain existing riparian corridor fences on private land. Seek additional riparian fencing projects on the river and tributaries. Obtain renewed 10-year access and fence maintenance agreement with King Creek Grazing Association. • Reduce the number of hatchery trout stocked. • Seek funding for a full-time technician and seasonal aide to maintain riparian corridor fences, seek new fencing projects on private land in coordination with other natural resource agencies and solicit grants for fencing projects.
BLACKFOOT RIVER AND TRIBUTARIES	Native Rainbow Trout, Hatchery Rainbow	• Improve migration conditions in spawning tributaries in	• Repair potential migration barrier on Miner Creek below the highway bridge.

	Trout	the Blackfoot River from its mouth upriver to Blackfoot Reservoir.	
		• Stock rainbow trout in Blackfoot Reservoir of a size that has the best return to anglers.	• Conduct season-long creel survey to compare the relative return to anglers of a large number of small fingerlings (3-inches) and a small number of large catchables (9- to 10-inch). Use the results to update the stocking program for Blackfoot Reservoir.
		• Maintain sufficient oxygen and decrease anaerobic gasses so that trout can live through the winter under ice-cover in Dike Lake (a diked-off arm of Blackfoot Reservoir.	• Apply herbicide to reduce growth of aquatic macrophytes throughout the growing season.
HENRYS FORK SNAKE RIVER DRAINAGE	Native Rainbow Trout, Hatchery Rainbow Trout	• Maintain quality trout fishing in the Henrys Fork from the South Fork confluence upstream to Riverside Campground.	• Monitor trout populations in indicator reaches by electrofishing on a regularly scheduled basis, propose regulation changes as biologically or socially necessary • Maintain from the mouth to Del Rio its general harvest regulations for all trout with seasons and area closures as needed for protection of spawners. • Work for habitat and stream flow protection and/or enhancement.
		• Sustain high catch rates and a desirable size structure in the Henrys Fork on the catch-and-release section from	• Continue long-term monitoring of trout population and angling success through regularly scheduled sampling surveys. • Work for stream flow protection and enhancement, focusing on winter flow enhancements to optimize

		Riverside Campground upstream to Island Park Dam.	juvenile trout over-winter survival.
		• Manage the Henrys Fork above Island Park Reservoir for satisfactory and diverse angling opportunity, as desired by the public.	• Continue long-term monitoring of trout population and angling success through regularly scheduled sampling surveys, propose regulation changes as biologically or socially necessary. • Work for habitat and stream flow protection and enhancement. • Continue to manage Island Park Reservoir for optimum trout production goals to ensure strong escapements of spawning rainbow trout and kokanee upstream through the upper Henrys Fork to Moose Creek, Big Springs, and Henrys Lake Outlet.
		• Maintain maximum fishing opportunity necessary without detriment to ecologically sensitive species (trumpeter swans) throughout the Henrys Fork drainage.	• Monitor, through and in coordination with the Department wildlife bureau and the USFWS and its contractors, the spring nest distribution of trumpeter swans and potential impacts to swans by anglers, implementing emergency regulations (area closures, etc.) as needed.
		• Produce and maintain a quality, consumptive salmonid fishery in Island Park Reservoir.	• Continue stocking hatchery rainbow trout and kokanee at a size and on a schedule that provides high quality fishing with economic efficiency. • Work towards reservoir tributary habitat and stream flow protection and enhancement.
		• Evaluate management strategies to minimize negative	• Develop cooperative research projects with area universities to better understand chub population dynamics in Henrys Lake

		impacts of Utah chubs to the trout fishery	and develop potential management strategies.
TETON RIVER DRAINAGE	Native Rainbow Trout, Hatchery Rainbow Trout	• Increase consumptive trout fishing opportunity for bank anglers near population centers.	• Acquire or lease small, highly accessible ponds to provide an intensive hatchery supported fishery. Develop handicapped facilities where feasible. • Adjust rate and timing of stocking to provide 80% to 100% return to the creel. • Inform anglers of hatchery supported trout fishing opportunities through maps, brochures, media coverage, and signs.
		• Monitor incidence of fish disease and minimize its threat to wild trout populations.	• Continue to evaluate the effects of whirling disease on wild trout populations. • Educate private pond owners on the threat of whirling disease and strictly enforce fish transport regulations. • Educate the public on the threat of whirling disease and methods to control its spread. • Evaluate the effects of black spot disease on wild trout populations.
		• Monitor status of illegal fish releases and minimize their threat to wild trout populations.	• Monitor status of illegal brown trout and hatchery fish introductions. • Educate the public on the threat of illegal fish releases and strictly enforce regulations.
		• Minimize impacts of land use and development on fish habitat and water quality.	• Work with government agencies, private landowners and developers, and interested conservation groups to make protection and enhancement of fish habitat and water quality a primary concern in land use decisions. • Maintain cooperative fencing, pasture management, and livestock non-use projects with local landowners. • Ensure restoration of habitat or mitigation of habitat loss

			whenever possible.
		• Minimize loss of juvenile fish to irrigation diversions and tributary de-watering.	• Educate and negotiate with local irrigators for minimum stream flows when possible.
		• Obtain adult fish passage around or through barriers.	• Identify and obtain passage around irrigation diversions in cooperation with local irrigators. Continue to operate and maintain the South Fork Teton fish ladder. • Identify barriers and obtain passage through road culverts. • Negotiate with local irrigators for minimum stream flows when possible.
		• Improve angler compliance with special regulations.	• Develop informational programs to encourage compliance. Educate anglers on the need for regulations, the kinds and location of regulations, and alternative fishing opportunities. Continue to publish and distribute the Teton Valley fishing map. • Focus available enforcement to reduce poaching losses.
SOUTH FORK SNAKE RIVER DRAINAGE	Native Rainbow Trout, Hatchery Rainbow Trout	• Obtain adequate winter stream flows to reduce juvenile fish mortality.	• Work with Bureau of Reclamation to maintain at least 1500 cfs release from Palisades Dam during winter. Establish ramping rates to minimize water level fluctuations.
		• Monitor incidence of fish disease and minimize its threat to wild trout populations.	• Continue to monitor for presence of whirling disease. • Educate private pond owners on the threat of whirling disease and strictly enforce fish transport regulations. • Educate the public on the threat of whirling disease and methods to control its spread.
		• Minimize loss of juvenile fish to irrigation diversions and stream	• Operate and maintain the Palisades Creek and Burns Creek screens in cooperation with local irrigators.

		dewatering.	• Operate and maintain the Palisades Creek and Burns Creek screens in cooperation with local irrigators.
		• Minimize impacts of land use and development on fish habitat and water quality.	• Work with government agencies, private landowners, developers, and interested conservation groups to make protection and enhancement of fish habitat and water quality a primary concern in land use decisions. • Ensure restoration of habitat or mitigation of habitat loss whenever possible.
		• Improve angler compliance with special regulations.	• Develop informational programs to encourage compliance. Educate anglers on the need for regulations, the kinds and location of regulations, and alternative fishing opportunities. • Focus available enforcement to reduce poaching losses. •
SINKS DRAINAGES	Native Rainbow Trout, Hatchery Rainbow Trout	• Improve water quality conditions in Mud Lake by maintaining higher year-round pool levels to provide for stable game fish populations and improved year-round fishing opportunity.	• Work with irrigation storage space-holders and private fishing organizations to facilitate enhanced winter lake volumes.
		• Continue to provide for balanced quality and general harvest oriented stream fishing opportunity	• Continue wild trout management for Medicine Lodge Creek drainage to protect isolated cutthroat trout populations and maintain wild trout fishing opportunity. • Continue to manage Camas Creek drainage and Birch Creek under general regulations for consumptive fishing opportunity.

			• Evaluate the adequacy of current fishing regulations and management direction for the Big Lost River fishery below Mackay Reservoir to satisfy public angling desires.
BEAR RIVER AND TRIBUTARIES	Native Rainbow Trout, Hatchery Rainbow Trout	• Increase number of wild Bonneville cutthroat spawners and fry production in St. Charles Creek.	• Continue a graduate student project to investigate limiting factors for spawning and recruitment in St. Charles Creek. • Seek ways to divert less water from St. Charles Creek. • Reduce numbers of brook and rainbow trout in St. Charles Creek.
MALAD RIVER DRAINAGE	Native Rainbow Trout, Hatchery Rainbow Trout	• Maintain the trophy trout fishery at Daniels Reservoir but with protection of Bonneville cutthroat trout.	• Obtain Bonneville cutthroat trout eggs from Wyoming or adfluvial Bonneville cutthroat trout eggs from Utah for stocking into Daniels Reservoir. Stock half cutthroat trout and half sterile rainbow trout. Maintain sterile rainbow trout program. • Seek improved riparian and stream bed conditions on the Little Malad Spring.
		• Restore the quality of the Crowthers Reservoir rainbow trout fishery.	• Renovate Crowthers Reservoir to eliminate chubs, carp and goldfish that may have come downstream into this reservoir from Devil Creek Reservoir.
		• Improve the quality of the game fish fishery in Stone (Curlew Valley) Reservoir.	• Work with the local irrigation district to see if common carp can be eliminated in the reservoir. If necessary, considered using triploid grass carp to control vegetation.

Appendix Table 4.4.5 Oregon Department of Fish & Wildlife Trout Management Plan (source: Ray Perkins 2004)

Management Objectives

Objective 1. Influence land management decisions in ways that benefit fish habitat.

Assumptions and Rationale

1. Coordination of fish population and habitat inventories with allotment evaluations will provide current information for making better management decisions that benefit fish habitat.

2. Stream surveys need to be updated and monitoring established on many streams in the Owyhee basin.

3. Habitat management plans written for the Coyote Lake subbasin and McDermitt Creek need to be reviewed and updated.

Actions

1.1 Coordinate fish population and habitat inventories with grazing allotment evaluations. Integrate inventory findings and recommendations into evaluations.

1.2 Develop a priority list and use the ODFW Aquatic Inventory methodology, or other suitable method, to gather baseline habitat information on streams in the planning area.

a. Work with the Burns, Vale, and Winnemucca BLM districts and NDOW to standardize habitat inventory methodologies.

b. Combine resources and manpower with BLM and NDOW to accomplish habitat inventory needs.

c. Identify opportunities for public involvement in habitat inventories through volunteers or classroom projects.

1.3 Provide up-to-date fish population and habitat information to land managers.

1.4 Evaluate inventory data with regard to land management and make recommendations to land managers. Request data be used in consideration of management decisions.

1.5 Cooperate with BLM and private land managers on measures to protect and enhance fish habitat. Identify opportunities for public involvement in fish habitat enhancement through volunteers or classroom projects.

1.6 Request Vale BLM review and update pertinent habitat management plans.

1.7 Recommend riparian protection and instream flow protection or restoration in review of other agencies' permit applications and plans.

Objective 2. Improve riparian habitat to provide food and cover for fish, maintain late season flows, prevent erosion, and ameliorate temperature extremes.

Assumptions and Rationale

1. Loss of riparian vegetation, such as reduction in seral stage, diversity, and quantity, affects fish habitat.

2. Restoration and maintenance of riparian vegetation in the subbasins would benefit fish populations.

Actions

2.1 Encourage land managers to institute grazing practices that benefit the riparian habitat and associated uplands, and restrict mining activities in the riparian zone to protect fish habitat.

2.2 Encourage land managers to consider the impacts on habitat when designing roads and making recreation plans, such as trails.

2.3 Coordinate with land management entities (public and private) to identify specific areas of concern and develop cooperative projects to improve riparian habitats.

2.4 Provide information to private landowners on the benefits of healthy riparian conditions and methods to achieve them.

2.5 Manage beaver populations in conjunction with grazing practices to benefit riparian and aquatic habitat.

   a. Monitor beaver populations and evaluate their adverse effects on fish habitat.

   b. Take appropriate action to control beaver where necessary.

2.6 Evaluate riparian habitat conditions at BLM reservoirs managed for fisheries. Make recommendations to BLM as required to improve riparian habitat conditions at BLM reservoirs.

Objective 3. Improve water quantity and water quality to meet the biological needs of fish by providing adequate instream flows, reducing fish losses at diversions, and reducing nonpoint source pollution.

Assumptions and Rationale

1. Improved supervision of water diversions would benefit fish by ensuring that water in excess of legal rights remained in the stream.

2. Obtaining instream water rights will protect fish habitat from further out-of-stream diversion.

3. ODFW will continue to apply for instream water rights.

4. Natural recovery of the riparian habitat will result in improvement of the structural components of instream habitat and water quality.

5. Quantitative water quality data has not been collected for most streams in the Owyhee basin.

Actions

3.1 Identify screen needs. If a problem exists, identify a solution and screen strategy.

   a. Draft a list of high priority screening needs in the planning area.

   b. Work with the screen task force to identify screen projects.

   c. Provide information to the Water Resources Department on diversions not in its data base.

   d. Identify opportunities where volunteers could help construct and maintain fish screens.

3.2 Identify opportunities to improve instream flows.

a. Set priorities for identifying streams/reaches where flows are most needed.

b. Work with the WRD to monitor instream flows, identify areas to focus water right permit reviews, and identify other areas to participate (e.g., basin planning) where fish habitat can benefit.

c. Explore cooperative opportunities with senior water right holders.

d. Identify opportunities where volunteers can help gather instream flow information.

3.3 Request on-the-ground water quality assessment studies from EPA, DEQ, or land management agencies, to evaluate the extent of nonpoint source pollution and trend.

3.4 Monitor mining activities; identify existing and potential problems (Denio Creek).

3.5 Coordinate with public and private land managers to identify specific areas of concern.

a. Request enforcement where violations occur.

b. Develop cooperative projects to improve water quality and water quantity.

ECOLOGICAL CONSIDERATIONS

1. Warmwater vs. coldwater interactions

Channel catfish and smallmouth bass in the river upstream of the reservoir may be limiting the distribution of redband trout in the main river.

The warmwater fish populations in the reservoir may be impacting the native amphibian fauna around the reservoir.

2. Fish issues that may conflict with amphibians issues.

Management for large brown trout in the river downstream of the dam may have impacts on the frog/salamander population within this reach of the river.

Management of trout in the upper basin stock ponds maybe impacting native populations of amphibians.

3. Introduced populations of fish in the upper river may impact the amphibians native this reach of the river.

Hatchery rainbow trout stocked into several mainstream stock ponds in the headwaters of Oregon tributaries might be impacting native populations of redband trout.

4. All management activities in the future that concern the reservoir maybe driven by the status of the introduced Lahontan tui chub.

Redband Trout Management Concerns

A combination of habitat alteration and natural conditions restrict the abundance and distribution of both tributary and mainstem populations of inland redband trout. These conditions also keep the populations in the mainstem very low. Removal of riparian vegetation has allowed water temperatures to increase. The stream banks where the riparian vegetation has been removed are less stable and flush more sediment into streams during high water events. Unscreened diversions allow fish to enter irrigation ditches where they perish.

The confinement of small numbers of individuals in short perennial stream reaches increases the susceptible of these populations to catastrophic events and genetic bottlenecks. Maintaining connectivity of the populations in the planning area with the populations in Idaho and Nevada is important. It maintains genetic variability and allows populations that are eliminated by catastrophic events to be repopulated.

Introduced hatchery trout that can interbreed with the native redband trout are still being planted in reservoirs in the planning area and upstream in Idaho and Nevada. Effects of stocked hatchery trout into waters with redbands are unknown.

The fishery directed on redband is small and incidental to stocked hatchery rainbow trout and warmwater fish. Stocking hatchery rainbow trout attracts more anglers into remote areas where native fish occur. The impact of an artificially inflated fishery can impact the small native populations.

Critical Uncertainties

What effects are the hatchery trout stocked into the planning area having on the native redband trout populations?

What effects are the nonnative trout stocked into the upper basin in Idaho and Nevada having on the native redband trout in the planning area?

What are the effects are introduced warmwater game fish having on native redband trout in the planning area?

In desert watersheds the issue of water rights is a major concern. The issue of increasing water storage upstream of Owyhee Reservoir is a concern because construction of additional dams would further segment this species and destroy spawning habitat. The result could mean the isolation and eventual extinction of the small populations in the planning area.

The populations of inland redband trout upstream of Owyhee Dam are acting as a meta-population. A meta-population is a series of populations that exchange individuals over time. If small populations are lost due, the habitat can be re-seeded from other nearby populations. This spreads the risk of extinction over several populations. Maintaining this interconnectivity within the Owyhee Basin is very important to long-term survival and genetic viability of this/these populations.

Appendix Table 4.4.6 Objectives and strategies proposed for rainbow trout (hatchery) and redband trout (native) in various subbasins of the upriver-interior ecological Provinces of the Columbia and Snake Basins {source: Resident Fish Multi-Year Implementation Plan, CBFWA Resident Fish Committee (1996)}.

Subbasin	Species	Objectives	Strategies	Preformance Measures
Mainstem Columbia / Lake Roosevelt	Rainbow trout (adfluvial stock)	• Provide a subsistence and recreational fishery • Manage the adfluvial rainbow trout populations as self-sustaining naturally reproducing populations. • Increase parr production consistent with habitat availability.	• Conduct stock assessments and population inventories (both adult and juvenile) to estimate population strength and population dynamics. • Continue to suspend stocking of fluvial rainbow trout in tributaries utilized by adfluvial rainbow trout. • Monitor the effectiveness of in-stream habitat improvements, passage improvements, and riparian enhancement efforts in increasing parr production. • Operate fish weirs on spawning tributaries to assess adult escapement and potential introgression of hatchery fish into the spawning population. • Conduct genetic evaluation of potentially distinct stocks of adfluvial rainbow trout. • Conduct evaluations of additional streams that may have potential for rainbow production. • Initiate watershed management activities to complement stream habitat improvements. • Operate Lake Roosevelt	• Increase in parr production over time. • Increased adult escapement and harvest numbers (12,000 fish harvest by year 2000 and 150,000 ultimately). • Average fish weight of 2 lb. • Evidence of adfluvial rainbow trout colonizing areas opened by passage improvement • Increased duration of flows in intermittent streams utilized by adfluvial fish.

			consistent with guidelines identified in NWPCC Fish and Wildlife Program. • Minimize entrainment through Grand Coulee Dam.	
Mainstem Columbia / Lake Roosevelt	Hatchery Rainbow trout	• Create and maintain a high quality sport and subsistence kokanee salmon and rainbow trout fishery as substitution for lost anadromous fish angling opportunity above Chief Joseph and Grand Coulee Dams • Maintain and enhance self sustaining wild kokanee salmon and rainbow trout populations where appropriate consistent with sound resource protection guideline. • Create and maintain a balanced ecosystem able to withstand unfavorable lake operations.	• Produce 1,000,000 yearling kokanee and 500,000 rainbow trout among the Spokane Tribal Hatchery, Sherman Creek Hatchery and the Lake Roosevelt Net Pen Program for release in June each year. • Acclimate and imprint 225,000 kokanee yearlings for net pen rearing at the Kettle Falls net pen site. • Trap and spawn adult wild rainbow trout broodstock at Phalon Lake to obtain 1 million eggs annually. • Weir tributaries to allow only wild fish pass above the weir to spawn • Operate Grand Coulee Dam consistent with guidelines identified in NWPCC Fish and Wildife Program. • Monitor the effect of lake elevation and water retention time on the kokanee and rainbow trout populations. • Conduct genetic evaluations to determine whether wild kokanee are a unique stock • Conduct stream and lake shoreline redd counts to determine extent of wild spawning. • Improve habitat by	• Weight of trout reared for release. • Annual harvest and escapement numbers.

			revegetating the Lake Roosevelt shoreline. • Education • Monitor and evaluate the effects of fish management actions • Model the effect of lake operations on the food chain. • Identify and implement methods to reduce kokanee and rainbow entrainment • Develop a fisheries management plan that recommends specific lake operations for improvements to the rainbow and kokanee fisheries.	
Mainstem tributary subbasins (including Colville Indian Reservation)	Rainbow trout (non-native stock)	• Provide successful subsistence fishery for the Colville Tribal members and non-member sport fishery on hatchery-reared rainbow trout in streams of the Colville Reservation. • Improve spawning and rearing conditions for rainbow trout in areas they currently occupy.	• Continue to stock rainbow trout into Colville Reservation waters (200,000 fingerlings, 300,000 subcatchable, and 81,000 catchable-sized fish annually). • Develop a "free-ranging" rainbow trout source of rainbow trout eggs as the basis for hatchery production for Colville Reservation waters (130,000 eggs per year by the year 2000) • Continue to obtain eggs from WDFW until local broodstock source is developed • Maintain current fishing regulations for rainbow trout on the Colville Reservation • Conduct stock assessments, population inventories, and angler surveys to estimate population	• Annual rainbow trout egg take of 130,000 from an on-reservoir (free-ranging) source by the year 2000 • Annual plants of 581,000 juvenile rainbow trout • CPUE greater than 0.8 fish/hr for sport anglers and 1.0 fish per hour for subsistence anglers • Fish condition factors greater than 5.5E-4.

			strength, population dynamics, and fishery quality over time (population trends) • Initiate marking program that allows monitoring of year class recruitment into the spawning population and into the creel over time. • Revise stocking and harvest rates as necessary to maintain brook trout population levels below maximum carrying capacity • Initiate watershed management from a holistic management approach to maintain or improve habitat for brook trout in areas they currently occupy. • Plant fish capable of survival and reproduction to increase natural production	• Average fish length greater than 13.5". • Minimal mortality during hatchery rearing due to diseases or parasitic infections. • Increase in natural production of rainbow trout adults by 15% by 2010.
Coeur d'Alene Subbasin (including Tribal Reservation Tributaries)	Rainbow Trout	• Provide alternate (limited) harvest fishery in closed or isolated systems • Develop additional rainbow trout fisheries to reduce pressure on native stocks • Mitigate in part for anadromous fish losses. • Additional biological/quantitative objectives will be developed in other areas of the subbasin. • Modify existing stocking program, where	• Monitor and evaluate to determine effectiveness of stocking to reduce pressure on wild stocks • Set regulations for enforcement • Develop additional ponds to maintain additional Rainbow trout fisheries. • Produce 25,000 rainbow trout to stock in pond system	• Attain biological objectives in section 10.8 of the Northwest Power Planning Council Program (under Coeur d'Alene Tribe). • Catch rates approaching .5 fish/hours • Removal rates approaching 60% of stocked fish.

		necessary, to minimize impacts to native stocks.		
Lower Pend Oreille Subbasin (below Albeni Falls Dam)	Native rainbow trout	• Identify historic stocks, population levels, habitat conditions, and geographic ranges as targets for restoration • Increase or protect population levels above minimum viable populations that maintain genetic diversity • Restore degraded habitat in historical use areas where feasible • When appropriate stock hatchery origin fish to recover or restore native stocks, also, use hatchery origin fish for recreational and subsistence opportunities. • Mitigate and compensate for resident and anadromous fish losses caused by construction and operation of federally regulated and federally operated hydropower projects	• Design studies that will identify stock status.	• Determination of non-game stock status in the subbasin.

Upper Pend Oreille Subbasin (upstream from Albeni Falls Dam)	Rainbow trout	• Mitigate and compensate for resident fish losses caused by the construction and operation of federally regulated and federally operated hydroprojects. • Improve sport fishing opportunity for rainbow trout. • Enhance and maintain self-sustaining rainbow trout populations in Lake Pend Oreille at a level that allows for maximum sustainable yield. • Additional biological/quantitative objectives will be developed in other areas of the subbasin.	• Conduct habitat assessments. • Determine areas within tributaries and upland sites for enhancement opportunities. • Conduct habitat improvements techniques involving: riparian planting, fencining, and instream structures. • Monitor and evaluate the effectiveness of habitat improvement projects. • Enforcement of illegal harvest. • Education • Develop and implement BRC's/IRC's and a mitigation plan. • Maintain higher winter lake levels to benefit a major prey item for Kamloops rainbow trout, thus improving lake trout population size and sport harvest opportunity	• A statistically significant increase in the rainbow trout sport fishery harvest (both number and size of fish)
Kootenai River	Resident Rainbow trout	• Mitigate and compensate for resident fish losses caused by construction and operation of federally regulated and federally operated hydropower projects. • Create viable populations in historic spawning and rearing areas. • Provide subsistence and	• Use habitat improvement techniques to restore habitat necessary to sustain natural reproduction and recruitment: revegetation, bank stabilization, cover installation, spawning substrate improvement, pool formation, and riparian fencing. (including Idaho tributaries to Kootenai River) • Correct fish passage problems: screens, fish ladders, jump pool construction, culvert	• Identification rainbow trout stocks and their status • Valid estimates of rainbow trout losses due to hydropower development. • Development and implementation of a mitigation plan. • Improved rainbow trout

		recreational fisheries based on sustainable harvest levels for kokanee salmon in Libby Reservoir, kokanee entrained through Libby Dam into the Kootenai River, and burbot in the Kootenai River.	replacement, baffles for velocity reduction and resting areas. • Dam operation modifications: implement Integrated Rule Curves, flow ramping rates, seasonal flow restrictions, minimum and maximum flow limits. • Harvest management: regulations and enforcement, education, and voluntary angler practices • Hatchery propagation: imprint planting, species reintroductions, and population enhancement (including exploration of the feasibility of instream egg incubation or conservation aquaculture to enhance kokanee in Idaho) • Research and monitoring: pre- and post-treatment sampling, cost effectiveness evaluations. (including annual trends in kokanee year class and growth, nutrification alteration effects, burbot tagging and recovery to identify habitats and movements) • Assess the feasibility of various technologies to control entrainment at Libby Dam. • Identify historic, and current stocks, population levels, habitat conditions, geographic range of rainbow trout and burbot as targets for protection	production, growth and survival • Protection, restoration, and reconnection of spawning and rearing habitat (miles by gradient and stream order). • Implement balanced dam operations • Production of thorough biological status report of aquatic biota and recommenda tion for nutrient/ productivity manipulation

			and/or restoration. • Evaluate Water quality in the Kootenai River for heavy metal and phenol pollutants • Develop a predictive model to estimate trophic responses to a range of hypothetical management options for the Kootenai River aquatic ecosystem.	
Lower Snake Subregion	Redband Native species	• Ensure that native population levels are above minimum viable population sizes which maintain adaptability and genetic diversity maximize probability of survival, and do not constrain consumptive and nonconsumptive uses of other species to protect sensitive populations. • Restore populations to near historic levels with sustainable harvest opportunities.	• Obtain stock assessment information of native fish populations incidental to work focused on other problems. • Restore anadromous fish habitat and abundance to near historic levels to provide nutrients, food resources, and habitat conditions suitable for sensitive resident species.	• Detailed habitat protection and restoration plans for <u>native</u> species in mainstem areas.
Subbasin Tributaries	Redband Native species	• Maintain and restore population productivity reduced by hydropower development and operations to healthy levels which provide opportunities for	• Identify and estimate the status of unique populations and groups of native fish species in subbasin tributaries. • Identify limiting factors (i.e., critical habitat per life stage, genetic introgression, etc.) affecting management objectives (i.e.,	• Distribution, abundance, size composition, genetic characteristic s, and habitat associations of native species in

		consumptive and nonconsumptive uses of native populations or other species whose use is constrained to protect sensitive populations in subbasin tributaries • Ensure population levels of native fish in subbasin tributaries are above minimum viable population sizes which maintain adaptability and genetic diversity, and maximize probability of survival	biological objectives) for native fish populations in subbasin tributaries • Implement selected measures based on distribution, status, and limiting factor assessments to improve habitat conditions, restore connectivity between isolated subpopulations, and meet biological objectives for native fish populations in subbasin tributaries • Improve and maintain stream flows in the subbasin to more resemble the natural hydrograph (including timing, volume, duration, temperature etc.) to benefit native resident fish. • Implement an irrigation diversions screening program with monitoring and evaluation, and screen maintenance provisions. • Provide enforcement emphasis to protect weak stocks from illegal harvest and harassment • Purchase land and water for the purpose of protecting and restoring native fish species. • Restore anadromous fish habitat and abundance to near historic levels to provide nutrients, food resources, and habitat conditions suitable to support sensitive resident species. • Monitor the status of native fish populations in	subbasin tributaries.

			subbasin tributaries to evaluate the effectiveness of restoration efforts and to determine when protection and restoration goals have been achieved.	
Subbasin Tributaries	Rainbow trout Hatchery	• Protect and enhance native wild stocks of anadromous and resident species as a higher priority than hatchery or introduced gamefish species in subbasin tributaries • Reduce or eliminate detrimental effects of existing hatchery or introduced gamefish species on native species where feasible in subbasin tributaries • Provide only those opportunities for consumptive and nonconsumptive uses of hatchery or introduced gamefish populations which do not produce substantial negative effects on native species in subbasin tributaries.	• Obtain stock assessment information appropriate to optimizing management of hatchery-reared and introduced species. • Implement stock specific measures including setting population escapement goals (e.g., redd densities, individual spawner densities) to ensure stocks are maintained and/or restored to healthy levels consistent with available habitat. • Develop ponds to maintain additional intensive and isolated fisher	• Angler effort, angler catch rate, and size-specific harvest of hatchery-reared and introduced gamefish. • Genetic assessment to monitor the status of westslope cuthroat trout populations relative to stocking programs based on localized broodstock.

Dworshak Reservoir and Tributaries	Rainbow trout Hatchery	• Increase opportunities for sustainable trout fisheries that are compatible with the continued persistence of native resident species and their restoration to near historic abundances (includes intensive fisheries within closed or isolated systems). • Develop additional hatchery trout fisheries to substitute, in part, for anadromous fisheries until anadromous fisheries impacted by federally licensed and federally operated hydroelectric facilities, are restored to near historic levels.	• Actively revegetate Dworshak Reservoir shoreline areas food production and rearing habitat for trout and smallmouth bass • Develop/Manage/Maintain in 14 fish ponds averaging 6 acres with production of 125-130 pounds per acre.	• Kokanee abundance/ density, catch/harvest rates, fishery yield, return to creel percentage, genetic profiles, population structure indeces, surface area of littoral vegetation. •
Upper Snake Subregion Mainstem / Hells Canyon Reservoirs	Redband Native species	• Protect native fish and their habitats in perpetuity. • Restore and maintain the health and diversity of native resident fish populations and their habitats. • Mitigate and	• Identify and estimate the status of populations and groups of populations of native fish species with unique genetic characteristics. • Identify factors limiting each population, critical habitats or conditions which limit life stages, and population sizes corresponding to management objectives	• Detailed habitat protection and restoration plans for native species in mainstem reservoirs. • Implementation of BRC's and IRC's

		compensate for resident and anadromous fish losses caused by the construction and operation of federally operated and federally regulated hydropower projects • Protect and maintain the health and diversity of watersheds. • Pursue opportunities for resident fisheries (consumptive and nonconsumptive) compatible with or isloated from native species protection and recovery programs.	(i.e. biological objectives) for native fish populations. • Select and implement measures based on distribution, status, and limiting factor assessments to improve habitat conditions, restore connectivity between isolated subpopulations, and meet biological objectives for native fish populations • Identify historic native fish population levels, habitat conditions, and geographic ranges as targets for restoration. • Monitor and evaluate results of efforts to restore fish populations, habitats and fisheries. • Continue to quantify and refine targets for protection, restoration, and fisheries. • Restore anadromous fisheries to near historic levels to provide nutrients and food resources to support sensitive resident species near historic levels • Develop and implement BRC's and IRC's • Improve streamflows to more resemble the natural hydrograph (including timing, volume, duration, temperature etc.) to benefit resident fish • Purchase land and water for the purpose of protecting and restoring native fish species . This inclueds all the	• Implementati on of restoration plans • Identification of native stocks and their status. • Valid estimates of native fish losses due to hydropower development . • Improved flow regimes in the subbasin that benefit native resident fish.

			required analyses and permits • Implement an irrigation diversion screening program with monitoring, evaluation, and screen maintenance provisions. • Provide educational information to the public to promote conservation of native species. • Provide enforcement emphasis to protect stocks from illegal harvest and harassment. • Develop and implement subregional/subbasin mitigation plans based on loss assessments • Form a Watershed Councils when and where needed	
Upper Snake Subregion Mainstem / Hells Canyon Reservoirs	Hatchery -reared trout	• Protect and enhance native wild stocks of anadromous and resident species as a higher priority than hatchery-reared trout in mainstem reservoirs. • Enhance existing trout fisheries and pursue development of others that are compatible with the preservation and enhancement of native resident and anadromous species to substitute for lost anadromous fisheries. • Mitigate and	• Monitor and regulate fisheries and stocking programs to optimize benefits to anglers (e.g. catch rates, return to creel, etc.) and to ensure no negative impacts to native species. • Develop and maintain consumptive, noncomsumptive, and trophy fisheries in closed or isolated waters.	• Angler effort, angler catch rate, and catch rate of hatchery-reared trout.

		compensate for resident and anadromous fish losses caused by the construction and operation of federally operated and federally regulated hydropower projects.		
Subbasin Tributaries (downstream from Shoshone Falls)	Redband trout Native species	• Protect native fish and their habitats in perpetuity • Restore and maintain the health and diversity of native resident fish populations and their habitats • Mitigate and compensate for resident and anadromous fish losses caused by the construction and operation of federally operated and federally regulated hydropower projects • Protect and maintain the health and diversity of watersheds • Pursue opportunities for resident fisheries (consumptive and nonconsumptive) compatible with or isloated from native species	• Identify and estimate the status of populations and groups of populations of native fish species with unique genetic characteristics • Identify factors limiting each population, critical habitats or conditions which limit life stages, and population sizes corresponding to management objectives (i.e. biological objectives) for native fish populations • Select and implement measures based on distribution, status, and limiting factor assessments to improve habitat conditions, restore connectivity between isolated subpopulations, and meet biological objectives for native fish populations • Identify historic native fish population levels, habitat conditions, and geographic ranges as targets for restoration • Monitor and evaluate results of efforts to restore fish populations, habitats and fisheries. • Continue to quantify and	• Detailed habitat protection and restoration plans for native species • Implementation of BRC's and IRC's • Implementation of restoration plans • Identification of native stocks and their status (Distribution, abundance, size composition, genetic characteristics, and habitat associations, etc) • Valid estimates of native fish losses due to hydropower development • Improved flow regimes in the

		protection and recovery programs	refine targets for protection, restoration, and fisheries. • Restore anadromous fisheries to near historic levels to provide nutrients and food resources to support sensitive resident species near historic levels. • Develop and implement BRC's and IRC's. • Improve streamflows to more resemble the natural hydrograph (including timing, volume, duration, temperature etc.) to benefit resident fish. • Purchase land and water for the purpose of protecting and restoring native fish species . This includes all the required analyses and permits • Implement an irrigation diversion screening program with monitoring, evaluation, and screen maintenance provisions. • Provide educational information to the public to promote conservation of native species. • Provide enforcement emphasis to protect stocks from illegal harvest and harassment • Develop and implement subregional/subbasin mitigation plans based on loss assessments • Form a Watershed Councils when and where needed	subbasin that benefit native resident fish. • Recovery of weak stocks.
Subbasin Tributaries	Rainbow trout	• Protect and	• Monitor and regulate	• Angler effort,

(downstream from Shoshone Falls)	Hatchery-reared	enhance native wild stocks of anadromous and resident species as a higher priority than hatchery-reared or introduced gamefish species. • Enhance trout fisheries that are compatible with the preservation and enhancement of native resident and anadromous species to substitute, in part, for anadromous fisheries until anadromous fisheries impacted by federally licensed and federally operated hydroelectric facilities, are restored to near historic levels. • Mitigate and compensate for resident and anadromous fish losses caused by the construction and operation of federally operated and federally regulated hydropower projects.	fisheries and stocking programs to optimize benefits to anglers (e.g. catch rates, return to creel, etc.) and to ensure no negative impactsa to native species • Develop and maintain consumptive, noncomsumptive, and trophy fisheries in closed or isolated waters • Obtain stock assessment information appropriate to optimizing management of hatchery-reared and introduced species • Implement stock specific measures including setting population escapement goals (e.g., redd densities, individual spawner densities) to ensure stocks are maintained and/or restored to healthy levels consistent with available habitat.	angler catch rate, and size-specific harvest of hatchery-reared and introduced gamefish.
Brownlee Pool to Shoshone	Redband trout Native	• Protect native fish and their habitats in	• Identify and estimate the status of populations and groups of	• Detailed habitat protection

Falls (mainstem and reservoirs)	species	perpetuity. • Restore and maintain the health and diversity of native resident fish populations and their habitats • Mitigate and compensate for resident and anadromous fish losses caused by the construction and operation of federally operated and federally regulated hydropower projects. • Protect and maintain the health and diversity of watersheds.	populations of native fish species with unique genetic characteristics • Identify factors limiting each population, critical habitats or conditions which limit life stages, and population sizes corresponding to management objectives (i.e. biological objectives) for native fish populations • Select and implement measures based on distribution, status, and limiting factor assessments to improve habitat conditions, restore connectivity between isolated subpopulations, and meet biological objectives for native fish populations. • Identify historic native fish population levels, habitat conditions, and geographic ranges as targets for restoration • Monitor and evaluate results of efforts to restore fish populations, habitats and fisheries • Continue to quantify and refine targets for protection, restoration, and fisheries. • Restore anadromous fisheries to near historic levels to provide nutrients and food resources to support sensitive resident species near historic levels. • Develop and implement BRC's and IRC's • Improve streamflows to more resemble the	and restoration plans for native species • Implementation of BRC's and IRC's. • Implementation of restoration plans • Identification of native stocks and their status (Distribution, abundance, size composition, genetic characteristics, and habitat associations, etc). • Valid estimates of native fish losses due to hydropower development • Improved flow regimes in the subbasin that benefit native resident fish • Recovery of weak stocks.

			natural hydrograph (including timing, volume, duration, temperature etc.) to benefit resident fish. • Purchase land and water for the purpose of protecting and restoring native fish species . This includes all the required analyses and permits. • Implement an irrigation diversion screening program with monitoring, evaluation, and screen maintenance provisions • Provide educational information to the public to promote conservation of native species • Provide enforcement emphasis to protect stocks from illegal harvest and harassment • Develop and implement subregional/subbasin mitigation plans based on loss assessments • Form Watershed Councils when and where needed	
Brownlee Pool to Shoshone Falls (mainstem and reservoirs)	Hatchery-reared and introduced trout	• Mitigate and compensate for resident and anadromous fish losses caused by the construction and operation of federally regulated and federally operated hydropower projects. • Manage non-native resident fish stocks to ensure the health and	• Pursue opportunities for resident fisheries (consumptive, nonconsumptive, and trophy) compatible with or isolated from native species recovery and protection programs • Monitor and regulate fisheries and stocking programs to optimize benefits to anglers (e.g. catch rates, return to creel, etc.) and to ensure no negative impactsa to native species.	• Angler effort, angler catch rate, and catch rate of hatchery-reared trout

		diversity of native resident fish stocks, anadromous fish stocks, and wildlife stocks, and their habitats, then maximize consumptive and nonconsumptive use of non-native stocks when appropriate.		
Shoshone Falls to headwaters	Hatchery-reared and introduced trout	• Mitigate and compensate for resident and anadromous fish losses caused by the construction and operation of federally regulated and federally operated hydropower projects • Manage non-native resident fish stocks to ensure the health and diversity of native resident fish stocks, anadromous fish stocks, and wildlife stocks, and their habitats, then maximize consumptive and nonconsumptive use of non-native stocks when appropriate.	• Pursue opportunities for resident fisheries (consumptive, nonconsumptive, and trophy) compatible with or isolated from native species recovery and protection programs • Monitor and regulate fisheries and stocking programs to optimize benefits to anglers (e.g. catch rates, return to creel, etc.) and to ensure no negative impacts to native species.	• Angler effort, angler catch rate, and catch rate of hatchery-reared trout.
Owyhee Bruneau River Drainage	Redband trout Native species	• Manage stream and reservoir fisheries to preserve the	• Stock other strains and species of fish where they will not pose a threat to preserving	N/A

		genetic integrity of native desert redband trout and other native species • Work cooperatively with state and federal land management agencies and grazing permittees to improve riparian and aquatic habitats • Increase reservoir fishing opportunities • Maintain and improve bull and redband trout populations in the Owyhee River drainage.	native species • Restock streams with depleted populations where habitat conditions have been restored with redband trout by collecting fish or eggs from adjacent areas that contain native redband trout. • Develop a broodstock reservoir foir redband trout to annually produce fingerlings that could be used to stock reservoirs and streams in this area • Determine distribution and density of redband populations within the basin • Determine habitat condition of streams containing redband trout • Establish riparian vegetation objectives in management plan capable of protecting streambanks and riparian areas during high water. • Monitor station on major tributaries of the Owyhee River capable of protecting streambanks, riparian conditions, aquatic habitat, and fish production • Seek opportunities to construct new fishing reservoirs in cooperation with federal, state, and private landowners • Restock reservoirs with appropriate stocks of fish when drought conditions cause fish kills or dewatering. • Renovate existing	

			reservoirs that historically were stocked. • Establish/maintain catch-and-release regulation and encourage adoption of similar protective regulations by the Nevada Division of Wildlife. • Support effort by state and federal agencies to remove manmade migration barriers • Renovate reservoirs with undesirable fish populations when they limit the fishery	

Appendix 4.5. Monitoring Strategy for the Duck Valley Indian Reservation (Draft Report) by Tracy Hillman, BioAnalysts, Inc. May 1, 2004 – under Subcontract to Steven Vigg & Company for the Shoshone-Paiute Tribes.

MONITORING STRATEGY FOR THE DUCK VALLEY INDIAN RESERVATION

Draft Report

May 1, 2004

BioAnalysts, Inc.

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introduction

The Shoshone-Paiute Tribes on the Duck Valley Indian Reservation (DVIR) have been actively involved in protecting and enhancing streams on the Reservation. Their goals include protecting and enhancing natural springs and headwater streams, removing stresses that degrade channel conditions (e.g., livestock grazing), monitoring water quality and quantity, and developing a database that includes information on habitat conditions, water quality, and fish composition, health, abundance, and genetic makeup. To this end, the Tribes have installed riparian exclosures and off-site water developments, planted riparian vegetation, repaired and improved road crossings, modified roads so they have little to no effect on streams, and identified a number of alternatives for restoring stream and riparian habitat along the Owyhee River. They have already implemented many of these actions; others will be implemented in the near future.

Although the Tribes understand the importance of protecting and enhancing aquatic resources on their lands, they also understand the value of monitoring their actions. There are several reasons for monitoring. First, monitoring informs the Tribes on the current status of their resources and how those resources change over time. Second, it allows the Tribes to assess the beneficial (or detrimental) effects of their management actions (strategies). That is, monitoring by the Tribes will assess cause-and-effect relationships. This information will allow the Tribes to determine cost/benefits of specific actions or strategies. Finally, monitoring will help inform the Tribes on factors that are important in limiting certain resources (e.g., redband trout) on the Reservation.

The Tribes recognize the value of having an integrated status/trend and effectiveness monitoring program. This plan outlines a program that will allow the Tribes to assess current conditions, changes in conditions over time, and the effects of management actions on conditions on the Reservation. Thus, this plan has three major parts. The first part (Section 4) describes landscape classification, which is needed to describe the ecological and geological setting on the Reservation. This section also identifies methods for describing channel and valley characteristics. The second part (Section 5) details the status/trend component of the monitoring plan, while the last major part (Section 6) describes effectiveness monitoring. Together, these three major parts make up the framework for monitoring on the DVIR. For completeness, this plan includes additional sections that deal with essential elements of a monitoring program (Section 3) and a description of measuring protocols (Section 7).

It is important to note that this document does not include a detailed Quality Assurance/Quality Control (QA/QC) Plan. Although the monitoring plan includes a description of sampling and experimental designs, indicators, and a general description of sampling protocols, it does not address in detail an evaluation of data, quality control,[1] or qualifications and training of personnel. These are important components of a valid monitoring program that will be developed after the monitoring plan is finalized.

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[1] Quality control refers to specific actions required to provide information for the quality assurance program. Included are standardizations, calibration, replicates, and control and check samples suitable for statistical estimates of confidence of the data.

PROJECT AREA

This monitoring plan will be implemented within the Duck Valley Indian Reservation, which straddles Idaho and Nevada and encompasses an area of roughly 289,820 acres (117,290 ha) (Figure 1). The Reservation includes over 350 miles (563 km) of streams that drain into the Owyhee and Bruneau rivers. This area also contains three man-made lakes, three large wetlands areas, and over 200 natural springs. The Reservation forms part of the larger Snake River Basin/High Desert Ecoregion (Omernik 1987), although the southeastern corner of the Reservation falls within the Northern Basin and Range Ecoregion. The Reservation is entirely within the Intermountain Semi-Desert Province (Bailey 1994). Depending on location, average annual precipitation on the Reservation ranges from 10-30 inches (25-76 cm) and total solar radiation from 350-400 watts/m^2. Mean annual air temperatures on the Reservation range from 40-45˚F (4-7˚C). Geologies on the Reservation are complex and include alluvial, granitic, sedimentary, and volcanic districts. Geomorphic classes include both plateau and fluvial lands.

Streams on the Reservation are upstream from the Hells Canyon Complex, which has blocked anadromous fish migration into the Owyhee and Bruneau basins for over 40 years. Before hydropower development, the Owyhee and Bruneau basins supported diverse communities of anadromous and resident fish populations. Today these basins support native resident species, such as redband and bull trout, and hatchery-produced species like rainbow trout, cutthroat trout, brown trout, brook trout, catfish, crappie and other exotics. Genetically pure populations of redband trout still exist on the Reservation and are the focus of Tribal fisheries management goals. Bull trout may exist on the Reservation in the headwaters of the Jarbidge River.

The overall goal of the Tribes is to “protect, mitigate, and enhance fish and wildlife” by implementing management actions that protect and enhance natural resources on the Reservation. They intend to protect and restore all natural springs and native fish spawning areas on their lands. There are over 200 springs with few being protected from the effects of livestock use. These streams provide cold, clean water to the Owyhee River. The Tribes began protecting these springs in 1998. In addition, unimproved back-county roads increase fine sediment loads to streams supporting genetically-pure populations of redband trout. The Tribes have been working to improve these roads and have replaced or improved stream crossings. By implementing these actions, the Tribes will be able to provide high-quality water to downstream locations in the Owyhee, Bruneau, and Snake rivers.

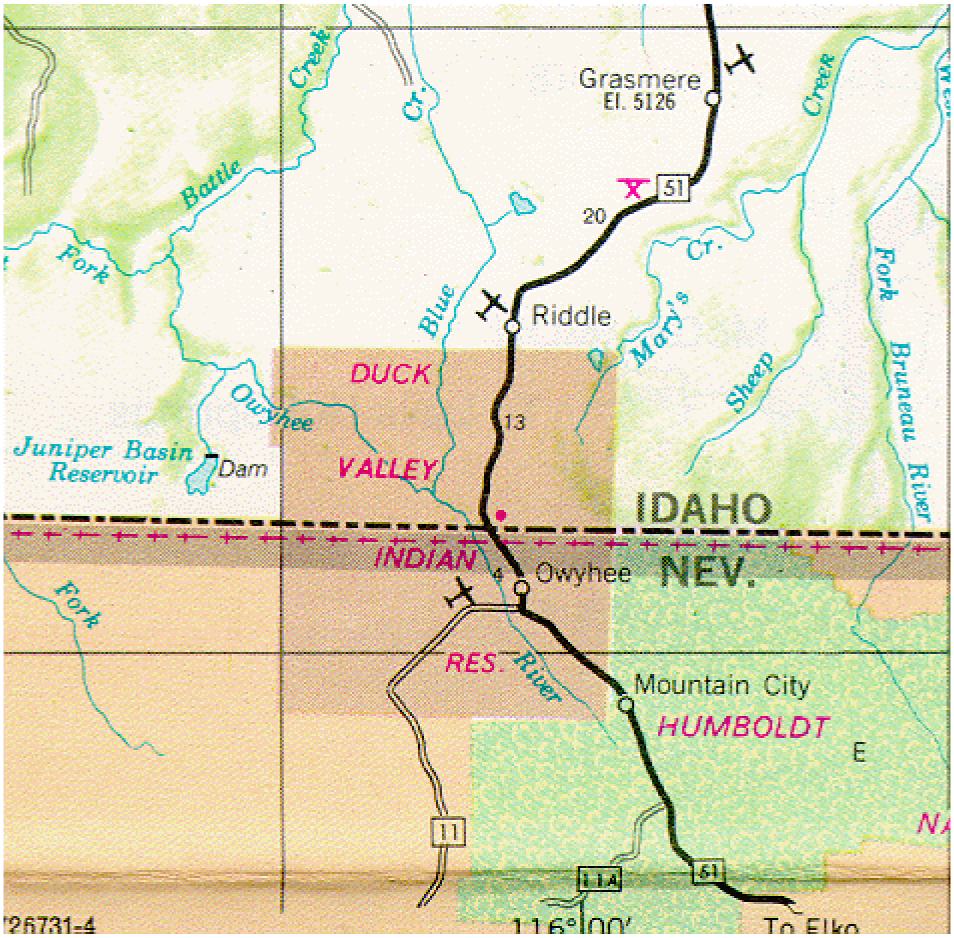

Figure 1. Location of the Duck Valley Indian Reservation along the Idaho/Nevada border.

Essential Elements of monitoring

Monitoring is a critical component of any management plan. Recently, several different entities have outlined appropriate strategies for monitoring aquatic resources. For example, the Independent Scientific Advisory Board (ISAB) of the Northwest Power and Conservation Council outlined a monitoring and evaluation plan for assessing recovery of tributary habitat (ISAB 2003). They describe a three-tiered monitoring program that includes trend or routine monitoring (Tier 1), statistical (status) monitoring (Tier 2), and experimental research (effectiveness) monitoring (Tier 3). Trend monitoring obtains repeated measurements, usually representing a single spatial unit over a period of time, with a view to quantifying changes over time. Changes must be distinguished from background noise. This type of monitoring does not establish cause-and-effect relationships and does not provide inductive inferences to larger areas or time periods. Statistical monitoring, on the other hand, provides statistical inferences that extend to larger areas and longer time periods than the sample. This type of monitoring requires probabilistic selection of study sites and repeated visits over time. Experimental research monitoring is often required to establish cause-and-effect relationships between management actions and population/habitat response. This requires the use of experimental designs incorporating "treatments" and "controls" assigned randomly to study sites.

According to the ISAB (2003), the value of monitoring is greatly enhanced if the different types of monitoring are integrated. For example, trend and statistical monitoring will help define the issues that should be addressed with more intensive, experimental research monitoring. The latter will identify which habitat attributes are most informative and will provide conclusive information about the efficacy of various restoration approaches. Implementing experimental research in the absence of trend and statistical monitoring would increase uncertainty about the generalization of results beyond the sampling locations. The ISAB (2003) identified the following essential elements of a valid monitoring program.

- Develop a trend monitoring program based on remotely-sensed data obtained from sources such as aerial photography or satellite imagery or both.

- Develop and implement a long-term statistical monitoring program to evaluate the status of fish populations and habitat. This requires probabilistic (statistical) site selection procedures and establishment of common (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.

Another strategy developed by the Bonneville Power Administration, the U.S. Army Corps of Engineers, the Bureau of Reclamation (collectively referred to as the Action Agencies), and NOAA Fisheries responds to the Federal Columbia River Power System (FCRPS) Biological Opinion issued by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. Although the Action Agencies/NOAA Fisheries Draft Research, Monitoring, and Evaluation

(RME) Program was developed before the release of the ISAB (2003) report, it is in many respects consistent with ISAB recommendations. For example, the draft RME Program calls for the classification of all watersheds that have listed fish populations and receive restoration actions. Classification is hierarchical and captures physical/environmental differences spanning from the largest scale (regional setting) down to the channel segment. This component of the draft RME Program comports with Tier 1 Trend Monitoring in the ISAB (2003) plan. Status Monitoring (similar to Tier 2 Statistical Monitoring) and Action Effectiveness Research (similar to Tier 3 Experimental Research) are also included in the RME Program. The ISAB recently provided a favorable review of the RME Program.

About the time the Action Agencies/NOAA Fisheries released their draft program, the Washington Salmon Recovery Funding Board (SRFB) released a draft monitoring and evaluation strategy for habitat restoration and acquisition projects. The document identified implementation, effectiveness, and validation monitoring as key components of their program. The monitoring program is scaled to capture factors operating at different hierarchical levels. At the lowest level (Level 0), the program determines if the action was implemented (implementation monitoring). Level 1 monitoring determines if projects meet the specified engineering and design criteria. Level 2 and 3 monitoring assess the effectiveness of projects on habitat and fish abundance, respectively. Levels 1-3 constitute effectiveness monitoring. Finally, level 4 (validation) monitoring addresses how management and habitat restoration actions, and their cumulative effects, affect fish production within a watershed. This type of monitoring is the most complex and technically rigorous.

Although the three programs (ISAB, Action Agencies/NOAA Fisheries, and SRFB) describe monitoring in slightly different terms, they all address the same goal. That is, all three intend to assess the effectiveness of restoration projects and management actions on tributary habitat and fish populations. Consequently, the overall approaches among the three programs are similar, with the Action Agencies/NOAA Fisheries RME Program being the most intensive and extensive, in part because of the requirements of the FCRPS Biological Opinion. Indeed, the Action Agencies/NOAA Fisheries Program calls for monitoring all tributary actions with intensive, standardized protocols and data collection methods. For each tributary action, a list of specific indicators, ranging from water quality to watershed condition, are to be measured.

The monitoring strategy described in this document closely follows these regional programs. In fact, this plan relies heavily on the Upper Columbia Basin Monitoring Strategy (Hillman 2004), which integrates all the essential elements of the regional programs. A common theme found among all strategies is that an efficient monitoring program must include a valid statistical design, probabilistic sampling design, standardized data collection protocols, consistent data reporting methods, and selection of sensitive indicators (Currens et al. 2000; Bayley 2002).[2] What follows is a brief description of these elements (from Hillman 2004). The focus of this

[2] An efficient monitoring plan reduces "error" to the maximum extent possible. One can think of error as unexplained variability, which can reduce monitoring efficiency through the use of invalid statistical designs, biased sampling designs, poorly selected indicators, biased measurement protocols, and non-standardized reporting methods.

section is on statistical design and sampling design. The other elements are described in other sections.

Statistical Design

"Statistical design" is the logical structure of a monitoring study. It does not necessarily mean that all studies require rigorous statistical analysis. Rather, it implies that all studies, regardless of the objectives, must be designed with a logical structure that reduces bias and the likelihood that rival hypotheses are correct.[3]

The validity of a monitoring design is influenced by the degree to which the investigator can exercise experimental control; that is, the extent to which rival variables or hypotheses can be controlled or dismissed. Experimental control is associated with randomization, manipulation of independent variables, sensitivity of dependent (indicator) variables to management activities (treatments), and sensitivity of instruments or observations to measure changes in indicator variables. There are two criteria for evaluating the validity of any effectiveness monitoring design: (1) does the study infer a cause-and-effect relationship (*internal validity*) and (2) to what extent can the results of the study be generalized to other populations or settings (*external validity*)? Ideally, when assessing cause-and-effect, the investigator should select a design strong in both internal and external validity. With some thought, one can see that it becomes difficult to design a study with both high internal and external validity.[4] Because the intent of effectiveness monitoring is to demonstrate a treatment effect, the study should err on the side of internal validity. Without internal validity the data are difficult to interpret because of the confounding effects of uncontrolled variables. Listed below are some common threats to validity.

- Sampling units that change naturally over time, but independently of the treatment, can reduce validity. For example, fine sediments within spawning gravels may decrease naturally over time independent of the treatment. Alternatively, changes in land-use activities upstream from the study area and unknown to the investigator may cause levels of fine sediments to change independent of the treatment.
- The use of unreliable or inconsistent sampling methods or measuring instruments can reduce validity. That is, an apparent change in an indicator variable may actually be nothing more than using an instrument that was not properly calibrated. Changes in indicator variables may also occur if the measuring instrument changes or disturbs the sampling site (e.g., core sampling).
- Measuring instruments that change the sampling unit before the treatment is applied can reduce validity. That is, if the collection of baseline data alters the site in such a way that the measured treatment effect is not what it would be in the population, the results of the study cannot be generalized to the population.

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[3] Rival hypotheses are alternative explanations for the outcome of an experimental study. In effect, rival hypotheses state that observed changes are due to something other than the management action under investigation.
[4] Studies with high internal validity (laboratory studies) tend to have low external validity. In the same way, studies with high external validity (field studies) tend to have lower internal validity.

- Differential selection of sampling units can reduce validity, especially if treatment and control sites are substantially different before the study begins. This initial difference may at least partially explain differences after treatment.
- Biased selection of treatment sites can reduce validity. The error here is that the investigator selects sites to be treated in such a way that the treatment effects are likely to be higher or lower than for other units in the population. This issue is complicated by the fact that treatment areas are often selected precisely because they are thought to be problematic.
- Loss of sampling units during the study can reduce validity. This is most likely to occur when the investigator drops sites that shared characteristics such that their absence has a significant effect on the results.
- Multiple treatment effects can reduce validity. This occurs when sampling units get more than one treatment, or the effects of an earlier treatment are present when a later treatment is applied. Multiple treatment effects make it very difficult to identify the treatment primarily responsible for causing a response in the indicator variables.
- The threats above could interact or work in concert to reduce validity.

In most cases, there are simple design elements or requirements that reduce threats to internal and external validity. In general, the more complex the study, the more complex the requirements, but the minimum requirements include *randomization*, *replication*, *independence*, and *controls*.

Randomization—Randomization should be used whenever there is an arbitrary choice to be made of which units will be measured in the sampling frame, or of the units to which treatments will be assigned. The intent is that randomization will remove or reduce systematic errors (bias) of which the investigator has no knowledge. If randomization is not used, then there is the possibility of some unseen bias in selection or allocation. In some situations, complete randomization (both random selection of sampling units and random assignment of treatments) is not possible. Indeed, there will be instances where the investigator cannot randomly assign management activities to survey areas (e.g., removal of mine contaminants from a stream). In this case replication in time and space is needed to generalize inferences of cause-effect relationships.[5] Here, confidence in the inference comes from replication outside the given study area. The rule of thumb is simple: randomize whenever possible.

Replication—Replication is needed to estimate "experimental error," which is the basic unit of measurement for assessing statistical significance or for determining confidence limits. Replication is the means by which natural variability is accounted for in interpreting results. The only way to assess variability is to have more than one replicate for each treatment, including the controls. In the absence of replication, there is no way, without appealing to non-statistical arguments, to assess the importance of observed

[5] This does not mean that one cannot infer a cause-effect relationship in the study area. The point here is that without random assignment of management activities, it is questionable if results can be generalized to other sites outside the study area.

differences among experimental units. Depending on the objectives of the study, spatial and/or temporal replication may be necessary.

Independence—It is important that the investigator select replicates that are spatially and temporally independent. A lack of independence can confound the study and lead to "pseudoreplication" (Hurlbert 1984). The basic statistical problem of pseudoreplication is that replicates are not independent, and the first assumption of statistical inference is violated. The simplest and most common type of pseudoreplication occurs when the investigator only selects one replicate per treatment. It can be argued that case studies, where a single stream or watershed has been monitored for several years, suffer from pseudoreplication. Therefore, one might conclude that no inference is possible. However, the motive behind a single-replicate case study is different from that behind statistical inference. The primary purpose of a case study is to reveal information about biological or physical processes in the system. This information can then be used to formulate and test hypotheses using real statistical replicates. Indeed, case studies provide the background information necessary to identify appropriate management actions and to monitor their effectiveness.

Investigators need to be aware of spatial pseudoreplication and how to prevent it or deal with it. Spatial pseudoreplication can occur when sampling units are spaced close together. Sampling units close together are likely to be more similar than those spaced farther apart.[6] Spatially dependent sites are "subsamples" rather than replicates and should not be treated as independent replicates. Confounding also occurs when control sites are not independent of treatment sites. This is most likely to occur when control sites are placed downstream from treatments sites (although the reverse can also occur; see Underwood 1994). Understandably, there can be no detection of a management action if the treatment affects both the test and control sites similarly.

Similar, although less often recognized problems occur with temporal replication. In many monitoring studies it is common for sampling to be done once at each of several years or seasons. Any differences among samples may then be attributed to differences among years or seasons. This could be an incorrect inference because a single sample collected each year or season does not account for within year or season variability. Take for example the monitoring of fine sediments in spawning gravels in, say, Sheep Creek. An investigator measures fine sediments at five random locations (spatial replication) during six consecutive years during the second week of July. A simple statistical analysis of the data could indicate that mean percentages of fine sediments decreased significantly during the latter three years. The investigator may then conclude that fines differed among years.

[6] A common concern of selecting sampling units randomly is that there is a chance that some sampling units will be placed next to each other and therefore will lack independence. Although this is true, if the investigator has designed the study so that it accounts for the obvious sources of variation, then randomization is always worthwhile as a safeguard against the effects of unknown factors.

The conclusion may be incorrect because the study lacked adequate temporal replication. Had the investigator taken samples several times during each year (thereby accounting for within year variability), the investigator may have found no difference among years. A possible reason for the low values during the last three years is because the investigator collected samples before the stream had reached baseflow (i.e., there was a delay in the time that the stream reached baseflow during the last three years compared to the first three years). The higher flows during the second week of July in the last three years prevented the deposition of fines in spawning gravels. An alternative to collecting several samples within years or seasons is to collect the annual sample during a period when possible confounding factors are the same among years. In this case, the investigator could have collected the sample each year during baseflow. The results, however, would apply only to baseflow conditions.

The use of some instruments to monitor physical/environmental indicators may actually lead to pseudoreplication in monitoring designs. This can occur when a "destructive" sampling method is used to sample the same site repeatedly. To demonstrate this point one can look at fine-sediment samples collected repeatedly within the same year. In this example, the investigator designs a study to sample five, randomly-selected locations once every month from June through November (high flows or icing preclude sampling during other months). The investigator randomly selects the week in June to begin sampling, and then samples every fourth week thereafter (systematic sampling). To avoid systematic bias, the same well-trained worker using the same equipment (McNeil core sampler) collects all samples. After compiling and analyzing the data, the investigator may find that there is no significant difference in percent fines among replicates within the year. This conclusion is tenuous because the sampling method (core sampler) disturbed the five sampling locations, possibly reducing fines that would have been measured in following surveys. A more appropriate method would have been to randomly select five new sites (without replacement) during each survey period.

Although replication is an important component of monitoring and should be included whenever possible, it is also important to understand that using a single observation per treatment, or replicates that are not independent, is not necessarily wrong. Indeed, it may be unavoidable in some field studies. What is wrong is to ignore this in the analysis of the data. There are several analyses that can be used to analyze data that are spatially or temporally dependent (see Manly 2001). Because it is often difficult to distinguish between true statistical replicates and subsamples, even with clearly defined objectives, investigators should consult with a professional statistician during the development of monitoring studies.

Controls—Controls are a necessary component of effectiveness research because they provide observations under normal conditions without the effects of the management action or treatment. Thus, controls provide the standard by which the results are compared.[7] The exact nature of the controls will depend on the hypothesis being tested.

[7] Lee (1993, pg 205) offers a quote from Tufte that adequately describes the importance of controls in study designs. Lee writes, "One day when I was a junior medical student, a very important Boston surgeon visited the school and delivered a great treatise on a large number of patients who had undergone successful operations for vascular

For example, if an investigator wishes to implement a rest-rotation grazing strategy along a stream with heavy grazing impacts, the investigator would monitor the appropriate physical/environmental indicators in both treatment (modified grazing strategy) and control (unmodified intensive grazing) sites. Because stream systems are quite variable, the study should use "contemporaneous controls." That is, both control and treatment sites should be measured at the same time.

Temporal controls can be used to increase the "power" of the statistical design. In this case the treatment sites would be measured before and after the treatment is applied. Thus, the treatment sites serve as their own controls. However, unless there are also contemporaneous controls, all before-after comparisons must assume homogeneity over time, a dubious assumption that is invalid in most ecological studies (Green 1979). Examples where this assumption *is* valid include activities that improve fish passage at irrigation diversions or screen intake structures. These activities do not require contemporaneous controls. However, a temporal control is needed to describe the initial conditions. Therefore, a before-after comparison is appropriate. The important point is that if a control is not present, it is impossible to conclude anything definite about the effectiveness of the treatment.

It should be clear that the minimum requirements of valid monitoring include randomization, replication, independence, and controls. In some instances monitoring studies may lack one or more of these ingredients. Such studies are sometimes called "quasi-experiments." Although these studies are often used in environmental science, they have inherent problems that need to be considered during data analysis. Investigators should consult Cook and Campbell (1979) for a detailed discussion of quasi-experimental studies.

Sampling Design

Once the investigator has selected a valid statistical design, the next step is to select "sampling" sites. *Sampling* is a process of selecting a number of units for a study in such a way that the units represent the larger group from which they were selected. The units selected comprise a *sample* and the larger group is referred to as a *population*.[8] All the possible sampling units available

reconstruction. At the end of the lecture, a young student at the back of the room timidly asked, 'Do you have any controls?' Well, the great surgeon drew himself up to his full height, hit the desk, and said, 'Do you mean did I not operate on half of the patients?' The hall grew very quiet then. The voice at the back of the room very hesitantly replied, 'Yes, that's what I had in mind.' Then the visitor's fist really came down as he thundered, 'Of course not. That would have doomed half of them to their death.' God, it was quiet then, and one could scarcely hear the small voice ask, 'Which half?' (Tufte 1974, p.4--attributed to Dr. E. Peacock, Jr., chairman of surgery, University of Arizona College of Medicine, in Medical World News, Sept. 1, 1974, p. 45.)"

[8] This definition makes it clear that a "*population*" is not limited to a group of organisms. In statistics, it is the total set of elements or units that are the target of our curiosity. For example, habitat parameters will be monitored at sites selected from the *population* of all possible stream sites in the watershed.

within the area (population) constitute the *sampling frame*.[9] The purpose of sampling is to gain information about a population. If the sample is well selected, results based on the sample can be generalized to the population.[10] Statistical theory assists in the process of drawing conclusions about the population using information from a sample of units.

Defining the population and the sample units may not always be straightforward, because the extent of the population may be unknown, and natural sample units may not exist. For example, a researcher may exclude livestock grazing from sensitive riparian areas in a watershed where grazing impacts are widespread. In this case the management action may affect aquatic habitat conditions well downstream from the area of grazing. Thus, the extent of the area (population) that might be affected by the management action may be unclear, and it may not be obvious which sections of streams to use as sampling units.

When the population and/or sample units cannot be defined unambiguously, the investigator must subjectively choose the potentially affected area and impose some type of sampling structure. For example, sampling units could be stream habitat types (e.g., pools, riffles, or glides), fixed lengths of stream (e.g., 150-m long stream reaches), or reach lengths that vary according to stream widths (e.g., see Simonson et al. 1994). Before selecting a sampling method, the investigator must define the population, size and number of sample units, and the sampling frame.

Selection of a sample is a crucial step in monitoring fish populations and physical/environmental conditions in streams. The "goodness" of the sample determines the general applicability of the results. Because monitoring studies usually require a large amount of time and money, non-representative results are wasteful. Therefore, it is important to select a method or combination of methods that increases the degree to which the selected sample represents the population. The five most commonly used sampling designs for monitoring fish populations and physical/environmental conditions are random sampling, stratified sampling, systematic sampling, cluster sampling, and multi-stage sampling. It is important to note that some monitoring programs include a combination of sampling designs. For example, the EMAP approach is a combination of random and systematic sampling. See Scheaffer et al. (1990) for a more detailed discussion of these sampling methods.

Measurement Error

[9] The *sampling frame* is a "list" of all the available units or elements from which the sample can be selected. The sampling frame should have the property that every unit or element in the list has some chance of being selected in the sample. A sampling frame does not have to list all units or elements in the population.

[10] The error of extrapolating from a poor sampling design is nicely summarized by Mark Twain: "In the space of one hundred and seventy six years, the Lower Mississippi has shortened itself by two hundred and forty two miles. That is an average of a trifle over one mile and a third every year. Therefore, any calm person, who is not blind or idiotic, can see that in the Old Oolitic Silurian Period, just a million years ago next November, the Lower Mississippi was upwards of one million three hundred thousand miles long, and stuck out over the Gulf of Mexico like a fishing rod. There is something fascinating about science. One get such wholesale returns of conjecture out of such a trifling investment of fact."

Because most fish population and habitat variables are difficult to measure, and the errors in these measurements are often large, it is important to find ways to reduce measurement errors. Often, investigators ignore these errors and proceed as though the estimates reflect the true state of the resource. One should resist this temptation because it could lead to missing a treatment effect, resulting in a waste of money and effort. Investigators need to be aware of the types of errors and how they can be identified and minimized. This is important because total sample size and statistical power are related to variability. By reducing measurement error and bias, one effectively reduces variability, resulting in greater statistical power.

In general, "error" indicates the difference between an estimated value (from a sample) and its "true" or "expected" value. The two common types of error are *random error* and *systematic error*. Random error (a.k.a. chance error) refers to variation in a score or result that displays no systematic *bias*[11] when taking repeated samples. In other words, random error is the difference between the estimate of a population parameter that is determined from a random sample and the true population value, absent any systematic bias. One can easily detect the presence of random errors by simply repeating the measurement process several times under similar conditions. Different results, with no apparent pattern to the variation (no bias) indicate random error. Although random errors are not predictable, their properties are understood by statistical theory (i.e., they are subject to the laws of probability and can be estimated statistically). The standard deviation of repeated measurements of the same phenomenon gauges the average size of random errors.[12]

Random errors can occur during the collection and compilation of sample data. These errors may occur because of carelessness in recording field data or because of missing data. Recording errors can occur during the process of transferring information from the equipment to field data sheets. This often results from misplacing decimal points, transposing numbers, mixing up variables, or misinterpreting hand-written records. Although not always the fault of the investigator, missing data are an important source of error.

Systematic errors or bias, on the other hand, are not subject to the laws of probability and cannot be estimated or handled statistically without an independent estimate of the bias. Systematic errors are present when estimates consistently over or underestimate the true population value. An example would be a poorly calibrated thermometer that consistently underestimates the true water temperature. These errors are often introduced as a result of poorly calibrated data-recording instruments, miscoding, misfiling of forms, or some other error-generating process. They may also be introduced via interactions among different variables (e.g., turbidity is usually highest at high flows). Systematic error can be reduced or eliminated through quality control procedures implemented at the time data are collected or through careful checking of data before analysis. For convenience, systematic errors are divided into two general classes: those that

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[11] *Bias* is a measure of the divergence of an estimate (statistic) from the population parameter in a particular direction. The greater the divergence the greater the bias. Nonrandom sampling often produces such bias.

[12] It is important not to confuse standard deviation with standard error. The *standard error of a sample average* gauges the average size of the fluctuation of means from sample to sample. The *sample standard deviation* gauges the average size of the fluctuations of the values within a sample. These two quantities provide different information.

occur because of inadequate procedures and those that occur during data processing. Each is considered in turn.

Biased Procedures—A biased procedure involves problems with the selection of the sample, the estimation of population parameters, the variables being measured, or the general operation of the survey. For example, selecting sample units based on access can increase systematic error because the habitat conditions near access points may not represent the overall conditions of the population. Changing sampling times and sites during the course of a study can introduce systematic error. Systematic errors can grow imperceptibly as equipment ages or observers change their perspectives (especially true of "visual" measurements). Failure to calibrate equipment introduces error, as does demanding more accuracy than can be expected of the instrument or taking measurements outside the range of values for which the instrument was designed.

Processing Errors—Systematic errors can occur during compiling and processing data. Errors can occur during the transfer of field records to computer spreadsheets. Investigators can also introduce large systematic errors by using faulty formulas (e.g., formulas for converting variables). Processing errors are the easiest to control.

The investigator must consider all these sources of error and identify ways to minimize measurement bias. Certainly some errors are inevitable, but a substantial reduction in systematic errors will benefit a monitoring study considerably. The following guidelines will help to reduce systematic errors.

(1) Measures based on counts (e.g., Redds, LWD, Pools)

- Make sure that new personnel are trained adequately by experienced workers.
- Reduce errors by taking counts during favorable conditions and by implementing a rigorous protocol.
- If an over or underestimate is assumed, attempt to assess its extent by taking counts of populations of known size.

(2) Measures based on visual estimates (e.g., snorkel surveys, bank stability)

- Make sure that all visual estimates are conducted according to rigorous protocols by experienced observers.
- Attempt to assess observer bias by using trained personnel to check observations of new workers.

(3) Measures based on instruments (e.g., dissolved oxygen, temperature)

- Calibrate instruments before first use and periodically thereafter.
- Personnel must be trained in the use of all measuring devices.
- Experienced workers should periodically check measurements taken by new personnel.
- Use the most reliable instruments.

(4) Re-measurement of indicators

- Use modern GPS technology, photographs, permanent station markers (e.g., orange plastic survey stakes or rebar[13]), and carefully marked maps and diagrams to relocate previous sampling units.
- Guard against the transfer of errors from previous measurements.
- Make sure that bias is not propagated through the use of previous measurements as guides to subsequent ones.

(5) Handling of data

- Record data directly into electronic form where possible.
- Back-up all data frequently
- Design manual data-recording forms and electronic data-entry interfaces to minimize data-entry errors.
- Use electronic data-screening programs to search for aberrant measurements.
- Frequently double-check the transfer of data from field data forms to computer spreadsheets.

Before leaving this discussion, it is important to describe briefly how one should handle outliers. Outliers are measurements that look aberrant (i.e., they appear to lie outside the range of the rest of the values). Because they stand apart from the others, it appears as if the investigator made some gross measurement error. It is tempting to discard them not only because they appear unreasonable, but because they also draw attention to possible deficiencies in the measurement process. Before discarding an apparent outlier, the investigator should look thoroughly at how they were generated. Quite often apparent outliers result from simple errors in data recording, such as a misplaced decimal point. On the other hand, they may be part of the natural variability of the system and therefore should not be ignored or discarded.[14] If one routinely throws out aberrant values, the resulting data set will give false impressions of the structure of the system. Therefore, as a general rule, investigators should not discard outliers unless it is known for certain that measurement errors attend the estimates.

The information contained in this section provides the framework for developing the plan for monitoring resources on the DVIR. The following sections describe in detail how the Tribes intend to monitor existing conditions, changes in conditions, and effects of their tributary habitat strategies on aquatic conditions.

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[13] Metal detectors can be used to relocate rebar.

[14] Another reason that outliers should be treated carefully is because they can invalidate standard statistical inference procedures. Outliers tend to affect assumptions of variability and normality.

Landscape classification

Both status/trend and effectiveness monitoring require landscape classification. The purpose of classification is to describe the "setting" in which monitoring occurs. This is necessary because biological and physical/environmental indicators may respond differently to tributary actions depending on landscape characteristics. An hierarchical classification system that captures a range of landscape characteristics should adequately describe the setting in which monitoring occurs. The idea advanced by hierarchical theory is that ecosystem processes and functions operating at different scales form a nested, interdependent system where one level influences other levels. Thus, an understanding of one level in a system is greatly informed by those levels above and below it.

A defensible classification system should include both ultimate and proximate control factors (Naiman et al. 1992). Ultimate controls include factors such as climate, geology, and vegetation that operate over large areas, are stable over long time periods, and act to shape the overall character and attainable conditions within a watershed or basin. Proximate controls are a function of ultimate factors and refer to local conditions of geology, landform, and biotic processes that operate over smaller areas and over shorter time periods. These factors include processes such as discharge, temperature, sediment input, and channel migration. Ultimate and proximate control characteristics help define flow (water and sediment) characteristics, which in turn help shape channel characteristics within broadly predictable ranges (Rosgen 1996).

This plan includes a classification system that incorporates the entire spectrum of processes influencing stream features and recognizes the tiered/nested nature of landscape and aquatic features. This system captures physical/environmental differences spanning from the largest scale (regional setting) down to the channel segment (Table 1). By recording these descriptive characteristics, the Tribes will be able to assess differential responses of indicator variables to proposed actions within different classes of streams and watersheds. The system is similar to the Action Agencies/NOAA Fisheries RME plan and the Upper Columbia Basin Monitoring Strategy (Hillman 2004). Importantly, the classification work described here fits well with Level 1 monitoring under the ISAB (2003) monitoring and evaluation plan. Classification variables and recommend methods for measuring each variable are defined below.

Table 1. List of classification (stratification) variables, their corresponding measurement protocols, and temporal sampling frequency. The variables are nested according to spatial scale and their general characteristics. Table is from Hillman (2004).

Spatial scale	General characteristics	Classification variable	Recommended protocols	Sampling frequency (years)
Regional setting	Ecoregion	Bailey classification	Bain and Stevenson (1999)	20
		Omernik classification	Bain and Stevenson (1999)	20
	Physiography	Province	Bain and Stevenson (1999)	20
	Geology	Geologic districts	Overton et al. (1997)	20
Drainage basin	Geomorphic features	Basin area	Bain and Stevenson (1999)	20
		Basin relief	Bain and Stevenson (1999)	20
		Drainage density	Bain and Stevenson (1999)	20
		Stream order	Gordon et al. (1992)	20
Valley segment	Valley characteristics	Valley bottom type	Cupp (1989); Naiman et al. (1992)	20
		Valley bottom width	Naiman et al. (1992)	20
		Valley bottom gradient	Naiman et al. (1992)	20
		Valley containment	Bisson and Montgomery (1996)	20
Channel segment	Channel characteristics	Elevation	Overton et al. (1997)	10
		Channel type (Rosgen)	Rosgen (1996)	10
		Bed-form type	Bisson and Montgomery (1996)	10
		Channel gradient	Overton et al. (1997)	10
	Riparian veg.	Primary vegetation type	Platts et al. (1983)	5

Classification work relies heavily on remote-sensed data and GIS. The majority of this work can be conducted in an office with GIS. It is important, however, to spend some time in the field verifying spatial data. This plan requires that at least 10% of the channel segments identified in a subbasin be verified in the field. These segments can be selected randomly. Additional verification may be needed for those segments that cannot be accurately delineated from remote-sensed data. Variables such as primary riparian vegetation type, channel type, and bed-form type will be verified during field surveys (described in Sections 5 and 6).

A large part of this work has already been conducted by White Horse Associates.[15] They described the regional and drainage basin characteristics for the entire Snake River Basin.

Regional Setting

[15] Mr. Sherm Jensen, White Horse Associates, 140 North Main, Box 123, Smithfield, UT 84335.

Ecoregions

Ecoregions are relatively uniform areas defined by generally coinciding boundaries of several key geographic variables. Ecoregions have been defined holistically using a set of physical and biotic factors (e.g., geology, climate, landform, soil, vegetation, and water). Of the systems available, this plan includes the two most commonly used ecoregion systems, Bailey (1978) and Omernik (1987). Bailey's approach uses macroclimate and prevailing plant formations to classify the continent into various levels of detail. Bailey's coarsest hierarchical classifications include domains, divisions, provinces, and sections. These regional classes are based on broad ecological climate zones and thermal and moisture limits for plant growth (Bailey 1998). Specifically, domains are groups of related climates, divisions are types of climate based on seasonality of precipitation or degree of dryness or cold, and provinces are based on macro features of vegetation. Provinces include characterizations of land-surface form, climate, vegetation, soils, and fauna. Sections are based on geomorphology, stratigraphy and lithology, soil taxa, potential natural vegetation, elevation, precipitation, temperature, growing season, surface water characteristics, and disturbance. Information from domains, divisions, and provinces can be used for modeling, sampling, strategic planning, and assessment. Information from sections can be used for strategic, multi-forest, statewide, and multi-agency analysis and assessment.

The system developed by Omernik (1987) is used to distinguish regional patterns of water quality in ecosystems as a result of land use. Omernik's system is suited for classifying aquatic ecoregions and monitoring water quality because of its ecological foundation, its level of resolution, and its use of physical, chemical, and biological information. Like Bailey's system, this system is hierarchical, dividing an area into finer regions in a series of levels. These levels are based on characterizations of land-surface form, potential natural vegetation, land use, and soils. Omernik's system has been extensively tested and found to correspond well to spatial patterns of water chemistry and fish distribution (Whittier et al. 1988).

Until there is a better understanding of the relationships between fish abundance/distribution and the two classes of ecoregions on the Reservation, the Tribes will use both classifications. Chapter 3 in Bain and Stevenson (1999) outlines protocols for describing ecoregions. Published maps of ecoregions are available to assist with classification work.[16] This work will be updated once every 20 years.

Physiographic Province

Physiographic province is the simplest division of a land area into hierarchical natural regions. In general, delineation of physiographic provinces is based on topography (mountains, plains, plateaus, and uplands) and, to a lesser extent, climate, which governs the processes that shape the landscape (weathering, erosion, and sedimentation). Specifically, provinces include descriptions

[16] Bailey's digital-compressed ARC/INFO ecoregion maps are available at http://www.fs.fed.us/institute/ecolink.html. Omernik's digital level III ecoregion maps of the conterminous U.S. are available at http://www.epa.gov/OST/BASINS/gisdata.html (download BASINS core data) with documentation at http://www.epa.gov/envirofw/html/nsdi/nsditxt/useco.txt.

of climate, vegetation, surficial deposits and soils, water supply or resources, mineral resources, and additional information on features particular to a given area (Hunt 1967). Physiographic provinces and drainage basins have traditionally been used in aquatic research to identify fish distributions (Hughes et al. 1987; Whittier et al. 1988).

Chapter 3 in Bain and Stevenson (1999) outlines methods for describing physiographic provinces. Physiographic maps are available to aid classification work.[17] The Tribes will update physiographic provinces once every 20 years.

Geology

Geologic districts are areas of similar rock types or parent materials that are associated with distinctive structural features, plant assemblages, and similar hydrographic character. Geologic districts serve as ultimate controls that shape the overall character and attainable conditions within a watershed or basin. They are corollary to subsections identified in the U.S. Forest Service Land Systems Inventory (Wertz and Arnold 1972). Watershed and stream morphology are strongly influenced by geologic structure and composition (Frissell et al. 1986; Nawa et al. 1988). Structural features are the templates on which streams etch drainage patterns. The hydrologic character of landscapes is also influenced by the degree to which parent material has been weathered, the water-handling characteristics of the parent rock, and its weathering products. Like ecoregions, geologic districts do not change to other types in response to land uses.

Geologic districts can be identified following the methods described in Overton et al. (1997). Published geology maps aid in the classification of rock types. This work will be updated once every 20 years.

Drainage Basin

Geomorphic Features

This plan includes four important geomorphic features of drainage basins: basin area, basin relief, drainage density, and stream order. Basin area (a.k.a. drainage area or catchment area) is the total land area (km^2), measured in a horizontal plane, enclosed by a drainage divide, from which direct surface runoff from precipitation normally drains by gravity into a wetland, lake, or river. Basin relief (m) is the difference in elevation between the highest and lowest points in the basin. It controls the stream gradient and therefore affects flood patterns and the amount of sediment that can be transported. Hadley and Schumm (1961) demonstrated that sediment load increases exponentially with basin relief. Drainage density (km) is an index of the length of stream per unit area of basin and is calculated as the drainage area (km^2) divided by the total stream length (km). This ratio represents the amount of stream necessary to drain the basin. High drainage density may indicate high water yield and sediment transport, high flood peaks,

[17] Detailed information about physiographic provinces of the U.S. can be found at http://www.salem.mass.edu/~lhanson/. Digital maps can be found at http://water.usgs.gov/GIS/.

steep hills, and low suitability for certain land uses (e.g., agriculture). The last geomorphic feature, stream order, is based on the premise that the order number is related to the size of the contributing area, to channel dimensions, and to stream discharge. Stream ordering follows the Strahler ordering system. In that system, all small, exterior streams are designated as first order. A second-order stream is formed by the junction of any two first-order streams; third-order by the junction of any two second-order streams. In this system only one stream segment has the highest order number.

Chapter 4 in Bain and Stevenson (1999) outlines standard methods for estimating basin area, basin relief, and drainage density. Gordon et al. (1992) describes the Strahler stream-ordering method. The Tribes will use USGS topographic maps (1:100,000 scale) and GIS to estimate these parameters. This work will be updated once every 20 years.

Valley Segment

Valley Characteristics

The plan incorporates four important features of the valley segment: valley bottom type, valley bottom width, valley bottom gradient, and valley confinement. Valley bottom types are distinguished by average channel gradient, valley form, and the geomorphic processes that shaped the valley (Cupp 1989a,b; Naiman et al. 1992). They correspond with distinctive hydrologic characteristics, especially the relationship between stream and alluvial ground water (Table 2). Valley bottom width is the ratio of the valley bottom[18] width (m) to active channel width (m). Valley gradient is the slope or the change in vertical elevation (m) per unit of horizontal valley distance (m). Valley gradient is typically measured in lengths of about 300 m (1,000 ft) or more. Valley confinement refers to the degree that the valley walls confine the lateral migration of the stream channel. The degree of confinement can be classified as strongly confined (valley floor width < 2 channel widths), moderately confined (valley floor width = 2-4 channel widths), or unconfined (valley floor width > 4 channel widths).

The latter three variables, valley bottom width, valley gradient, and confinement, are nested within valley bottom types. Therefore, these three variables will be described for each valley bottom type identified within the drainage basin (i.e., the valley bottom type defines the scale at which these variables are described).

The Tribes will follow methods of Naiman et al. (1992) to describe valley bottom types. Naiman et al. (1992) also describe methods for measuring valley bottom width and valley bottom gradient. Bisson and Montgomery (1996) outline methods for measuring valley confinement. GIS will aid in estimating these parameters. These variables will be updated once every 20 years.

[18] Valley bottom is defined as the essentially flat area adjacent to the stream channel.

Table 2. Examples of valley bottom types and valley geomorphic characteristics. Table is from Naiman et al. (1992).

Valley bottom type[a]	Valley bottom gradient[b]	Sideslope gradient[c]	Valley bottom width[d]	Channel patterns	Strahler stream order	Landform and geomorphic features
F1 Estuarine delta	≤0.5%	<5%	>5X	Unconstrained; highly sinuous; often braided	Any	Occur at mouth of streams on estuarine flats in and just above zone of tidal influence
F2 Alluviated lowlands	≤1%	>5%	>5X	Unconstrained; highly sinuous	Any	Wide floodplains typically formed by present or historic large rivers within flat to gently rolling lowland landforms; sloughs, oxbows, and abandoned channels commonly associated with mainstream rivers
F3 Wide mainstream valley	≤2%	<5%	>5X	Unconstrained; moderate to high sinuosity; braids common	Any	Wide valley floors bounded by mountain slopes; generally associated with mainstream rivers and the tributary streams flowing through the valley floor; sloughs and abandoned channels common.
F4 Wide mainstream valley	≤1-3%	≤10%	>3X	Variable; generally unconstrained	1-4	Generally occur where tributary streams enter low-gradient valley floors; ancient or active alluvial/colluvial fan deposition overlying floodplains of larger, low-gradient stream segments; stream may actively downcut through deep alluvial fan deposition.
F5 Gently sloping plateaux and terraces	≤2%	<10%	1-2X	Moderately constrained; low to moderate sinuosity	1-3	Drainage ways shallowly incised into flat to gently sloping landscape; narrow active floodplains; typically associated with small streams in lowlands, cryic uplands or volcanic flanks.
M1 Moderate sloping plateaux and terraces	2-5%	<10-30%	<2X	Constrained; infrequent meanders	1-4	Constrained, narrow floodplains bounded by moderate gradient sideslopes; typically found in lowlands and foothills, but may occur on broken mountain slopes and volcano flanks.
M2 Alluviated, moderate slope bound	≤2%	<5%, gradually increase to 30%	2-4X	Unconstrained; moderate to high sinuosity	1-4	Active floodplains and alluvial terraces bounded by moderate gradient hillslopes; typically found in lowlands and foothills, but may occur on broken mountain slopes and volcano flanks.
V1 V-shaped moderate-gradient bottom	2-6%	30-70%	<2X	Constrained	≥2	Deeply incised drainage ways with steep competent sideslopes; very common in uplifted mountainous topography; less commonly associated with marine or glacial outwash terraces in lowlands and foothills.
V2 V-shaped high-gradient bottom	6-11%	30-70%	<2X	Constrained	≥2	Same as above, but valley bottom longitudinal profile steep with pronounced stair-step characteristics.

Table 2. (continued)

Valley bottom type[a]	Valley bottom gradient[b]	Sideslope gradient[c]	Valley bottom width[d]	Channel patterns	Strahler stream order	Landform and geomorphic features
V3 V-shaped, bedrock canyon	3-11%	70%+	<2X	Highly constrained	≥2	Canyon-like stream corridors with frequent bedrock outcrops; frequently stair-stepped profile; generally associated with folded, faulted or volcanic landforms.
V4 Alluviated mountain valley	1-4%	Channel adjacent slopes <10%; increase to 30%+	2-4X	Unconstrained; high sinuosity with braids and side-channels common	2-5	Deeply incised drainage ways with relatively wide floodplains; distinguished as "alluvial flats" in otherwise steeply dissected mountainous terrain.
U1 U-shaped trough	<3%	<5%; gradually increases to 30%+	>4X	Unconstrained; moderate to high sinuosity; side channels and braids common	1-4	Drainage ways in mid to upper watersheds with history of glaciation, resulting in U-shaped profile; valley bottom typically composed of glacial drift deposits overlain with more recent alluvial material adjacent to channel.
U2 Incised U-shaped valley, moderate-gradient bottom	2-5%	Steep channel adjacent slopes, decreases to <30%, then increases to >30%	<2X	Moderately contrained by unconsolidated material; infrequent short flats with braids and meanders	2-5	Channel downcuts through deep valley bottom glacial till, colluvium, or coarse glacio-fluvial deposits; cross-sectional profile variable, but generally weakly U-shaped with active channel vertically incised into valley fill deposits; immediate side-slopes composed of unconsolidated and often unsorted coarse-grained deposits.
U3 Incised U-shaped valley, high-gradient bottom	6-11%	Steep channel adjacent slopes, decreases to <30%, then increases to >30%	<2X	Moderately constrained by unconsolidated material; infrequent short flats with braids and meanders	2-5	Channel downcuts through deep valley bottom glacial till, colluvium, or coarse glacio-fluvial deposits; cross-sectional profile variable, but generally weakly U-shaped with active channel vertically incised into valley fill deposits; immediate side-slopes composed of unconsolidated and often unsorted coarse-grained deposits.
U4 Active glacial out-wash valley	1-7%	Initially <5%, increasing to >60%	<4X	Unconstrained; highly sinuous and braided	1-3	Stream corridors directly below active alpine glaciers; channel braiding and shifting common; active channel nearly as wide as valley bottom.
H1 Moderate-gradient valley wall/head-water	3-6%	>30%	<2X	Constrained	1-2	Small drainage ways with channels slightly to moderately entrenched into mountain toe-slopes or head-water basins.
H2 High-gradient valley wall/head-water	6-11%	>30%	<2X	Constrained; stair-stepped	1-2	Small drainage ways with channels moderately entrenched into high gradient mountain slopes or headwater basins; bedrock exposures and outcrops common; localized alluvial/colluvial terrace deposition.

Table 2. (concluded)

Valley bottom type[a]	Valley bottom gradient[b]	Sideslope gradient[c]	Valley bottom width[d]	Channel patterns	Strahler stream order	Landform and geomorphic features
H3 Very high-gradient valley wall/head-water	11%+	>60%	<2X	Constrained; stair-stepped	1-2	Small drainage ways with channels moderately entrenched into high gradient mountain slopes or headwater basins; bedrock exposures and out-crops common; localized alluvial/colluvial terrace deposition.

[a]Valley bottom type names include alphanumeric mapping codes in italic (from Cupp 1989a, b).
[b]Valley bottom gradient is measured in length of about 300 m (1,000 ft).
[c]Sideslope gradient characterizes the hillslopes within 1,000 horizontal and about 100 m (300 ft) vertical distance from the active channel.
[d]Valley bottom width is a ratio of the valley bottom width to active channel width.

Channel Segment

Channel Characteristics

The plan includes four important characteristics of the channel segment: elevation, channel gradient, channel type, and bed-form type. These characteristics are nested within valley bottom types and therefore will be described for each valley bottom type identified within the drainage basin. Elevation (m) is the height of the stream channel above or below sea level. Channel gradient is the slope or the change in the vertical elevation of the channel per unit of horizontal distance. Channel gradient will be presented graphically as a stream profile.

Channel type follows the classification technique of Rosgen (1996) and is based on quantitative channel morphology indices.[19] These indices result in objective and consistent identification of stream types. The Rosgen technique consists of four different levels of classification. Level I describes the geomorphic characteristics that result from the integration of basin relief, landform, and valley morphology. Level II provides a more detailed morphological description of stream types. Level III describes the existing condition or "state" of the stream as it relates to its stability, response potential, and function. Level IV is the level at which measurements are taken to verify process relationships inferred from preceding analyses. Monitoring on the DVIR will include Level I (geomorphic characterization) classification (Figure 2; Table 3).

[19] Indices include entrenchment, gradient, width/depth ratio, sinuosity, and dominant channel material.

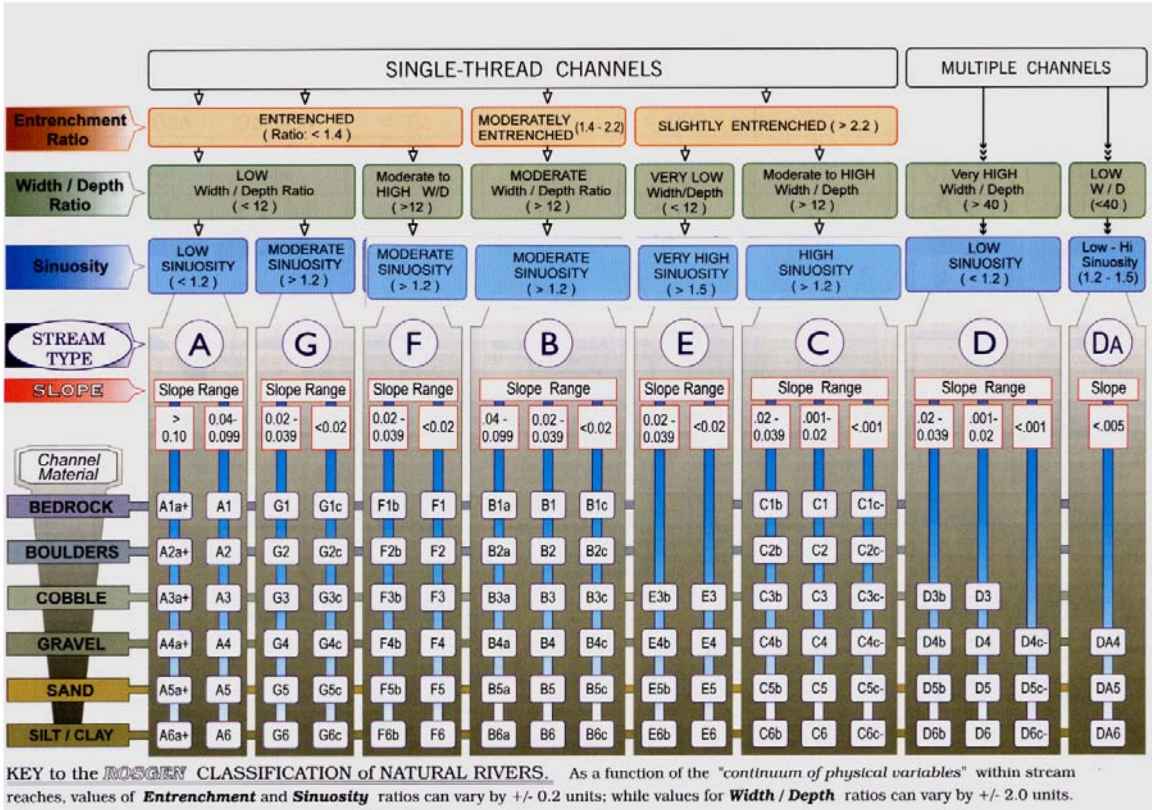

Figure 2. Classification key for identifying different channel types (from Rosgen 1996).

Table 3. General stream type descriptions and delineative criteria for Level I channel classification. Table is from Rosgen (1996).

Stream Type	General description	Entrenchment ratio	W/D ratio	Sinuosity	Slope %	Landform/ soils/features
Aa+	Very steep, deeply entrenched, debris transport, torrent streams.	<1.4	<12	1.0-1.1	>10	Very high relief. Erosional, bedrock or depositional features; debris flow potential. Deeply entrenched streams. Vertical steps with deep scour pools; waterfalls.
A	Steep, entrenched, cascading, step/pool streams. High energy/debris transport associated with depositional soils. Very stable if bedrock or boulder dominated channel.	<1.4	<12	1.0-1.2	4-10	High relief. Erosional or depositional and bedrock forms. Entrenched and confined streams with cascading reaches. Frequently spaced, deep pools in associated step/pool bed morphology.
B	Moderately entrenched, moderate gradient, riffle-dominated channel, with infrequently spaced pools. Very stable plan and profile. Stable banks.	1.4-2.2	>12	>1.2	2-4	Moderate relief, colluvial deposition, and/or structural. Moderate entrenchment and W/D ratio. Narrow, gently sloping valleys. Rapids predominate with scour pools.
C	Low gradient, meandering, point-bar, riffle/pool, alluvial channels with broad, well defined floodplains.	>2.2	>12	>1.4	<2	Broad valleys with terraces, in association with floodplains, alluvial soils. Slightly entrenched with well-defined meandering channels. Riffle/pool bed morphology.
D	Braided channel with longitudinal and transverse bars. Very wide channel with eroding banks.	n/a	>40	n/a	<4	Broad valleys with alluvium, steeper fans. Glacial debris and depositional features. Active lateral adjustment, with abundance of sediment supply. Covergence/divergence bed features, aggradational processes, high bedload and bank erosion.

Table 3. (concluded)

Stream Type	General description	Entrenchment ratio	W/D ratio	Sinuosity	Slope %	Landform/ soils/features
DA	Anastomosing (multiple channels) narrow and deep with extensive, well-vegetated floodplains and associated wetlands. Very gentle relief with highly variable sinuosities and width/depth rations. Very stable streambanks.	>2.2	Highly variable	Highly variable	<0.5	Broad, low-gradient valleys with fine alluvium and/or lacustrine soils. Anastomosed (multiple channel) geologic control creating fine deposition with well-vegetated bars that are laterally stable with broad wetland floodplains. Very low bedload, high wash load sediment.
E	Low gradient, meandering riffle/pool stream with low sidth/depth ratio and little deposition. Very efficient and stable. High meander width ratio.	>2.2	<12	>1.5	<2	Broad valley/meadows. Alluvial materials with floodplains. Highly sinuous with stable, well-vegetated banks. Riffle/pool morphology with very low width/depth ratios.
F	Entrenched meandering riffle/pool channel on low gradients with high width/depth ratio.	<1.4	>12	>1.4	<2	Entrenched in highly weathered material. Gentle gradients, with a high width/depth ratio. Meandering, laterally unstable with high bank erosion rates. Riffle/pool morphology.
G	Entrenched “gully” step/pool and low width/depth ratio on moderate gradients.	<1.4	<12	>1.2	2-4	Gullies, step/pool morphology with moderate slopes and low width/depth ratio. Narrow valleys, or deeply incised in alluvial or colluvial materials, i.e., fans or deltas. Unstable, with grade control problems and high bank erosion rates.

Bed-form type follows the classification proposed by Montgomery and Buffington (1993). This technique is comprehensive and is based on hierarchies of topographic and fluvial characteristics. This system provides a geomorphic, process-oriented method of identifying valley segments and stream reaches. It employs descriptors that are measurable and ecologically relevant. Montgomery and Buffington (1993) identified three valley segment types: colluvial, alluvial, and bedrock. They subdivided the valley types into one or more stream-reach types (bed-form types) depending on whether substrates are limited by the supply of sediment or by the fluvial transport of sediment (Table 4). For example, depending on sediment supply and transport, Montgomery and Buffington (1993) recognized six alluvial bed-form types: braided, regime, pool/riffle, plane-bed, step-pool or cascade. Both colluvial and bedrock valley types consist of only one bed-form type. Only colluvial bed-forms occur in colluvial valleys and only bedrock bed-forms occur in bedrock valleys.

Table 4. Characteristics of different bed-form types. Table is modified from Montgomery and Buffington (1993).

Valley types	Bed-form types	Predominant bed material	Dominant roughness elements	Typical slope (%)	Typical confinement	Pool spacing (channel widths)
Colluvial	Colluvial	Variable	Boulders, large woody debris	>20	Strongly confined	Variable
Bedrock	Bedrock	Bedrock	Streambed, banks	Variable	Strongly confined	Variable
Alluvial	Cascade	Boulder	Boulders, banks	8-30	Strongly confined	<1
	Step-pool	Cobble/boulder	Bedforms (steps, pools) boulders, large woody debris, banks	4-8	Moderately confined	1-4
	Plane-bed	Gravel/cobble	Boulders and cobbles, banks	1-4	Variable	None
	Pool-riffle	Gravel	Bedforms (bars, pools) boulders and cobbles, large woody debris, sinuosity, banks	0.1-2	Unconfined	5-7
	Regime	Sand	Sinuosity, bed-forms (dunes, ripples, bars), banks	<0.1	Unconfined	5-7
	Braided	Variable	Bedforms (bars, pools)	<3	Unconfined	Variable

Methods for measuring elevation and channel gradient are found in Overton et al. (1997). Bisson and Montgomery (1996) describe in detail the method for identifying channel bed-form types, while Rosgen (1996) describes methods for classifying channel types. All classification work will include Level I (geomorphic characterization) channel type classification. These variables will be updated once every 10 years.

Riparian Vegetation

Because riparian vegetation has an important influence on stream morphology and aquatic biota, this plan incorporates primary vegetation type as a characteristic of riparian vegetation. Primary vegetation type refers to the dominant vegetative cover along the stream. At a minimum, vegetation will be described as barren, grasses or forbs, shrubs, and trees. If remote sensing allows, the Tribes will conduct a more detailed classification of shrubs and trees. If possible, trees will be described as cottonwoods, fir, cedar, hemlock, pine, etc. Primary vegetation type will be described for a riparian width of at least 30 m along both sides of the stream. If resources are available, primary vegetation type will be described for the entire floodplain.

Remote sensing will be used to describe the primary vegetation type along streams within valley bottom types. Remote sensing may include aerial photos, LANDSAT ETM+, or both.

status/trend monitoring

One of the goals of the Shoshone-Paiute Tribes is to document current conditions of aquatic resources on the Reservation. Another goal is to assess changes in those conditions over time, especially following the implementation of tributary habitat strategies. Specifically, the Tribes are interested in the following questions:

1. What are the current conditions of aquatic habitats (springs and streams) and associated biota on the DVIR (status monitoring)?
2. Are these conditions improving over time on the Reservation (trend monitoring)?

The specific objectives addressed by status/tend monitoring on the Reservation are to:

1. Describe current water quality, stream connectivity, aquatic habitat quality, channel conditions, riparian conditions, stream flows, and watershed conditions on the DVIR.
2. Describe the current abundance and distribution of redband trout and bull trout on the DVIR.
3. Describe the presence and abundance of Columbia spotted frogs and yellow warblers in riparian habitats on the DVIR.
4. Assess changes in these physical/environmental and biological attributes over time on the DVIR.

Below, this plan describes the statistical design, sampling design, and indicators that will be measured to address the four status/trend objectives. Description of protocols that will be used to measure indicators is presented in Section 7.

Statistical Design

Because the intent of status/trend monitoring is simply to describe existing conditions and document changes in conditions over time, it does not require all the elements of valid statistical design found in effectiveness monitoring studies. For example, controls are not required in status/trend monitoring. However, status/trend monitoring does require temporal and spatial replication and probabilistic sampling.

An appropriate design for monitoring status and trend is the U.S. Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) design, which is a spatially-balanced, site-selection process developed for aquatic systems. The state of Oregon has successfully implemented an EMAP-based program for coastal coho salmon (Moore 2002). The monitoring program is also the foundation for status/trend monitoring in the Upper Columbia Basin Monitoring Strategy (Hillman 2004). The monitoring program is spatially explicit, unbiased, and has reasonably high power for detecting trends. The design is sufficiently flexible to use on the scale of the Reservation and can be used to estimate the relative condition of aquatic biota and freshwater habitat. In addition, the EMAP site-selection approach supports sampling at varying spatial extents.

Specifically, EMAP is a survey design that describes current status and detects trends in a suite of indicators. These two objectives have conflicting design criteria; status is ordinarily best assessed by including as many sample units as possible, while trend is best detected by repeatedly observing the same units over time (Overton et al. 1990; Roper et al. 2003). EMAP addresses this conflict by using rotating panels (Stevens 2002). Each panel consists of a collection of sites that will have the same revisit schedule over time. This plan includes six panels, with one panel defining sites visited every year and five panels defining sites visited on a five-year cycle (Table 5). Each panel will consist of 15 independent sites, thus, a total of 90 sites (15 sites x 6 panels) will be selected on the Reservation.

Table 5. Rotating panel design for status/trend monitoring on the DVIR. Shading indicates the years in which sites within each panel are sampled. For example, sites in panel 1 are visited every year, while sites in panel 2 are visited only in years 1, 6, 11, and 16, assuming a 20-year sampling frame. The number (15) within each shaded cell represents the number of independent sites within a panel.

Panel	Year																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
2	15					15					15					15				
3		15					15					15					15			
4			15					15					15					15		
5				15					15					15					15	
6					15					15					15					15

Sampling Design

Because this plan follows EMAP, which requires spatially balanced samples, sites will be selected according to the generalized random tessellation stratified design (GRTS) (Stevens 1997; Stevens and Olsen 1999; Stevens and Urquhart 2000; Stevens 2002). Briefly, the GRTS design achieves a random, nearly regular sample point pattern via a random function that maps two-dimensional space onto a one-dimensional line (linear space). A systematic sample is selected in the linear space, and the sample points are mapped back into two-dimensional space. The GRTS design is used to select samples for all panels.

As noted above, this plan recommends a sample size of 15 sites per panel. This means that GRTS will select a total of 90 sites (6 panels x 15 sites per panel = 90 sites) on the reservation. Two panels of sites will be monitored each year (Table 5), resulting in a total of 30 sites sampled annually on the Reservation. Some of the sites may fall in areas that are physically inaccessible or cannot be accessed because of landowner denial. Therefore, GRTS will select an additional 90 sites (100% oversample), any one of which can replace an inaccessible site.

The sampling frame for the 90 sites (and the 90 oversample sites) will consist of all portions of first through fifth-order[20] streams on the Reservation (based on 1:100,000 scale USGS topographic maps) with reach gradients less than 12%[21]. The Tribes selected these stream segments because most salmonid spawning and rearing (especially redband trout) occurs in streams with gradients less than 12%. However, spawning and rearing are not evenly distributed among stream orders or among different gradient classes within stream orders. Therefore, this plan will divide each stream within the sampling frame into the following gradient classes: 0-2%, 2-4%, 4-8%, and 8-12%, which correspond roughly to dune-ripple/pool-riffle, plane-bed, step-pool, and cascade channel types, respectively (Montgomery and Buffington 1997; Roni et al. 1999). The first two classes represent response reaches, while the latter two represent transport reaches.

Although salmonids are more likely to spawn in stream segments with gradients less than 4% (Roni et al. 1999), it is unclear at this time how sites should be distributed among the four gradient classes. Therefore, this plan will model a variety of scenarios (Table 6). The first scenario will place 75% of the sites within gradient classes less than 4%, while the second will place 70% of the sites within these gradient classes. The third places 60% of the sites in classes with gradients less than 4%. The last examines the first three scenarios under the criteria that no more than 10% of the sites (9 sites) can fall within fifth-order streams. The purpose here is to limit the number of sites that fall within large streams (e.g., East Fork Owyhee River). The Tribes will evaluate the results of these scenarios to see which one most closely fits the objectives of status/trend monitoring on the Reservation. Importantly, estimates of subbasin-wide variables will not be biased by the choice of site-selection scenario (P. Larsen, personal communication, USEPA).

Table 6. Proportion of sample sites distributed among stream gradient classes on the DVIR.

Scenario	Gradient classes			
	0-2%	**2-4%**	**4-8%**	**8-12%**
1	0.45	0.30	0.15	0.10
2	0.45	0.25	0.20	0.10
3	0.30	0.30	0.20	0.20
4	Above scenarios but only 10% of the sites can fall within 5th order streams			

In order to estimate precision, 20% of the sites will be sampled by two independent crews each year for five years. This means that each year, six randomly selected sites will be surveyed by two different crews. Sampling by the two independent crews will be no more than two-days apart. This will minimize the effects of site changes on estimates of precision. These sites will also be used to compare fish sampling protocols (i.e., comparison of electrofishing and snorkel surveys).

[20] Stream order is based on Strahler (1952). This method of ordering streams is described in Gordon et al. (1992).
[21] Here, a reach is defined as a 300-m long stretch of stream. Therefore, all 300-m long reaches with a sustained gradient of >12% will be excluded from the sampling frame.

Data collected within the EMAP design will be analyzed according to the statistical protocols outlined in Stevens (2002). The Horvitz-Thompson or π-estimator is recommended for estimation of population status. Multi-phase regression analyses are recommended for estimating the distribution of trend statistics. These approaches are fully explained in Diaz-Ramos et al. (1996) and Stevens (2002).

Indicators

In this section, the plan identifies the suite of biological and physical/environmental indicator variables that will be measured on the DVIR. These indicators associate directly with the objectives of the status/trend monitoring program and are consistent with indicators identified in the Action Agencies/NOAA Fisheries RME Plan, the Upper Columbia Monitoring Strategy, and the WSRFB (2003) monitoring strategy. These indicators address various purposes, including assessment of fish production and survival, identifying limiting factors, assessing effects of various land uses, and evaluating habitat actions. The Tribes selected indicators that had the following characteristics:

- They are sensitive to land-use activities or stresses.
- They are consistent with other regional monitoring programs.
- They lend themselves to reliable measurement.
- The physical/environmental indicators relate quantitatively with fish production.

In addition, the indicators identified in this plan are consistent with most of the variables identified by the NMFS (1996) and USFWS (1998) as important attributes of "properly functioning condition." Indeed, NMFS and USFWS use these indicators to evaluate the effects of land-management activities for conferencing, consultations, and permits under the ESA.

Identified and described below are the biological and physical/environmental indicators that will be monitored by the Tribes on the DVIR.

Biological Indicators:

The biological variables that will be measured on the DVIR can be grouped into four general categories: fish, macroinvertebrates, amphibians, and birds. Each of these general categories consists of one or more indicator variables (Table 7). These biological indicators in concert will describe the characteristics of populations or sub-populations in aquatic and riparian habitats on the Reservation.

Table 7. Biological indicator variables to be monitored on the DVIR.

General characteristics	Specific indicators
Fish	Fish abundance
	Age/size structure
	Origin (hatchery or wild)
	Redd abundance
	Redd distribution
Macroinvertebrates	Abundance
	Composition
Amphibians	Occurrence
	Abundance
Birds	Occurrence
	Abundance

Fish

This plan includes five indicators associated with fish populations: abundance, age/size structure, origin, redd abundance, and redd distribution. Abundance describes the number of fish within specified stream reaches. The Tribes believe that fish abundance is an important biological indicator of population health. Indeed, numbers of mature adults within a stream or watershed is a function of all the factors that affect the life history of the population. Age/size structure describes the ages/sizes of fish within an area or population. Size describes the lengths and weights of fish within the population. Origin identifies the parentage (hatchery or wild) of individuals within the populations.

The Tribes will also census redband trout redds (nests) on the Reservation. Abundance describes the number of redds within a given area. Distribution indicates the spatial arrangement (e.g., random, even, or clumped) and geographic extent of redds within a stream or watershed.

Macroinvertebrates

This plan includes benthic macroinvertebrate abundance and diversity (composition) as important indicators of aquatic invertebrates in streams. Benthic macroinvertebrate assemblages in streams reflect overall biological integrity of the benthic community. Because benthic communities respond to a wide array of stressors in different ways, it is often possible to determine the type of stress that affects a macroinvertebrate community.

Amphibians

Amphibians are excellent indicators of environmental health, exhibiting marked declines in degraded habitat (deMaynadeir and Hunter 1995). Consequently, this plan includes the occurrence (presence) and abundance of Columbia spotted frogs as biological indicators that describe the health of riparian ecosystems on the Reservation. These organisms are thought to be common in wet habitats in the Owyhee and Bruneau basins. The Owyhee and Bruneau Subbasin plans identified the Columbia spotted frog as an important indicator species in those basins.

Birds

Occurrence (presence) and abundance of yellow warblers are also indicators of riparian ecosystem health. These birds occur within riparian areas, especially in willows and alders, throughout the Owyhee and Bruneau basins. These birds are quite sensitive to riparian disturbance. In a recent study, Earnst et al. (2004) found that when they compared yellow warblers to all other bird species, yellow warblers exhibited the most significant increase in abundance following cattle removal from high desert riparian habitats. The Owyhee and Bruneau Subbasin plans identified yellow warblers as an important riparian indicator species in those basins.

Physical/Environmental Indicators:

The physical/environmental variables that will be measured on the DVIR can be grouped into seven general categories: water quality, habitat access, habitat quality, channel condition, riparian condition, flow/hydrology, and watershed condition. Each of these categories consists of one or more indicator variables (Table 8). In sum, these categories and their associated indicators address watershed process and “input” variables (e.g., artificial physical barriers, road density, and other anthropogenic disturbances) as well as “outcome” variables (e.g., temperature, sediment, woody debris, pools, riparian habitat, etc.), as outlined in Hillman (2004).

Water Quality

Water Temperature:

This plan includes two temperature metrics that will serve as specific indicators of water temperature: maximum daily maximum temperature (MDMT) and maximum weekly maximum temperature (MWMT). MDMT is the single warmest daily maximum water temperature recorded during a given year or survey period. MWMT is the mean of daily maximum water temperatures measured over the warmest consecutive seven-day period. MDMT is measured to establish compliance with the short-term exposure to extreme temperature criteria, while MWMT is measured to establish compliance with mean temperature criteria.

Table 8. Physical/environmental indicator variables to be monitored on the DVIR. Table is modified from Hillman (2004).

General characteristics	Specific indicators
Water Quality	MWMT/MDMT
	Turbidity
	Conductivity
	pH
	Dissolved Oxygen
Habitat Access	Road crossings
	Diversion dams
Habitat Quality	Dominant substrate
	Embeddedness
	LWD (pieces/km)
	Pools per kilometer
	Residual pool depth
	Fish cover
	Off-channels habitats
Channel condition	Stream gradient
	Width/depth ratio
	Wetted width
	Bankfull width
	Bank stability
Riparian Condition	Structure
	Disturbance
	Canopy cover
Flows and Hydrology	Streamflow
Watershed Condition	Watershed road density
	Riparian-road index

Turbidity:

This plan includes turbidity as the one sediment-related specific indicator under water quality. Turbidity refers to the amount of light that is scattered or absorbed by a fluid. Suspended particles of fine sediments often increase turbidity of streams. However, other materials such as finely divided organic matter, colored organic compounds, plankton, and microorganisms can also increase turbidity of streams.

Conductivity, pH, and Dissolved Oxygen:

This plan includes three additional indicators associated with water quality: conductivity, pH, and dissolved oxygen (DO). Most of these indicators are commonly measured because of their sensitivity to land-use activities, municipal and industrial pollution, and their importance in aquatic ecosystems.

This plan included conductivity, pH, and DO because these parameters are often incorporated into water quality monitoring programs (e.g., OPSW 1999; Bilhimer et al. 2003). Conductivity (or specific conductance) refers to the ability of water to conduct an electric current. The conductivity of water is a function of water temperature and the concentration of dissolved ions. It is measured as micromhos/centimeter (µmhos/cm).[22]

pH is defined as the concentration of hydrogen ions in water (moles per liter). It is a measure of how acidic or basic water is—it is not a measure of acidity or alkalinity (acidity and alkalinity are measures of the capacity of water to neutralize bases and acids, respectively). The logarithmic pH scale ranges from 0 to 14. Pure water has a pH of 7, which is the neutral point. Water is acidic if the pH value is less than 7 and basic if the value is greater than 7.

DO concentration refers to the amount of oxygen dissolved in water. Its concentration is usually measured in mg per liter (mg/L). The capacity of water to hold oxygen in solution is inversely proportional to the water temperature. Increased water temperature lowers the concentration of DO at saturation. Respiration (both plants and animals) and biochemical oxygen demand (BOD) are the primary factors that reduce DO in water. Photosynthesis and dissolution of atmospheric oxygen in water are the major oxygen sources.

Habitat Access

Artificial Physical Barriers:

This plan includes two specific indicators associated with artificial physical barriers: road crossings (culverts) and dams (diversions). Roads and highways are common on the Reservation and where they intersect streams they may block fish passage. Culverts can block passage of fish particularly in an upstream direction (WDFW 2000). In several cases, surveys have shown a difference in fish populations upstream and downstream from existing culverts, leading to the conclusion that free passage is not possible (Clay 1995). Dams and diversions that lack fish passage facilities can also block fish passage. Unscreened diversions may divert migrating fish into ditches and canals. Entrained fish can end in irrigated fields.

Habitat Quality

Substrate:

[22] Conductivity may also be reported in millisiemens/meter, where 1 millisiemen/m equals 0.1 µmhos/cm.

This plan includes two specific indicators of substrate: dominant substrate (composition) and embeddedness. Dominant substrate refers to the most common particle size that makes up the composition of material along the streambed. This indicator describes the dominant material in spawning and rearing areas. Embeddedness is a measure of the degree to which fine sediments surround or bury larger particles. This measure is an indicator of the quality of over-wintering habitat for juvenile salmonids.

Large Woody Debris:

This plan includes the number of pieces of large woody debris (LWD) per stream kilometer as the one specific indicator of LWD in streams. LWD consists of large pieces of relatively stable woody material located within the bankfull channel and appearing to influence bankfull flows. LWD is also referred to as large organic debris (LOD) and coarse woody debris (CWD). LWD can occur as a single piece (log), an aggregate (two or more clumped pieces, each of which qualifies as a single piece), or as a rootwad.

The definition of LWD differs greatly among institutions. For example, NMFS (1996) defined LWD east of the Cascade Mountains as any log with a diameter greater than 30 cm (1 ft) and a length greater than 10.6 m (35 ft). Armantrout (1998) and BURPTAC (1999) defined LWD as any piece with a diameter >10 cm and a length > 1 m. Schuett-Hames et al. (1994) defined it as any piece with a diameter >10 cm and a length >2 m, while Overton et al. (1997) defined LWD as any piece with a diameter >10 cm and a length >3 m or two-thirds of the wetted stream width. Some Forest Service crews define LWD as any piece with a diameter >15 cm and a length >6 m. Because of the wide range of definitions, this plan recommends that LWD be placed within three size categories: >10-cm diameter x >1-m long; >15-cm diameter x >6-m long; and >30-cm diameter x >3-m long. By counting the number of pieces of LWD within each category, this plan will be consistent with many of the various organizations. This will also allow the Tribes to assess the association between different size categories of wood and fish production on the Reservation.

Pool Habitat:

This plan includes two specific indicators associated with pool habitat: number of pools per kilometer and residual pool depth. A pool is slow-water habitat with a gradient less than 1% that is normally deeper and wider than aquatic habitats upstream and downstream from it (Armantrout 1998). To be counted, a pool must span more than half the wetted width, include the thalweg, be longer than it is wide, and the maximum depth must be at least 1.5 times the crest depth. Plunge pools are included in this definition even though they may not be as long as they are wide. Residual pool depth refers to the maximum depth of a pool if there is little or no flow in the channel. It is calculated as the difference between the maximum pool depth and the maximum crest depth (Overton et al. 1997).

Fish Cover:

Fish cover consists of such things as algae, macrophytes, woody debris, overhanging vegetation, undercut banks, large substrate, and artificial structures that offer concealment cover for fish and macroinvertebrates. This information is used to assess habitat complexity, fish cover, and channel disturbance.

Off-Channel Habitat:

Off-channel habitat consists of side-channels, backwater areas, alcoves or sidepools, off-channel pools, off-channel ponds, and oxbows. A side channel is a secondary channel that contains a portion of the streamflow from the main or primary channel. Backwater areas are secondary channels in which the inlet becomes blocked but the outlet remains connected to the main channel. Alcoves are deep areas along the shoreline of wide and shallow stream segments. Off-channel pools occur in riparian areas adjacent to the stream channels and remain connected to the channel. Off-channel ponds are not part of the active channel but are supplied with water from over bank flooding or through a connection with the main channel. These ponds are usually located on flood terraces and are called wall-based channel ponds when they occur near the base of valley walls. Finally, oxbows are bends or meanders in a stream that become detached from the stream channel either from natural fluvial processes or anthropogenic disturbances.

Channel Condition

Stream gradient:

Stream gradient is the slope (change in vertical elevation per unit of horizontal distance) of the water surface within a site or reach. Although gradient is not usually affected by land-use activities, it is a major classification variable that indicates potential water velocities and stream power, which in turn control aquatic habitat and sediment transport within the reach. It is also an index of habitat complexity, as reflected in the diversity of water velocities and sediment sizes within the stream reach.

Width/Depth Ratio:

The width/depth ratio is an index of the cross-section shape of a stream channel at bankfull level. The ratio is a sensitive measure of the response of a channel to changes in bank conditions. Increases in width/depth ratios, for example, indicate increased bank erosion, channel widening, and infilling of pools. Because streams almost always are several times wider than they are deep, a small change in depth can greatly affect the width/depth ratio.

Wetted Width:

Wetted width is the width of the water surface measured perpendicular to the direction of flow. Wetted width is used to estimate water surface area, which is then used to calculate the density of fish (i.e., number of fish divided by the water surface area sampled)[23] within the reach.

Bankfull Width:

Bankfull width is the width of the channel (water surface) at the bankfull stage, where bankfull stage corresponds to the channel forming discharge that generally occurs within a return interval from 1.4 to 1.6 years and may be observed as the incipient elevation on the bank where flooding begins. There are several indicators that one can use to identify bankfull stage. The active floodplain is the best indicator of bankfull stage. It is the flat, depositional surface adjacent to many stream channels. These are most prominent along low-gradient, meandering reaches, but are often absent along steeper mountain streams. Where floodplains are absent or poorly defined, other useful indicators may serve as surrogates to identify bankfull stage (Harrelson et al. 1994). Those include:

- The height of depositional features (especially the top of the pointbar, which defines the lowest possible level for bankfull stage;
- A change in vegetation (especially the lower limit of perennial species);
- Slope or topographic breaks along the bank;
- A change in the particle size of bank material, such as the boundary between coarse cobble or gravel with fine-grained sand or silt;
- Undercuts in the bank, which usually reach an interior elevation slightly below bankfull stage; and
- Stain lines or the lower extent of lichens on boulders.

Streambank Condition:

This plan includes streambank stability as the one specific indicator of streambank condition. Streambank stability is an index of firmness or resistance to disintegration of a bank based on the percentage of the bank showing active erosion (alteration) and the presence of protective vegetation, woody material, or rock. A stable bank shows no evidence of breakdown, slumping, tension cracking or fracture, or erosion (Overton et al. 1997). Undercut banks are considered stable unless tension fractures show on the ground surface at the bank of the undercut.

Riparian Condition

Riparian structure:

Riparian structure describes the type and amount of various types of vegetation within the riparian zone. Information on riparian structure can be used to evaluate the health and

[23] By definition, the measure of the number of fish per unit area is called "crude density" (Smith and Smith 2001). However, not all of the water surface area provides suitable habitat for fish. Density measured in terms of the amount of area suitable as living space is "ecological density."

level of disturbance of the stream corridor. In addition, it provides an indication of the present and future potential for various types of organic inputs and shading.

Riparian disturbance:

Riparian disturbance refers to the presence and proximity of various types of human land-use activities within the riparian area. Activities include such things as walls, dikes, riprap, dams, buildings, pavement, roads and railroads, pipes, trash, parks, lawns, mining, agriculture, pastures, and logging. All these activities have an effect on the riparian vegetation, which in turn affects the quantity and quality of aquatic habitat for listed fish species.

Canopy cover:

Riparian canopy cover over a stream is important not only in its role in moderating stream temperatures through shading, but it also serves to control bank stability and provides inputs of coarse and fine particulate organic materials. Organics from riparian vegetation become food for stream organisms and structure to create and maintain complex channel habitat.

Flows and Hydrology

Streamflows:

This plan includes three specific indicators of streamflows: change in peak flow, change in base flow, and change in timing of flow. Peak flow is the highest or maximum streamflow recorded within a specified period of time. Base flow is the streamflow sustained in a stream channel and is not a result of direct runoff. Base flow is derived from natural storage (i.e., outflow from groundwater, large lakes, or swamps), or sources other than rainfall. Timing of flow refers to the time when peak and base flows occur and the rate of rises and falls in the hydrograph. These indicators are based on "annual" flow patterns.

Watershed Conditions

Road Density:

A road is any open way for the passage of vehicles or trains. This plan includes both road density and the riparian-road index (RRI) as indicators of roads within watersheds. Road density is an index of the total miles of roads within a watershed. It is calculated as the total length of all roads (km) within a watershed divided by the area of the watershed (km^2). The RRI is expressed as the total mileage of roads (km) within riparian areas divided by the total number of stream kilometers within the watershed (WFC 1998). For this index, riparian areas are defined as those falling within the federal buffers zones; that is, all areas within 300 ft (91 m) of either side of a fish-bearing stream, within 150 ft (46 m) of a permanent nonfish-bearing stream, or within the 100-year floodplain.

Ongoing Programs

The Tribal Environmental Protection Program (TEPP) is currently monitoring water quality on the DVIR for the purpose of establishing water quality standards for the Reservation, assessing overall water quality conditions, developing a 303(d) list, and writing a 305(b) report. In 2002, TEPP conducted an intensive sampling event on the East Fork Owyhee River to assess concentrations of toxicants released from tailings at the Rio Tinto Copper Mine. TEPP has sampled 28 locations on the Reservation (Figure 3) and measured metals[24] in the surface waters, in sediments, and in fish.

Under this plan, the Tribes will coordinate with TEPP to avoid redundant water quality sampling on the Reservation. This plan will rely on TEPP to monitor water quality in areas where monitoring efforts overlap. This plan, however, will monitor water quality on streams where no monitoring occurs under TEPP.

[24] Metals included aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

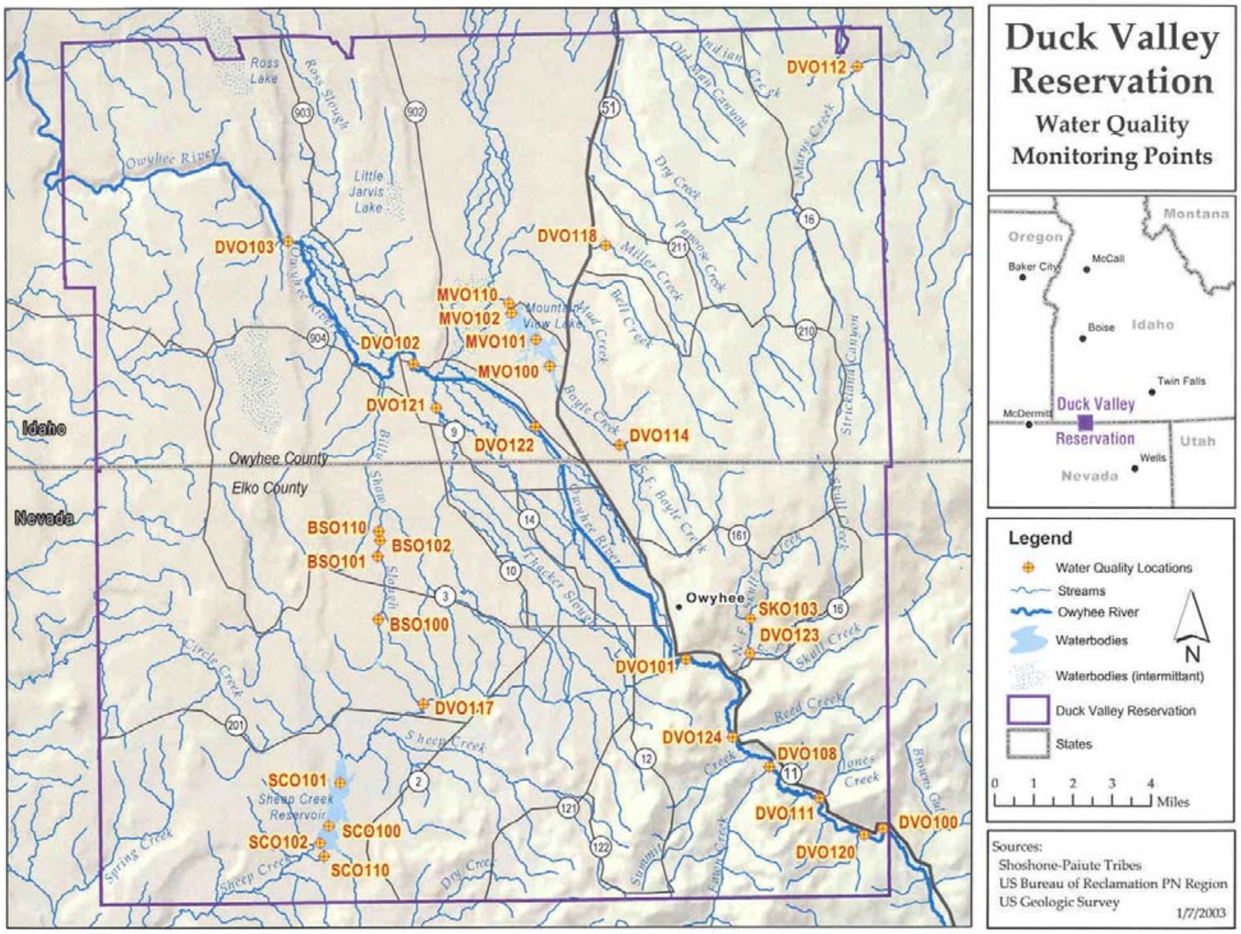

Figure 3. Water quality sites sampled by the Tribal Environmental Protection Program on the Duck Valley Indian Reservation.

Effectiveness monitoring

The Shoshone-Paiute Tribes are actively involved in restoring and improving aquatic habitat conditions on the Reservation. Their goal is to protect and enhance aquatic ecosystems on the Reservation. They have identified three classes of actions that should improve aquatic conditions on the Reservation:

- Protect and enhance springs and headwater springs
- Reclaim unimproved backcounty roads
- Restore habitat conditions within the East Fork Owyhee River

It is important to note that the sites sampled for effectiveness monitoring will be integrated with status/trend monitoring and ongoing monitoring activities of TEPP. Although this section identifies the number and general location of sites for monitoring the effectiveness of the three classes of actions, sites selected for status/trend and by TEPP may overlap with effectiveness monitoring sites. If that happens, then the sites selected under those programs will be used to help assess treatment effects. For example, if a status/trend monitoring site falls within the proposed treatment area on the East Fork Owyhee River, that site would then also serve as an effectiveness monitoring site, thereby reducing the number of additional effectiveness monitoring sites to be selected. The same is true for TEPP sites. If any TEPP sites fall within treatment or control areas, those sites will also be included as effectiveness monitoring sites.

What follows is a description of the objectives, statistical design, sampling design, and indicators that will be measured to assess effectiveness of each action implemented on the Reservation. Appendix A outlines plans for monitoring effectiveness of each of the classes of actions.

Spring Enhancement and Headwaters Protection

The goal of this action is to improve water quality, stream flows, and channel and riparian conditions on the Reservation by protecting headwaters and springs from livestock use. The specific objectives are to:

1. Improve water quality by excluding livestock from headwaters and springs.
2. Improve stream flow conditions and bank stability by excluding livestock from headwaters and springs.
3. Decrease fine sediment delivery to channels by excluding livestock from headwaters and springs.
4. Protect and restore riparian habitat conditions by excluding livestock from headwaters and springs.
5. Increase the abundance and distribution of salmonids (especially redband trout) by excluding livestock from headwaters and springs.
6. Increase the abundance and diversity of aquatic insects in streams by excluding livestock from headwaters and springs.

7. Increase the occurrence of yellow warblers and Columbia spotted frogs by excluding livestock from headwaters and springs.

The Tribes fenced headwaters, springs, and sensitive riparian areas and provided off-site stock watering areas in the Reed Creek, Jones Creek, Summit Creek, and in the East Fork Owyhee drainages. By implementing these strategies, the Tribes intend to test the following hypotheses:

1. The exclusion of livestock from headwaters and springs will significantly reduce stream temperatures and turbidity.
2. The exclusion of livestock from headwaters and springs will significantly increase stream flows and bank stability.
3. The exclusion of livestock from headwaters and springs will significantly decrease the accumulation of fine sediments in stream channels.
4. The exclusion of livestock from headwaters and springs will significantly improve riparian habitat conditions.
5. The exclusion of livestock from headwaters and springs will significantly increase that abundance and distribution of redband trout.
6. The exclusion of livestock from headwaters and springs will significantly increase the abundance and diversity of aquatic macroinvertebrates.
7. The exclusion of livestock from headwaters and springs will significantly increase the occurrence of yellow warblers and Columbia spotted frogs in riparian areas.

Statistical Design:

Because the Tribes began protecting springs and sensitive headwater streams from livestock before 2004, a BACI design is not possible. Instead, the effects of these actions will be assessed with a control-treatment design, which will compare biological and physical/environmental indicators in control areas (springs and headwater streams that were not treated) with treatment sites. Because the Tribes have treated different sites in different years, there should be a "gradient" of effects among treated sites. Thus, by collecting data from an unbiased sample of treated sites from each treatment year, the Tribes should be able to model with time and time x treatment interaction indicators. That is, the Tribes will collect data from a random sample of sites treated in year 2000, 2001, 2002, and 2003. Data will be compared among treatment years and with a random sample of sites that have not been treated (controls). The Tribes will monitor the same indicators using the same protocols for at least five years in both treatment and control areas.

Sampling Design:

This study does not allow the Tribes to randomly assign treatments to sites, because the sites have already been treated. However, the Tribes will randomly select treatment and control sites for monitoring. That is, from the array of sites already treated, the Tribes will randomly select three (3) sites from each treatment year for monitoring. They will also randomly select three (3) sites from the array of potential control sites.[25] Therefore, if there are four treatment years and one set of control sites, the total sample size for monitoring this action will be 15 randomly-selected sites.

Indicators:

Based on the objectives and hypotheses, the following biological and physical/environmental indicators will be measured at each of the 15 sampling sites.

Biological Conditions:
- Abundance and distribution of redband trout
- Abundance and diversity of aquatic macroinvertebrates
- Occurrence of yellow warblers
- Occurrence of Columbia spotted frogs

Water Quality:
- Temperature (MDMT and MWMT)
- Turbidity

Habitat Quality:
- Dominant substrate
- Embeddedness
- Number of pools
- Residual pool depth

Channel Condition:
- Width/depth ratio
- Wetted width
- Bankfull width
- Bank stability

Riparian Condition:
- Riparian structure
- Riparian disturbance
- Canopy cover

Flows and Hydrology:
- Stream flows

Section 7 describes methods that will be used to measure these indicators.

Although these indicators will be measured in only a random sample of treatment and control sites, all treated sites and sampled control sites will be documented with photographs. That is, all sites that receive a treatment (i.e., fencing) and monitored control sites will be photographed each year during base-flow conditions. Sites will be photographed from the same location each year (fixed photo points).

[25] Potential control sites will be matched as closely as possible with treatment sites based on the landscape classification variables described in Section 4.

Unimproved Backcounty Road Reclamation

The goal of this action is to reduce erosion and fine sediment recruitment to streams along backcountry roads and stream crossings on the Reservation. The specific objectives are to:

1. Improve water quality of streams by improving backcountry roads and streams crossings.
2. Improve stream habitat conditions (pools) by improving backcountry roads and streams crossings.
3. Decrease fine sediment delivery to channels by improving backcountry roads and streams crossings.
4. Increase the abundance of salmonids (especially redband trout) by improving backcountry roads and streams crossings.
5. Increase the abundance and diversity of aquatic insects in streams by improving backcountry roads and streams crossings.

The Tribes installed drainage dips (cross drains), sediment catchments, geo-web, and rock crossings (or culverts) where springs or small streams cross roads. They also in-sloped and contoured roads and re-vegetated along the streams. These actions were implemented in the Skull Creek, North Fork Skull Creek, Fawn Creek, and Summit Creek drainages. The Tribes will test the following hypotheses:

1. The improvement of backcountry roads and stream crossings will significantly reduce stream turbidity.
2. The improvement of backcountry roads and stream crossings will significantly increase numbers of pools and residual pool depths.
3. The improvement of backcountry roads and stream crossings will significantly decrease the accumulation of fine sediments in stream channels.
4. The improvement of backcountry roads and stream crossings will significantly increase that abundance of redband trout in the assessment area.
5. The improvement of backcountry roads and stream crossings will significantly increase the abundance and diversity of aquatic macroinvertebrates in the assessment area.

Statistical Design:

Because the Tribes implemented road improvements in 2002 and 2003, a BACI design is not possible. Therefore, the Tribes will assess the effectiveness of their road improvement projects by using a control-treatment design. For convenience, this action will be divided into two separate studies. The Skull Creek Road Project will serve as one study, while the South Red Cabin Road Project will be a separate study. The Skull Creek Road Project occurs within the Skull Creek drainage (including the North Fork); the South Red Cabin Road Project crosses both the Summit Creek and Fawn Creek drainages. Each project will have its own control-treatment design. The Tribes will monitor the same indicators using the same protocols for at least five years in both treatment and control areas.

Sampling Design:

Because sites have already been treated, the Tribes cannot randomly assign treatments to potential sites. In addition, because both projects include multiple treatments (i.e., implementation of numerous cross-drains/drainage dips, culverts, rock crossings, road contouring and grading, etc.), this plan will identify the cumulative effects of all treatments on biological and physical/environmental indicators. With the exception of culvert placements, this plan will not identify specific treatment effects for each individual treatment type.

For both projects, the Tribes will sample randomly selected treatment and control sites. For the Skull Creek Road Project, the Tribes will randomly select four (4) monitoring sites within the treatment area and four control (4) sites upstream from the treatment areas in the Skull Creek drainage.[26] For the South Red Cabin Road Project, the Tribes will randomly select four (4) sites within each of the treatment areas in the Summit and Fawn Creek drainages and four (4) control sites upstream from the treatment areas in the Summit and/or Fawn Creek drainages. Thus, the Tribes will sample 8 sites in the Skull Creek drainage and 12 sites in the Summit/Fawn Creek drainages.

All culverts placed in fish-bearing streams will be monitored for fish passage following the protocols identified in WDFW (2000).

Indicators:

Based on the objectives and hypotheses, the following biological and physical/environmental indicators will be measured at each of the 20 sampling sites.

Biological Conditions:
- Abundance of redband trout
- Abundance and diversity of aquatic macroinvertebrates

Habitat Access:
- Fish passage through culverts

Water Quality:
- Temperature (MDMT and MWMT)
- Turbidity

Habitat Quality:
- Dominant substrate
- Embeddedness
- Number of pools
- Residual pool depth

Channel Condition:
- Width/depth ratio
- Wetted width

[26] Potential control areas will be as similar as possible to treatment areas based on landscape classification variables described in Section 4.

- Bankfull width

Section 7 describes methods that will be used to measure these indicators.

This plan requires that all treatments implemented for the two projects be documented with photographs. Sites will be photographed from the same location each year (fixed photo points) during base-flow conditions.

Restoration of the East Fork Owyhee River

The goal of this action is to improve water quality, stream habitat, and channel and riparian conditions on the East Fork Owyhee River by implementing specific habitat restoration actions. The objectives of this project are to:

1. Improve water quality on the East Fork by implementing restoration and protection activities.
2. Improve habitat and channel conditions on the East Fork by implementing restoration and protection activities.
3. Decrease fine sediment delivery to the East Fork by implementing restoration and protection activities.
4. Improve riparian habitat conditions on the East Fork by implementing restoration and protection activities.
5. Increase the abundance of salmonids (especially redband trout) on the East Fork by implementing restoration and protection activities.
6. Increase the abundance and diversity of aquatic insects on the East Fork by implementing restoration and protection activities.
7. Increase the occurrence of yellow warblers and Columbia spotted frogs along the East Fork by implementing restoration and protection activities.

Along 3.5 miles of the East Fork Owyhee River, the Tribes will plant willows, re-slope and transplant shrubs on toe, excavate low-flow channel and floodplain, construct gravel bars, install riparian revetments and fabric-encapsulated soil lifts, and create new floodplains. By implementing these actions, the Tribes will test the following hypotheses:

1. The implementation of restoration actions will significantly reduce stream temperatures and turbidity on the East Fork Owyhee River.
2. The implementation of restoration actions will significantly reduce fine sediment concentrations in the East Fork Owyhee River.
3. The implementation of restoration actions will significantly increase habitat diversity on the East Fork Owyhee River.
4. The implementation of restoration actions will significantly improve channel conditions in the East Fork Owyhee River.
5. The implementation of restoration actions will significantly improve riparian habitat conditions along the East Fork Owyhee River.

6. The implementation of restoration actions will significantly increase the abundance of redband trout in the East Fork Owyhee River.
7. The implementation of restoration actions will significantly increase the abundance and diversity of aquatic macroinvertebrates in the East Fork Owyhee River.
8. The implementation of restoration actions will significantly increase the occurrence of yellow warblers and Columbia spotted frogs in riparian areas along the East Fork Owyhee River.

Statistical Design:

The Tribes will use a BACI design to assess treatment effects. Because the proposed treatment area (3.5-mile reach) will receive several treatments, this study will not assess the effects of each individual treatment. Rather, this study will assess the cumulative effects of the all treatments on biological and physical/environmental indicators. The Tribes will collect data on indicators in both the treatment area and control area at least once before the implementation of treatments. The control area will be upstream from the proposed treatment area and will be as similar as possible to the treatment area based on classification variables described in Section 4. Following the implementation of treatments, the Tribes will monitor the same indicators using the same protocols for at least five years in both the treatment and control areas.

Sampling Design:

The Tribes will randomly select sites for monitoring in both treatment and control areas. Three (3) sites will be selected randomly in both the treatment and control areas. Thus, for this project, the Tribes will monitor a total of six (6) sites on the East Fork Owyhee River.

Indicators:

Based on the objectives and hypotheses of this project, the following biological and physical/environmental indicators will be measured at each of the six (6) sites.

Biological Conditions:

- Abundance of salmonids (emphasis on redband trout)
- Abundance and diversity of aquatic macroinvertebrates
- Occurrence of yellow warblers
- Occurrence of Columbia spotted frogs

Water Quality:

- Temperature (MDMT and MWMT)
- Turbidity

Habitat Quality:

- Substrate composition
- Embeddedness
- Fequency of LWD
- Number of pools
- Residual pool depth
- Fish cover

- Off-channel habitat

Channel Condition:

- Width/depth ratio
- Wetted width
- Bankfull width
- Bank stability

Riparian Condition:

- Riparian structure
- Riparian disturbance
- Canopy cover

Section 7 describes methods that will be used to measure these indicators.

This plan requires that all treatments implemented in the 3.5-mile reach will be documented with photographs. Sites will be photographed from the same location each year (fixed photo points) during base-flow conditions.

Measuring protocols

The Tribes believe it is important to use the same measurement method for measuring a given indicator. The reason for this is to allow comparisons of biological and physical/environmental conditions within and among watersheds on the Reservation and across basins.[27] This section identifies methods that will be used to measure biological and physical/environmental indicators. The methods identified in this plan are consistent with those described in other programs (e.g., the Action Agencies/NOAA Fisheries RME Plan and the Upper Columbia Basin Monitoring Strategy) and are mostly consistent with EMAP and SRFB protocols.

Not surprisingly, there can be several different methods for measuring the same variable (Johnson et al. 2001). For example, channel substrate can be described using surface visual analysis, pebble counts, or substrate core samples (either McNeil core samples or freeze-core samples). These techniques range from the easiest and fastest to the most involved and informative. As a result, one can define two levels of sampling methods. Level 1 (extensive methods) involves fast and easy methods that can be completed at multiple sites, while Level 2 (intensive methods) includes methods that increase accuracy and precision but require more sampling time. This strategy, like other programs, uses primarily Level 2 methods, which minimize sampling error.

Before identifying measuring protocols, it is important to define a few terms. These terms are consistent with the Action Agencies/NOAA Fisheries RME Plan and the Upper Columbia Basin Monitoring Strategy (Hillman 2004).

Reach (effectiveness monitoring) – for effectiveness monitoring, a stream reach is defined as a relatively homogeneous stretch of a stream having similar regional, drainage basin, valley segment, and channel segment characteristics and a repetitious sequence of habitat types. Reaches are identified by using a list of classification (stratification) variables (from Table 1). Reaches may contain one or more sites. The starting point and ending point of reaches will be measured with Global Positioning System (GPS) and recorded as Universal Transverse Mercator (UTM).

Reach (status/trend monitoring) – for status/trend monitoring, a reach is a length of stream (20 times the mean bankfull width, but not less than 150-m long or longer than 500 m)[28] selected with a systematic randomized process (GRTS design). GRTS selects a point on the "blue-line" stream network represented on a 1:100,000 scale USGS map. This point is referred to as the "X-site." The X-site identifies the midpoint of the reach. That is, the sampling reach extends a

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[27] Bonar and Hubert (2002) and Hayes et al. (2003) review the benefits, challenges, and the need for standardized sampling.

[28] This reach length differs from Simonson et al. (1994) and Reynolds et al. (2003), which use 40x the wetted width. The use of 20x the bankfull width is consistent with AREMP and PIBO protocols. This protocol also allows one to assess channel conditions even if the channel is dry. There are naturally dry channels within the project area.

distance of 10 times the average bankfull width upstream and downstream from the X-site, measured along the thalweg[29]. Biological and physical/environmental indicators are measured within the reach. The X-site and the upstream and downstream ends of the reach will be measured with GPS and recorded as UTM. For purposes of re-measurements, these points will also be photographed, marked with permanent markers (e.g., orange plastic survey stakes or rebar[30]), and carefully identified on maps and site diagrams. Reach lengths and boundaries will be "fixed" the first time they are surveyed and they will not change over time even if future conditions change.

Site (effectiveness monitoring) – a site is an area of the effectiveness monitoring stream reach that forms the smallest sampling unit with a defined boundary. Site length depends on the width of the stream channel. Sites will be 20 times the average bankfull width with a minimum length of 150 m and a maximum length of 500 m. Site lengths are measured along the thalweg. The upstream and downstream boundaries of the site will be measured with GPS and recorded as UTM. For purposes of re-measurements, these points will also be photographed, marked with permanent markers (e.g., orange plastic survey stakes or rebar), and carefully identified on maps and site diagrams. Site lengths and boundaries will be "fixed" the first time they are surveyed and they will not change over time even if future conditions change.

Transect – a transect is a straight line across a stream channel, perpendicular to the flow, along which habitat features such as width, depth, and substrate are measured at pre-determined intervals. Effectiveness monitoring sites and status/trend monitoring reaches will be divided into 11 evenly-spaced transects by dividing the site into 10 equidistant intervals with "transect 1" at the downstream end of the site or reach and "transect 11" at the upstream end of the site or reach.

Habitat Type – Habitat types, or channel geomorphic units, are discrete, relatively homogenous areas of a channel that differ in depth, velocity, and substrate characteristics from adjoining areas. The Tribes will identify the habitat type under each transect within a site or reach following the Level II classification system in Hawkins et al. (1993). That is, habitat will be classified as turbulent fast water, non-turbulent fast water, scour pool, or dammed pool (see definitions in Hawkins et al. 1993). By definition, for a habitat unit to be classified, it should be longer than it is wide. Plunge pools, a type of scour pool, are the exception, because they can be shorter than they are wide.

Biological Variables

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[29] "Thalweg" is defined as the path of a stream that follows the deepest part of the channel (Armantrout 1998).
[30] Metal detectors can be used to relocate rebar.

As noted in Section 5, biological variables that will be measured on the DVIR can be grouped into four general categories: fish, macroinvertebrates, amphibians, and birds. Each of these general categories consists of one or more indicator variables (Table 9). These biological indicators in concert will describe the characteristics of biotic populations on the Reservation and will provide information necessary for assessing recovery of important Tribal resources.

Table 9. List of protocols and sampling frequency for biological indicator variables.

General characteristics	Specific indicators	Recommended protocol	Sampling frequency
Fish	Fish abundance	Thurow (1994); Reynolds (1996); Van Deventer and Platts (1989)	Annual
	Age/size structure	Borgerson (1992); Anderson and Neumann (1996)	Annual
	Origin (hatchery or wild)	Borgerson (1992)	Annual
	Redd abundance	Mosey and Murphy (2002)	Annual
	Redd distribution	Mosey and Murphy (2002)	Annual
Macroinvertebrates	Abundance	Peck et al. (2001)	Annual
	Composition	Peck et al. (2001)	Annual
Amphibians	Occurrence	USFS Protocol; Olson et al. (1997)	Annual
	Abundance	USFS Protocol; Olson et al. (1997)	Annual
Birds	Occurrence	Sutherland (1996)	Annual
	Abundance	Sutherland (1996)	Annual

Fish

Abundance:

Numbers of fish (with emphasis on salmonids) will be estimated within status/trend monitoring reaches and effectiveness monitoring sites using underwater observations (snorkeling) or electrofishing surveys. Snorkeling, which is a quick, nondestructive method that is not restricted by deep water and low conductivities,[31] is the "primary" sampling method in this plan. Snorkel surveys will follow the protocols identified in Thurow (1994). For each fish observed, snorkelers will estimate fish size to the nearest 2 cm and report numbers as fish/ha.

[31] Hillman and Miller (2002) reported that snorkel estimates were more accurate than electrofishing estimates in the Chiwawa River, a Wenatchee River tributary, because low conductivity (35 μmhos) in the river reduced the efficiency of electrofishing. They noted that electrofishing estimates were at best 68% of snorkel estimates.

Electrofishing is the "secondary" method and will be used within a sub-sample of snorkel sites. This plan recommends that at least six randomly-selected sites (20% of the status/trend sites sampled annually) be sampled with both snorkeling and electrofishing.[32] The purpose for this is to establish a relationship between the methods and to collect fish for assessment of condition (length and weight) and age. Electrofishing will follow the protocols outlined in Reynolds (1996). For salmonids, fork length (anterior tip to the median caudal fin rays) will be measured to the nearest 1 mm and weighed to the nearest 1 g. For all other fish, total length (anterior tip to the longest "compressed" caudal fin rays) will be measured to the nearest 1 mm and weighed to the nearest 1 g. This plan recommends the removal-depletion method of electrofishing, with at least three complete passes. The maximum-likelihood formula (Van Deventer and Platts 1989) will estimate population numbers and 95% confidence intervals. Numbers of fish will be reported as fish/ha.

Age/Size Structure:

Age structure describes the ages of fish within the population, while size describes the lengths and weights of fish within the population. Size structure will be estimated with both snorkeling and electrofishing. Scales will be pulled and read to determine age structure and origin (wild or hatchery). Age analysis will be completed following methods described by Borgerson (1992).

Origin:

Origin identifies the parentage (hatchery or wild) of individuals within the population. Origin will be assessed by examining scales or fins, with hatchery fish tending to have deformed or eroded fins.

Redd Abundance and Distribution:

Abundance describes the number of redds (nests) of fish species within a given area. Total numbers (based on a complete census) will be estimated for redband trout. Distribution indicates the spatial arrangement (e.g., random, even, or clumped) and geographic extent of redds within the basin. Throughout the spawning period, the Tribes will conduct weekly redd surveys following the example of Mosey and Murphy (2002). Each week new redds will be counted, mapped, and marked.[33] Marking is needed to avoid recounting redds during subsequent surveys. Abundance of redds will be reported as the number of redds within a population. Abundance will also be reported as the number of redds per km within each population.

Macroinvertebrates

[32] Sampling within a site will occur within the same day and sites will be blocked to fish prevent movement into and out of the site during and between sampling.
[33] Because of inclement weather and high streamflows, surveys for redband trout redds may not be made on regularly timed intervals. Adjusting surveys to fit environmental conditions may be necessary.

Abundance/Diversity:

This plan includes benthic macroinvertebrate abundance and diversity (composition) as important indicators of aquatic invertebrates in streams. Benthic macroinvertebrate assemblages in streams reflect overall biological integrity of the benthic community. The Tribes will follow the "targeted-riffle-sample" method described in Peck et al. (2001). This method requires at least eight independent kick-net[34] samples from riffles within sites or reaches. The eight samples are combined, sieved to remove debris and sediments, and then processed in a lab. Samples will be analyzed according to the River InVertebrate Prediction and Classification System (RIVPACS) (Hawkins et al. 2001).

Amphibians

Occurrence/Abundance:

Occurrence (presence) and abundance of amphibians (Columbia spotted frogs) are biological indicators that describe the health of a riparian ecosystem. The Tribes will follow the standard protocol developed by the Northern Nevada Spotted Frog Technical Team (NNSFTT) (Amy 2003) and used by the U.S. Forest Service on the Ruby Mountains/Jarbidge and Mountain City Ranger districts. The two-person survey protocol is not time constrained and follows the search pattern described in Olson et al. (1997). In accordance with this protocol, every attempt is made to capture all individuals for positive identification. These protocols are used to census spotted frogs in the Owyhee and Bruneau basins.

Birds

Occurrence/Abundance:

Another indicator of a healthy riparian ecosystem is the presence of yellow warblers. The Tribes will follow the protocols described in Sutherland (1996). Specifically, field workers will use "response to playback" to identify the presence and distribution of yellow warblers within monitoring sites. To minimize bias, playbacks will be broadcast for set durations at a standard volume under set conditions (e.g., certain periods of the day).

Physical/Environmental Variables

This section identifies the methods and instruments that will be used to measure physical/environmental indicators. Table 10 identifies indicator variables, example protocols for measuring indicators, and sampling frequency. Importantly, and for obvious reasons, all habitat

[34] The kick net is a D-frame sampler with a 30.5-cm wide base, a muslin bottom panel, a net with a mesh size of 500 µm, and a detachable bucket with a 500-µm mesh end (see Figure 11-1 in Peck et al. 2001).

sampling will follow fish sampling (snorkeling and electrofishing) within status/trend monitoring reaches and effectiveness monitoring sites.

Table 10. List of protocols and sampling frequency of physical/environmental indicator variables. Table is modified from Hillman (2004).

General characteristics	Specific indicators	Recommended protocols	Sampling frequency
Water Quality	MWMT/MDMT	Zaroban (2000)	Annual/Continuous (hourly)
	Turbidity	OPSW (1999)	Annual/Continuous (hourly)
	Conductivity	OPSW (1999)	Annual/Continuous (hourly)
	pH	OPSW (1999)	Continuous (hourly)
	Dissolved Oxygen	OPSW (1999)	Continuous (hourly)
Habitat Access	Road crossings	Parker (2000); WDFW (2000)	Annual
	Diversion dams	WDFW (2000)	Annual
Habitat Quality	Dominant substrate	Peck et al. (2001)	Annual
	Embeddedness	Peck et al. (2001)	Annual
	LWD (pieces/km)	BURPTAC (1999)	Annual
	Pools per kilometer	Hawkins et al. (1993); Overton et al. (1997)	Annual
	Residual pool depth	Overton et al. (1997)	Annual
	Fish cover	Peck et al. (2001)	Annual
	Off-channels habitats	WFPB (1995)	Annual
Channel condition	Stream gradient	Peck et al. (2001)	Annual
	Width/depth ratio	Peck et al. (2001)	Annual
	Wetted width	Peck et al. (2001)	Annual
	Bankfull width	Peck et al. (2001)	Annual
	Bank stability	Moore et al. (2002)	Annual
Riparian Condition	Structure	Peck et al. (2001)	Annual
	Disturbance	Peck et al. (2001)	Annual
	Canopy cover	Peck et al. (2001)	Annual
Flows and Hydrology	Streamflow	Peck et al. (2001)	Continuous
Watershed Condition	Watershed road density	WFC (1998); Reeves et al. (2001)	5 years
	Riparian-road index	WFC (1998)	5 years

Water Quality

Water Temperature:

This plan includes two temperature metrics that will serve as specific indicators of water temperature: maximum daily maximum temperature (MDMT) and maximum weekly maximum temperature (MWMT). Data loggers will be used to measure MWMT and MDMT. Zaroban (2000) describes pre-placement procedures (e.g., selecting loggers and calibration of loggers), placement procedures (e.g., launching loggers, site selection, logger placement, and locality documentation), and retrieval procedures. This manual also provides standard methods for conducting temperature-monitoring studies associated with land-management activities and for characterizing temperature regimes throughout a watershed.

Data loggers will record temperatures hourly to the nearest 0.1˚C throughout the year. Investigators will also measure water temperatures with a calibrated thermometer at each site or reach sampled for fish. These snap-shot measurements will be used to assess the reliability of fish sampling techniques.[35]

Turbidity:

This plan includes turbidity as the one sediment-related specific indicator under water quality. The Tribes will measure turbidity with monitoring instruments calibrated on the nephelometric turbidity method (NTUs). Chapter 11 in OPSW (1999) provides a standardized method for measuring turbidity, data quality guidelines, equipment, field measurement procedures, and methods to store and analyze turbidity data.

Monitoring instruments will measure turbidity hourly to the nearest 1 NTU throughout the year. The Tribes will also measure turbidity with a portable turbidimeter within each site or reach sampled for fish. Because both electrofishing and snorkeling are affected by turbidity, these snap-shot measurements will be used to assess the reliability of the fish sampling techniques.

Conductivity, pH, and Dissolved Oxygen:

This plan includes three addition indicators associated with water quality: conductivity, pH, and dissolved oxygen (DO). OPSW (1999) identifies standard methods for measuring conductivity (Chapter 9), pH (Chapter 8), and DO (Chapter 7).[36] OPSW (1999) also includes criteria for data quality guidelines, equipment, field-measurement procedures, and methods to store and analyze water quality data.

Water quality instruments will be used to monitor conductivity, pH, and DO. These indicators will be measured hourly throughout the year. Hydrolab® has a water quality instrument (DataSonde 4a)[37] that measures the water quality indicators identified in this plan (Table 11). Conductivity will be measured to the nearest 0.1 µmhos/cm, pH to the nearest 0.1 unit, and DO to the nearest 0.1 mg/L. Because conductivity affects electrofishing success, a portable conductivity meter will be used to measure conductivity within each site or reach sampled for fish.

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[35] Both electrofishing and snorkeling are affected by water temperature. Hillman et al. (1992) demonstrated that snorkel counts are less reliable at cold water temperatures.
[36] Although OPSW (1999) indicates that the Winkler Titration Method is the most accurate method for measuring DO concentration, this plan will use an electronic recording device with an accuracy of at least ±0.2 mg/L.
[37] Information on Hydrolab and the DataSonde 4a can be found at http://www.hydrolab.com. The use of trade names in this paper does not imply endorsement by the Shoshone-Paiute Tribes.

Table 11. Water quality indicators, range, accuracy, and resolution of the DataSonde 4a developed by Hydrolab.

Indicator	Range	Accuracy	Resolution
Temperature	-5˚ to 50˚C	±0.10˚C	0.01˚C
Turbidity	0 to 1000 NTU	±5% of range	0.1 to 1 NTU
Conductivity	0 to 100 mS/cm	±0.001 mS/cm	4 digits
pH	0 to 14 units	±0.2 units	0.01 units
Dissolved oxygen	0 to 50 mg/L	±0.2 mg/L	0.01 mg/L

Habitat Access:

Artificial Physical Barriers:

The plan includes two specific indicators associated with artificial physical barriers: road crossings (culverts) and dams. Remote sensing (aerial photos, LANDSAT ETM+, or both) will be used as a first cut to identify possible barriers. The Tribes will then conduct field surveys using the WDFW (2000) protocols to evaluate possible barriers. The WDFW (2000) manual provides guidance and methods on how to identify, inventory, and evaluate culverts and dams (diversions) that impede fish passage. WDFW (2000) also provides methods for estimating the potential habitat gained upstream from barriers, allowing prioritization of restoration projects. The manual by Parker (2000) focuses on culverts and assesses connectivity of fish habitats on a watershed scale. These manuals can be used to identify all fish passage barriers within monitoring reaches. Assessment of fish passage barriers will occur once annually during base-flow conditions.

Habitat Quality

Substrate:

This plan includes two specific indicators of substrate: dominant substrate (composition) and embeddedness. Peck et al. (2001) provides a method for describing substrate composition within each site or reach. Substrate composition will be assessed within the bankfull width (not wetted width) along the “channel bottom” in the site or reach, regardless if the channel is wet or dry. The Tribes will measure substrate at five equidistant points along each of the 11 “regular” transects, plus along an additional 10 transects placed mid-way between each of the 11 transects. The Tribes will visually estimate the size of a particle at each of the points along the 21 transects (total sample size of 105 particles). Classification of bed material by particle size will follow Table 12. For each sampling site or reach, the Tribes will report the dominant substrate size. Additionally, they will calculate reach-level means, standard deviations, and percentiles for substrate size classes (following methods in Kaufmann et al. 1999). Substrate will be characterized annually during base-flow conditions.

Table 12. Classification of stream substrate channel materials by particle size. Table is from Peck et al. (2001).

Class name	Size range (mm)	Description
Bedrock (smooth)	>4,000	Smooth surface rock larger than a car
Bedrock (rough)	>4,000	Rough surface rock larger than a car
Hardpan		Firm, consolidated fine substrate
Boulders	>250-4,000	Basketball to car size
Cobbles	>64-250	Tennis ball to basketball size
Gravel (coarse)	>16-64	Marble to tennis ball size
Gravel (fine)	>2-16	Ladybug to marble size
Sand	>0.06-2	Smaller than ladybug size, but visible as particles
Fines	<0.06	Silt, clay, muck (not gritty between fingers)

Peck et al. (2001) also provides methods for measuring embeddedness. As with substrate composition, embeddedness will be assessed within the bankfull width (not wetted width) along the "channel bottom," regardless if the channel is dry or wet. Embeddedness will be estimated at five equidistant points along the 11 "regular" transects (total sample size of 55). At each sampling point along a transect, all particles larger than sand within a 10-cm diameter circle will be examined for embeddedness. Embeddedness is the fraction of particle surface that is surrounded by sand or finer sediments. By definition, sand and fines are embedded 100%, while bedrock is embedded 0%. The Tribes will record the average percent (%) embeddedness of particles in the 10-cm circle. Embeddedness will be measured once annually during base-flow stream conditions.

Large Woody Debris:

Large woody debris (LWD) consists of large pieces of relatively stable woody material located within the bankfull channel and appearing to influence bankfull flows. The Tribes will simply count the number of LWD pieces within sites or reaches (wet or dry) in forested streams (e.g., see BURPTAC 1999). Pieces are counted throughout the entire reach or site, not just along transects. LWD will be divided into three size categories: >10 cm x >1 m; >15 cm x >6 m; and >30 cm x >3 m (diameter x length, respectively). The Tribes will record the count of LWD pieces within each size category. This indicator will be measured once annually during base-flow conditions.

Pool Habitat:

This plan includes two indicators associated with pool habitat: number of pools per km and residual pool depth. The Tribes will count the number of pools throughout a monitoring reach or site. To be counted, a pool must span more than half the wetted width, include the thalweg, be longer than it is wide, and the maximum depth must be at least 1.5 times the crest depth. Plunge pools are included in this definition even though they may not be as long as they are wide. Hawkins et al. (1993) and Overton et al. (1997) provide good descriptions of the various types of pools and how to identify them. Pools are counted throughout the entire reach or site, not just along transects.

Overton et al. (1997) describe methods for measuring residual pool depth. Residual pool depth is simply the difference between the maximum pool depth and the crest depth. Measurements differ, however, depending on the type of pool. For dammed pools, residual depth is the difference between maximum pool depth and maximum crest depth at the head of the pool. For scour pools, on the other hand, residual pool depth is the difference between maximum pool depth and maximum crest depth at the tail of the pool. Depths are measured to the nearest 0.01 m. For effectiveness monitoring, residual pool depth will be measured in all pools within treatment and control sites. For status/trend monitoring, residual pool depth will be measured in all pools within a reach. Both pool per km and residual pool depth will be measured once annually during base-flow conditions.

Fish Cover:

Fish cover is measured within the wetted width of a site or reach. Fish cover is not measured in dry side channels. It is visually estimated at 5 m upstream and 5 m downstream (10-m total length) at each of the 11 "regular" transects following procedures described in Peck et al. (2001). Cover types consist of filamentous algae, aquatic macrophytes (including wetland grasses), large woody debris, brush and small woody debris, in-channel live trees or roots, overhanging vegetation (within 1 m of the water surface but not in the water), undercut banks, boulders, and artificial structures (e.g., concrete, cars, tires, rip-rap, etc.). For each cover type, the Tribes will record areal cover as: 0 (zero cover), 1 (<10% cover), 2 (10-40% cover), 3 (40-75% cover), and 4 (>75% cover). Fish cover will be estimated annually during base-flow conditions.

Off-Channel Habitat:

Off-channel habitat consists of side-channels, backwater areas, alcoves or sidepools, off-channel pools, off-channel ponds, and oxbows. Following the definitions for each off-channel habitat type (see Section 5.3), the Tribes will enumerate the number of each type of off-channel habitat within a monitoring reach or site. Off-channel habitats will be enumerated throughout the entire site or reach, not just along transects. In addition, the Tribes will measure the lengths of side channels in the site or reach. They will record the number of off-channel habitat types and the lengths of side channels (measured to the nearest 0.5 m) within the site or reach. Sampling will occur once annually during base-flow conditions.

Channel Condition

Stream Gradient:

The water surface gradient or slope is an indication of potential water velocities and stream power. Water surface slope will be reported as a percentage[38] and will be measured according to the protocol described in Peck et al. (2001) with some modifications. Rather than measure percent slope directly with a clinometer or Abney level, as recommended in Peck et al. (2001), this plan calls for the measurement of water surface elevations with a hand level. That is, water surface elevation will be measured between each of the 21 transects (includes the 11 "regular" and 10 "additional" transects) using a hand level (5X magnifying level) and a telescoping leveling rod (graduated in cm). Beginning at the downstream-end of the reach or site, water surface elevation is measured by "backsighting" downstream between transects (results in 20 measurements per reach or site). The Tribes will record the elevation (measured to the nearest cm) and horizontal distance between transects points (measured to the nearest cm). Percent water surface slope is then calculated as the fall per unit distance (rise over run), times 100. Sampling will occur once annually during base-flow conditions.

Width/Depth Ratio:

The width/depth ratio is an index of the cross-section shape of a stream channel at bankfull level. The ratio is expressed as bankfull width (geomorphic term) divided by the mean cross-section bankfull depth. Peck et al. (2001) offer the recommended protocol for measuring bankfull widths and depths. This indicator will be measured at the 21 transects (includes the 11 "regular" and 10 "additional" transects) within each reach (for status/trend monitoring) or treatment and control sites (for effectiveness monitoring), regardless if the channel is wet or dry. Width and depth will be recorded to the nearest 0.1 m. Sampling will occur once annually during base-flow conditions.

Wetted Width:

Wetted width is the width of the water surface measured perpendicular to the direction of flow. Peck et al. (2001) describes the recommend method for measuring this indicator. Wetted width will be measured to the nearest 0.1 m at the 21 transects (11 "regular" and 10 "additional" transects) in each reach or treatment and control sites. Sampling will occur once annually during base-flow conditions.

Bankfull Width:

Bankfull width is the width of the channel (water surface) at bankfull stage. Peck et al. (2001) describe methods for measuring bankfull width. Bankfull width will be measured to the nearest 0.1 m at the 21 transects in each reach (for status/trend monitoring) or treatment and control sites (for effectiveness monitoring), regardless if the channel is wet or dry. Sampling will occur once annually during base-flow conditions.

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[38] Although this plan recommends reporting slope as a percentage, one can easily convert between percentage, decimal, and degrees with the following formulas: (1) Percent slope = slope (in decimal form) x 100; (2) Slope (in decimal form) = tan (slope in degrees); and (3) Slope (in degrees) = $\tan^{-1}$ (slope in decimal form).

Streambank Condition:

This plan includes streambank stability as the one specific indicator of streambank condition. Moore et al. (2002) describe the recommended method for assessing stream bank stability. The method estimates the percent (%) of the lineal distance that is actively eroding at the active channel height on both sides of the transect regardless if the channel is wet or dry. Active erosion is defined as recently eroding or collapsing banks and may have the following characteristics: exposed soils and inorganic material, evidence of tension cracks, active sloughing, or superficial vegetation that does not contribute to bank stability. Bank stability will be measured once annually during base-flow conditions at the 11 evenly-spaced transects within each reach (for status/trend monitoring) or treatment and control site (for effectiveness monitoring).

Riparian Condition

Structure:

Riparian structure identifies the type and amount of various kinds of riparian vegetation. Peck et al. (2001) offer methods for describing riparian structure. Riparian structure will be assessed within a 10 m x 10 m plot on both ends of each of the 11 transects, regardless if the channel is wet or dry. Within each riparian plot, the investigator will divide the vegetation into three layers: canopy layer (>5-m high), understory layer (0.5-5-m high), and the ground-cover layer (<0.5-m high). Areal cover will be estimated within each of the three vegetation layers. Aerial cover is recorded as “0” if no cover; “1” if <10% cover; “2” if 10-40%; “3” if 40-75%; or “4” if >75% cover. The type of vegetation will be described in both the canopy and understory layers. Vegetation types include deciduous, coniferous, broadleaf evergreen, mixed, and none. Kaufmann et al. (1999) describes methods for analyzing riparian structure data. This indicator will be measured once annually during base-flow conditions.

Disturbance:

Riparian disturbance will be measured as the presence and proximity of various types of human land-use activities in the riparian area. Peck et al. (2001) provide the recommended method for assessing this indicator. The presence/absence and proximity of 11 categories of human influences will be described within 5 m upstream and 5 m downstream from each of the 11 transects, regardless if the channel is wet or dry. Human influences include: (1) walls, dikes, revetments, riprap, and dams; (2) buildings; (3) pavement/cleared lot; (4) roads or railroads; (5) inlet or outlet pipes; (6) landfills or trash; (7) parks or maintained lawns; (8) row crops; (9) pastures, rangeland, hay fields, or evidence of livestock, (10) logging; and (11) mining. Proximity classes include: (1) present within the defined 10 m stream segment and located in the stream or on the stream bank; (2) present within the 10 x 10 m riparian plot but away from the bank; (3) present but outside the riparian plot; and (4) not present within or adjacent to the 10 m stream segment or the riparian plot area at the transect. Kaufmann et al. (1999) describes methods for analyzing riparian disturbance data. Riparian disturbance will be measured once annually during base-flow conditions.

Canopy Cover:

Peck et al. (2001) describe the recommended method for measuring canopy cover. Canopy cover will be measured at each of the 11 equally-spaced transects in wet or dry channels using a Convex Spherical Densiometer (model B). Six measurements are collected at each transect (four measurements in four directions at mid-channel and one at each bank). The mid-channel measurements estimate canopy cover over the channel, while the two bank measurements estimate cover within the riparian zone. The two bank measurements are particularly important in wide streams, where riparian canopy may not be detected at mid-channel. The investigator records the number of grid intersection points (0-17) that are covered by vegetation at the six points along each transect. Mean densiometer readings and standard deviations are calculated according to methods described in Kaufmann et al. (1999). Canopy cover will be measured once annually during base-flow conditions.

Flows and Hydrology

Streamflows:

Changes in streamflows will be assessed by collecting flow data at the downstream end of monitoring reaches and/or at the downstream end of the distribution of each population or subpopulation. The Tribes will use USGS or State flow data where available to assess changes in peak, base, and timing of flows. For those streams or springs with no USGS or State stream-gauge data, the Tribes will use the velocity-area method described in Peck et al. (2001) to estimate stream flows. Water velocities will be measured to the nearest 0.01 m/s with a calibrated water-velocity meter rather than the float method. Wetted width and depth will be measured to the nearest 0.1 m. Flows will be reported as m^3/s.[39]

Watershed Conditions

Road Density:

The plan includes road density and the riparian-road index (RRI) as indicators of roads within watersheds. Using remote sensing, the Tribes will measure the road density and riparian-road index within each watershed in which monitoring activities occur. Road density will be calculated with GIS as the total length (km) of roads within a watershed divided by the area (km^2) of the watershed. The riparian-road index will be calculated with GIS as the total kilometers of roads within riparian areas divided by the total number of stream kilometers within the watershed. WFC (1998) provides an example of

[39] The following formula can be used to convert cfs (cubic feet per second) to cms (cubic meters per second): cms = cfs x 0.02832.

calculating the riparian-road index in the Umpqua Basin. Both road density and the riparian-road index will be updated once every five years.

Equipment List

This section identifies the equipment that will be used to monitor biological and physical/environmental indicators on the Duck Valley Indian Reservation (Table 13). Some equipment will be used for more than one general indicator. Those items (e.g., chest waders and boots) are listed only once.

Table 13. List of equipment needed to monitor biological and physical/environmental indicators on the Duck Valley Indian Reservation.

General Indicator	Equipment	Quantity
Fish populations and redds	Backpack electrofisher with batteries	2
	Battery chargers	2
	Block nets	4
	Dip nets	4
	Rubber gloves	4
	Polarized sun glasses	4
	Buckets (5-gallon)	4
	Field-worthy scale (e.g., Ohaus Scale)	2
	Measuring board (mm)	2
	MS-222	2
	Lightweight breathable waders	4
	Wading boots with felt	4
	Dry/wet neoprene suits	4
	Diving gloves	4
	Diving hoods	4
	Masks and snorkels	4
	Dive slates	4
	Biodegradable flagging tapes	10
	First aid kits	2
	Write-in-the-rain notebooks	10
	Field data sheets	100
	USGS 7.5 minute topographic maps	4
	Soft pencils	10
Macroinvertebrates	Modified kick net (D-frame with 500 µm mesh)	2

	Stopwatch	2
	Plastic buckets (2-gallon)	2

Indicator	Equipment	Quantity
Macroinvertebrates (cont.)	Forceps	2
	Sieve with 500 μm mesh	2
	HDPE plastic sample jars (1 liter)	50
	Wash bottle (l liter)	2
	Spoons or scoops	2
	Funnel with large bore spout	2
	95% ethanol (2 gallons)	2
	Sample bottle labels	100
	Rubber gloves	4
	Waterproof labels	100
	Data forms	100
	Coolers	2
	Clear tape	4
	Soft lead pencils	10
	Pocket knifes	2
Amphibians	Aquatic net with 3 ft. aluminum handle	4
	3:1 concentration of bleach/water solution (5 L)	1
	Lightweight breathable waders/boots	4
	Data forms (write-in-the-rain logbooks)	8
	Soft lead pencils	10
Birds	Bird calls on CD	2
	CD electronic caller	2
	Waterproof compact binoculars	2
	Data forms	100
	Soft lead pencils	10
Water Quality	DataSonde 4a (or other continuous recorders)	
	Optic shuttle data transporter	2
	Submersible temperature loggers	
	Multi-parameter meters (turbidity/conductivity/DO/Temp)	2
Habitat Access, Quality, and Channel Condition	Digital camera	2
	Handheld GPS	2

	Rebar (2-foot lengths)	150
	Magnifying hand level (5x)	2

Indicator	Equipment	Quantity
Habitat Access, Quality, and Channel Condition	Telescoping fiberglass leveling rods (metric)	2
	Meter sticks	2
	Metal detectors (for finding rebar)	2
	Fiberglass measuring taps (50 m)	2
	Bearing compass	2
	Convex spherical densitometer (model B)	2
	Biodegradable flagging tapes	10
	Measuring rods (2-m wood or plastic rods marked in cm)	2
	Covered clipboards	2
	Blank write-in-the-rain sheets (for site diagrams)	100
	Data forms	100
	Soft lead pencils	20
	Ten-pocket field vests	4
Flows and Hydrology	Current velocity meters	2
	Stream staff gauges	
	Data forms	50
	Soft lead pencils	10

implementation schedule

The Shoshone-Paiute Tribes intend to begin status/trend and effectiveness monitoring in 2004 (Table 14). Before field work begins, however, the Tribes will classify the entire Reservation following methods described in Section 4. They will also work with EPA on selecting status/trend monitoring sites following protocols identified in Section 5. Once those sites are selected, the Tribes will work with the Tribal Environmental Protection Program (TEPP) to coordinate monitoring efforts. At the same time they will be selecting sites for effectiveness monitoring following methods outlined in Section 6. Sites selected for effectiveness monitoring will also be coordinated with status/trend monitoring and TEPP. This will be a one-time effort and will not be repeated annually.

Following classification work and the selection of sampling sites for both status/trend and effectiveness monitoring, the Tribes will begin collecting field data (Table 14). Most field sampling will occur in July and August during base-flow conditions. Spawning surveys will be conduced during the spring when redband trout spawn. Data compiling, analysis, and report writing will occur during autumn and early winter. Draft annual reports will be submitted for review by mid-February. Final annual reports will be completed by the end of March. Annual reports will document results of status/trend and effectiveness monitoring, coordination activities with TEPP, problems associated with the monitoring strategy, and changes or improvements to the strategy.

Table 14. Monitoring activities planned for 2004.

Program	Activity	Month 2004						
		Jun	Jul	Aug	Sep	Oct	Nov	Dec
Landscape Classification	GIS classification work	X	X					
Status/Trend Monitoring	Selection of sites	X	X					
	Coordination with TEPP	X	X					
	Data collection		X	X				
Effectiveness Monitoring	Selection of sites	X	X					
	Coordination with TEPP	X	X					
	Data collection		X	X				
Report Preparation	Data compiling/analysis				X	X	X	
	Report writing						X	X

Monitoring on the Reservation should continue for at least five years. Additional years may be needed to assess effects of actions on riparian habitat conditions. Status/trend monitoring should continue indefinitely.

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Appendix A—Effectiveness monitoring projects

This appendix identifies the three classes of management actions (strategies) that will be monitored for effectiveness on the Duck Valley Indian Reservation. For each action there is a brief description of the objectives, hypotheses, indicators, strategies, statistical/sampling designs, and existing monitoring efforts.

SPRING ENHANCEMENT AND HEADWATERS PROTECTION

Goal:

Improve water quality, stream flows, channel conditions, and riparian conditions on the DVIR by protecting headwaters and springs from livestock use.

Assessment Area:

Actions will be implemented in the following drainages:

- Reed Creek drainage
- East Fork Owyhee drainage
- Jones Creek drainage
- Summit Creek drainage

Objectives:

1. Improve water quality by excluding livestock from headwaters and springs.
2. Improve stream flow conditions and bank stability by excluding livestock from headwaters and springs.
3. Decrease fine sediment delivery to channels by excluding livestock from headwaters and springs.
4. Protect and restore riparian habitat conditions by excluding livestock from headwaters and springs.
5. Increase the abundance and distribution of salmonids (especially redband trout) by excluding livestock from headwaters and springs.
6. Increase the abundance and diversity of aquatic insects in streams by excluding livestock from headwaters and springs.
7. Increase the occurrence of yellow warblers and Columbia spotted frogs by excluding livestock from headwaters and springs.

Hypotheses:

1. The exclusion of livestock from headwaters and springs will significantly reduce stream temperatures and turbidity.
2. The exclusion of livestock from headwaters and springs will significantly increase stream flows and bank stability.
3. The exclusion of livestock from headwaters and springs will significantly decrease the delivery and accumulation of fine sediments in stream channels.
4. The exclusion of livestock from headwaters and springs will significantly improve riparian habitat conditions.
5. The exclusion of livestock from headwaters and springs will significantly increase that abundance and distribution of redband trout.
6. The exclusion of livestock from headwaters and springs will significantly increase the abundance and diversity of aquatic macroinvertebrates.
7. The exclusion of livestock from headwaters and springs will significantly increase the occurrence of yellow warblers and Columbia spotted frogs in riparian areas.

Focal Species:

1. Redband Trout
2. Aquatic macroinvertebrates (especially stoneflies, mayflies, and caddisflies)
3. Yellow warbler
4. Columbia spotted frog

Indicators:

Water Quality:
- Temperature (MDMT and MWMT)
- Turbidity

Habitat Quality:
- Dominant substrate
- Embeddedness
- Number of pools
- Residual pool depth

Channel Condition:
- Width/depth ratio
- Wetted width
- Bankfull width
- Bank stability

Riparian Condition:
- Riparian structure
- Riparian disturbance
- Canopy cover

Flows and Hydrology:
- Stream flows

Biological Conditions:
- Abundance and distribution of redband trout
- Abundance and diversity of aquatic macroinvertebrates
- Occurrence of yellow warblers
- Occurrence of Columbia spotted frogs

Management Actions (Strategies):

1. Fence headwaters, springs, and sensitive riparian areas.
2. Provide off-site stock watering.

Statistical/Sampling Design:

Because these actions were implemented before 2004, the effects of livestock exclusions on springs and headwaters will be assessed with a control-treatment design using random sampling. Gradient analysis may be used if the sampling design includes actions implemented within different years.

Ongoing Programs:

There are no current programs that monitor physical/environmental and biological conditions in this assessment area.

UNIMPROVED BACKCOUNTY ROAD RECLAMATION

Goal:

Reduce fine sediment recruitment and erosion within streams along backcountry roads and stream crossings on the DVIR.

Assessment Area:

Actions will be implemented in the following drainages:

- Skull Creek drainage
- North Fork Skull Creek drainage
- Fawn Creek drainage
- Summit Creek drainage

Objectives:

1. Improve water quality of streams by improving backcountry roads and streams crossings.
2. Improve stream habitat conditions (pools) by improving backcountry roads and streams crossings.
3. Decrease fine sediment delivery to channels by improving backcountry roads and streams crossings.
4. Increase the abundance of salmonids (especially redband trout) by improving backcountry roads and streams crossings.
5. Increase the abundance and diversity of aquatic insects in streams by improving backcountry roads and streams crossings.

Hypotheses:

1. The improvement of backcountry roads and stream crossings will significantly reduce stream turbidity.
2. The improvement of backcountry roads and stream crossings will significantly increase numbers of pools and residual pool depths.
3. The improvement of backcountry roads and stream crossings will significantly decrease the accumulation of fine sediments in stream channels.
4. The improvement of backcountry roads and stream crossings will significantly increase that abundance of redband trout in the assessment area.
5. The improvement of backcountry roads and stream crossings will significantly increase the abundance and diversity of aquatic macroinvertebrates in the assessment area.

Focal Species:

1. Redband Trout
2. Aquatic macroinvertebrates (especially stoneflies, mayflies, and caddisflies)

Indicators:

Water Quality:

- Temperature (MDMT and MWMT)
- Turbidity

Habitat Access:

- Fish passage through culverts

Habitat Quality:

- Dominant substrate
- Embeddedness
- Number of pools
- Residual pool depth

Channel Condition:

- Width/depth ratio
- Wetted width
- Bankfull width

Biological Conditions:

- Abundance of redband trout
- Abundance and diversity of aquatic macroinvertebrates

Management Actions (Strategies):

1. Install drainage dips (cross drains) and sediment catchments.
2. Install geo-web, rock crossings, or culverts where springs or small streams cross roads.
3. In-slope roads.
4. Re-vegetate.
5. Contour roads.

Statistical/Sampling Design:

Because actions were implemented in 2002 and 2003, the effects of road reclamation will be assessed with a control-treatment design using random sampling. All culverts placed in fish-bearing streams will be monitored for fish passage.

Ongoing Programs:

With the exception of Summit Creek, there are no current programs that monitor physical/environmental and biological conditions in this assessment area. There may be some monitoring within Summit Creek associated with spring enhancement actions. Monitoring in Summit Creek will be coordinated between the two actions.

RESTORATION OF THE EAST FORK OWYHEE RIVER

Goal:

Improve water quality, stream habitat, and channel and riparian conditions on the East Fork Owyhee River by implementing habitat restoration actions.

Assessment Area:

Actions will be implemented along a 3.5 mile stretch of the East Fork Owyhee River.

Objectives:

1. Improve water quality on the East Fork by implementing restoration and protection activities.
2. Improve habitat and channel conditions on the East Fork by implementing restoration and protection activities.
3. Decrease fine sediment delivery to the East Fork by implementing restoration and protection activities.
4. Improve riparian habitat conditions on the East Fork by implementing restoration and protection activities.
5. Increase the abundance of salmonids (especially redband trout) on the East Fork by implementing restoration and protection activities.
6. Increase the abundance and diversity of aquatic insects on the East Fork by implementing restoration and protection activities.
7. Increase the occurrence of yellow warblers and Columbia spotted frogs along the East Fork by implementing restoration and protection activities.

Hypotheses:

1. The implementation of restoration actions will significantly reduce stream temperatures and turbidity on the East Fork Owyhee River.
2. The implementation of restoration actions will significantly reduce fine sediment concentrations in the East Fork Owyhee River.
3. The implementation of restoration actions will significantly increase habitat diversity on the East Fork Owyhee River.
4. The implementation of restoration actions will significantly improve channel conditions in the East Fork Owyhee River.
5. The implementation of restoration actions will significantly improve riparian habitat conditions along the East Fork Owyhee River.
6. The implementation of restoration actions will significantly increase the abundance of redband trout in the East Fork Owyhee River.
7. The implementation of restoration actions will significantly increase the abundance and diversity of aquatic macroinvertebrates in the East Fork Owyhee River.
8. The implementation of restoration actions will significantly increase the occurrence of yellow warblers and Columbia spotted frogs in riparian areas along the East Fork Owyhee River.

Focal Species:

1. Redband Trout
2. Aquatic macroinvertebrates (especially stoneflies, mayflies, and caddisflies)
3. Yellow warbler

4. Columbia spotted frog

Indicators:

Water Quality:
- Temperature (MDMT and MWMT)
- Turbidity

Habitat Quality:
- Substrate composition
- Embeddedness
- Frequency of LWD
- Number of pools
- Residual pool depth
- Fish cover
- Off-channel habitat

Channel Condition:
- Width/depth ratio
- Wetted width
- Bankfull width
- Bank stability

Riparian Condition:
- Riparian structure
- Riparian disturbance
- Canopy cover

Biological Conditions:
- Abundance of salmonids (especially redband trout)
- Abundance and diversity of aquatic macroinvertebrates
- Occurrence of yellow warblers
- Occurrence of Columbia spotted frogs

Management Actions (Strategies):

1. Plant willows.
2. Re-slope and transplant shrubs.
3. Excavate low-flow channel and construct gravel bars.
4. Excavate floodplain.
5. Install fabric encapsulated soil lifts.
6. Install riparian revetments.
7. Create a new floodplain.

Statistical/Sampling Design:

1. Restoration actions implemented along the East Fork Owyhee River will be assessed with a before-after-control-impact design using stratified random sampling.

Ongoing Programs:

The Tribal Environmental Protection Program (TEPP) is currently monitoring water quality in the East Fork. This work will integrate with TEPP.

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