Owyhee Subbasin Plan

Chapter 4 Owyhee Management Plan

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and

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Disclaimer:

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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

[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.

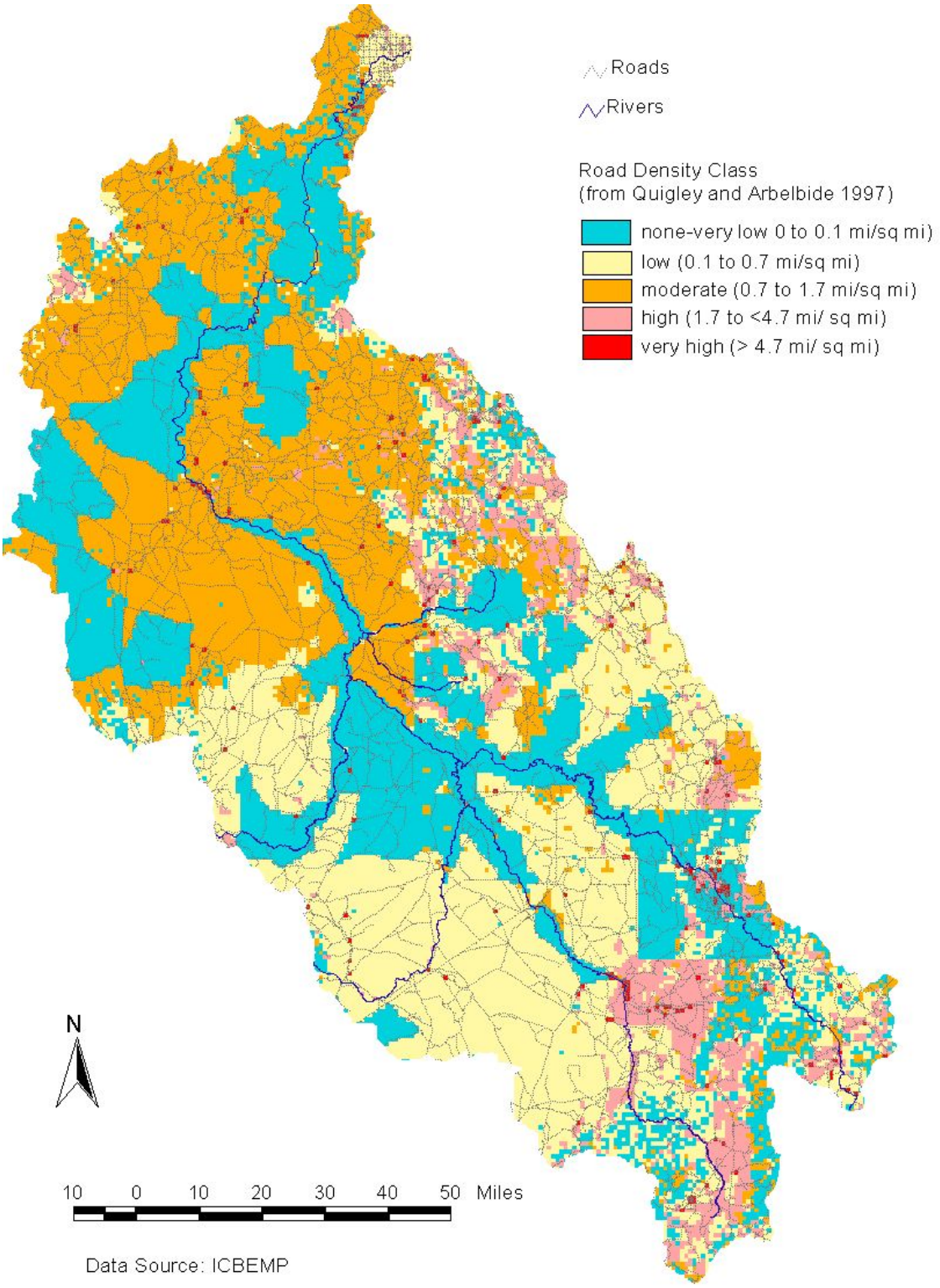

Figure 4.1. Road densities in the Owyhee subbasin (Perugini et al. 2002).

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).

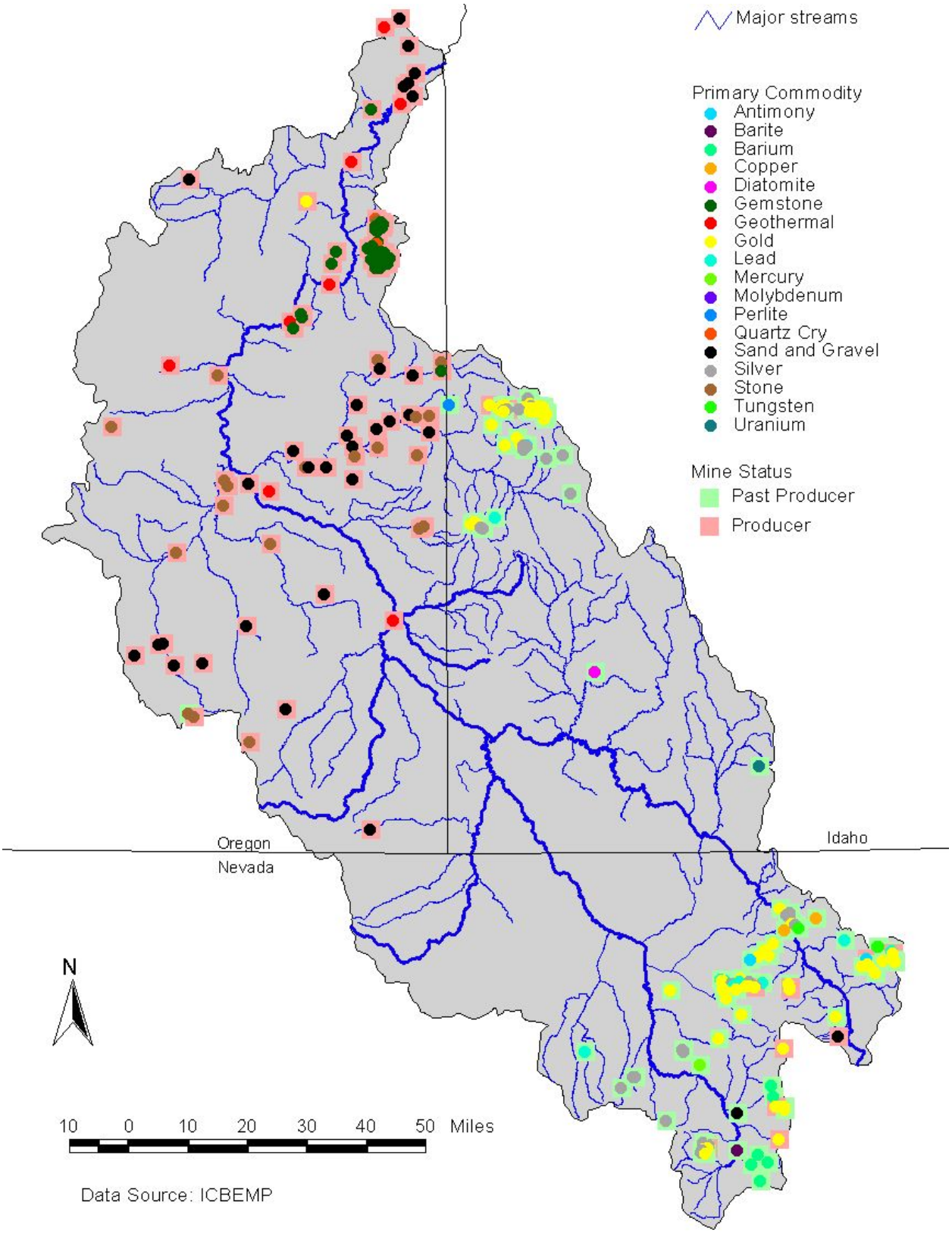

Figure 4.2. Current and historic mines in the Owyhee Subbasin (Perugini et al. 2002).

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).

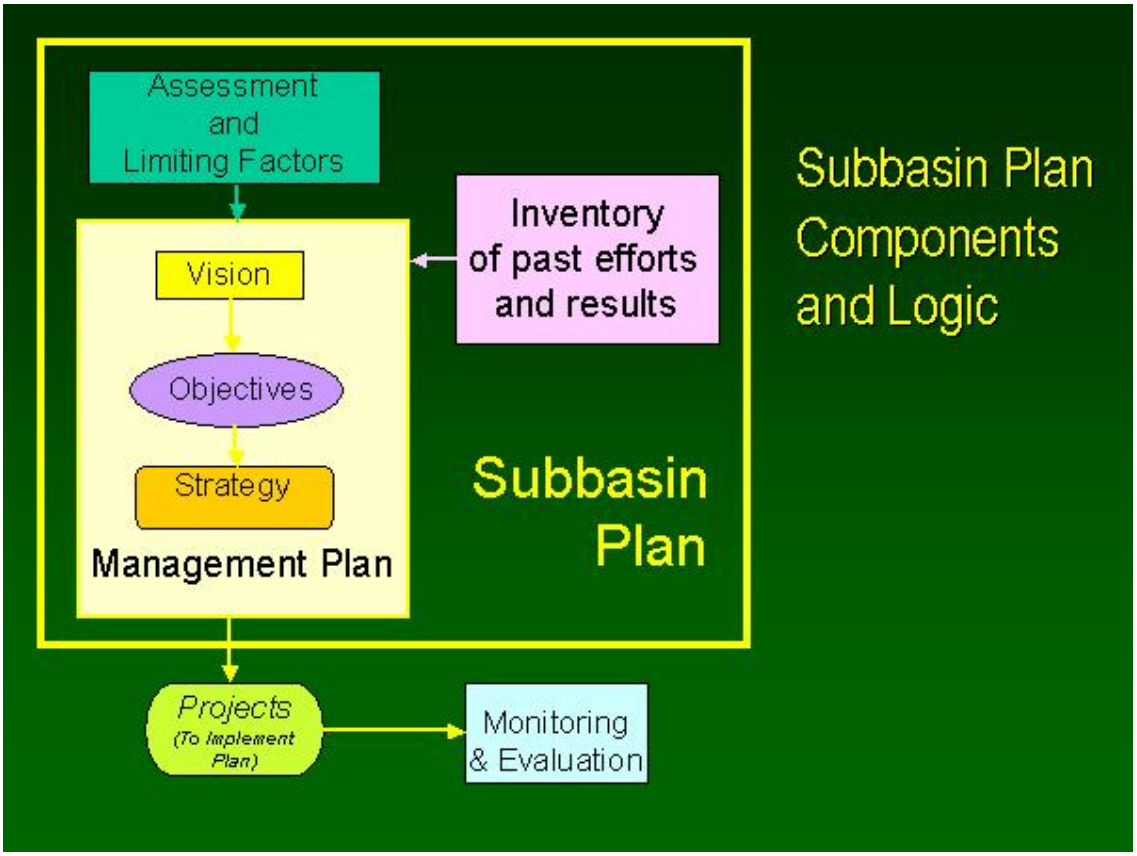

Figure 4.4. Flow chart of the logical connection between the components of the Owyhee Subbasin Plan (source: ISRP (2004) presentation).

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.

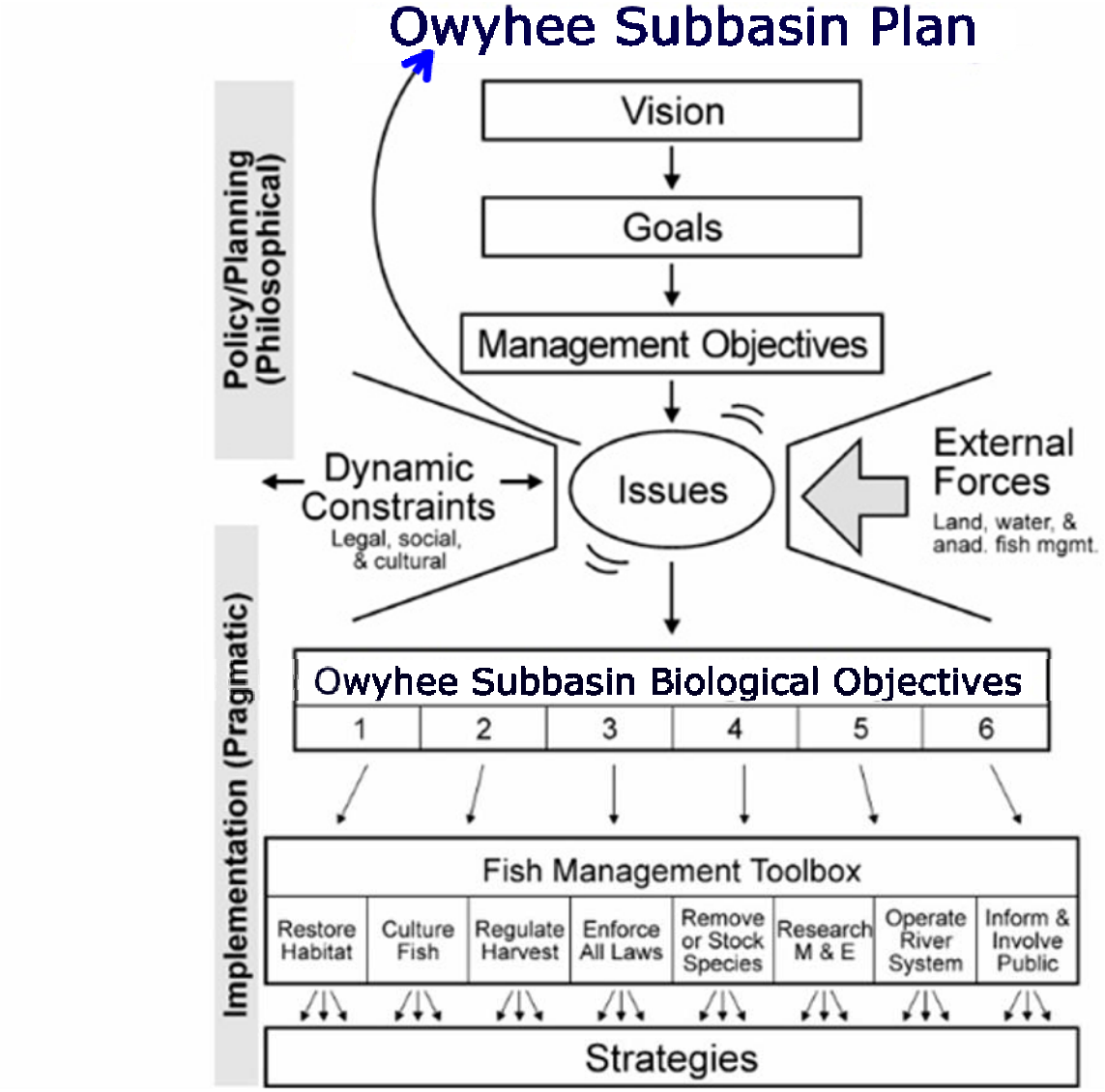

Figure 4.5. A simplified flow diagram of the implementation process showing the development of specific strategies -- from policy & planning through the filter of available management tools.

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

Restoration only:

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.

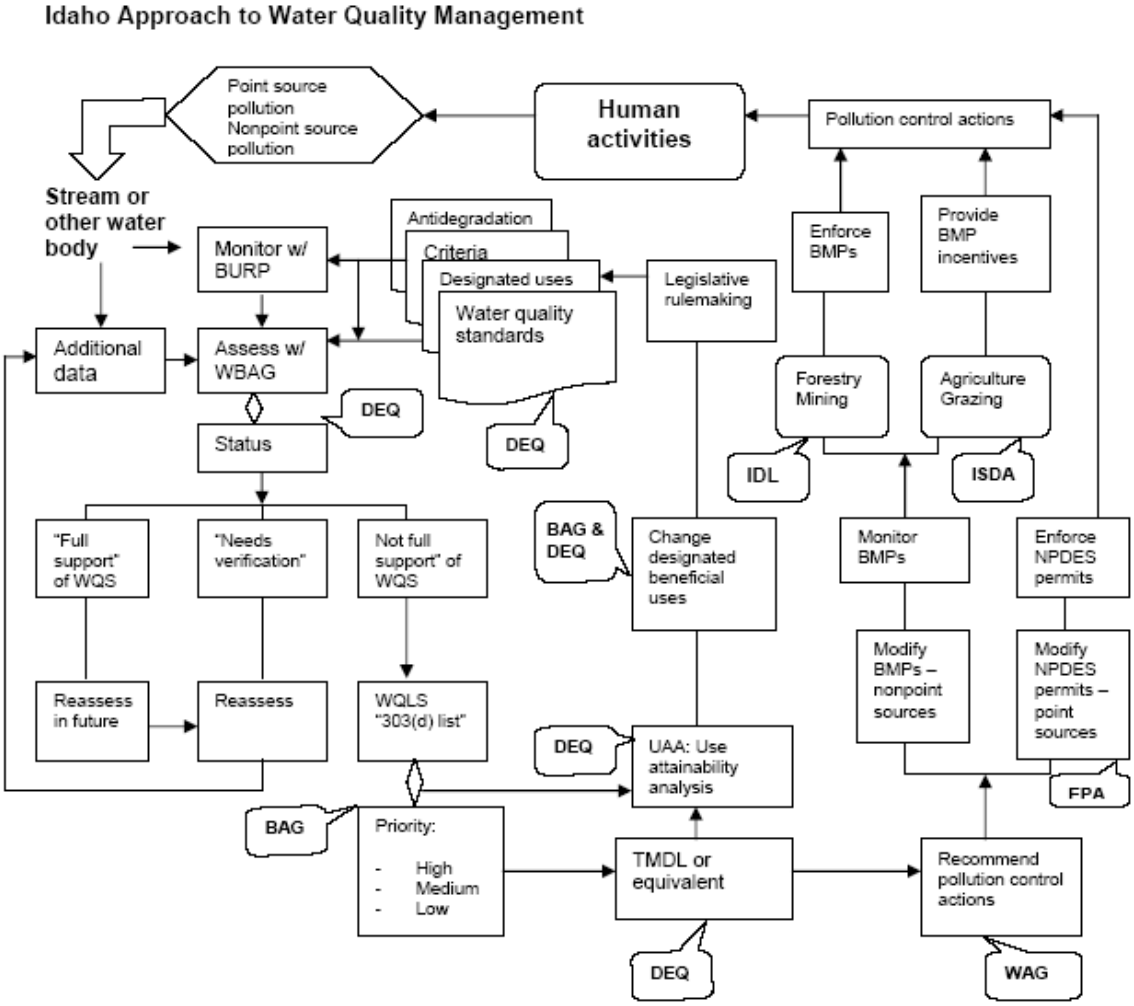

Figure 4.6. Flow chart for the development and implementation of TMDLs in the State of Idaho (Source IDEQ March 2004).

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**

Key to Headings on the Table 4.25 above: **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.

[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

[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 first 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

[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.

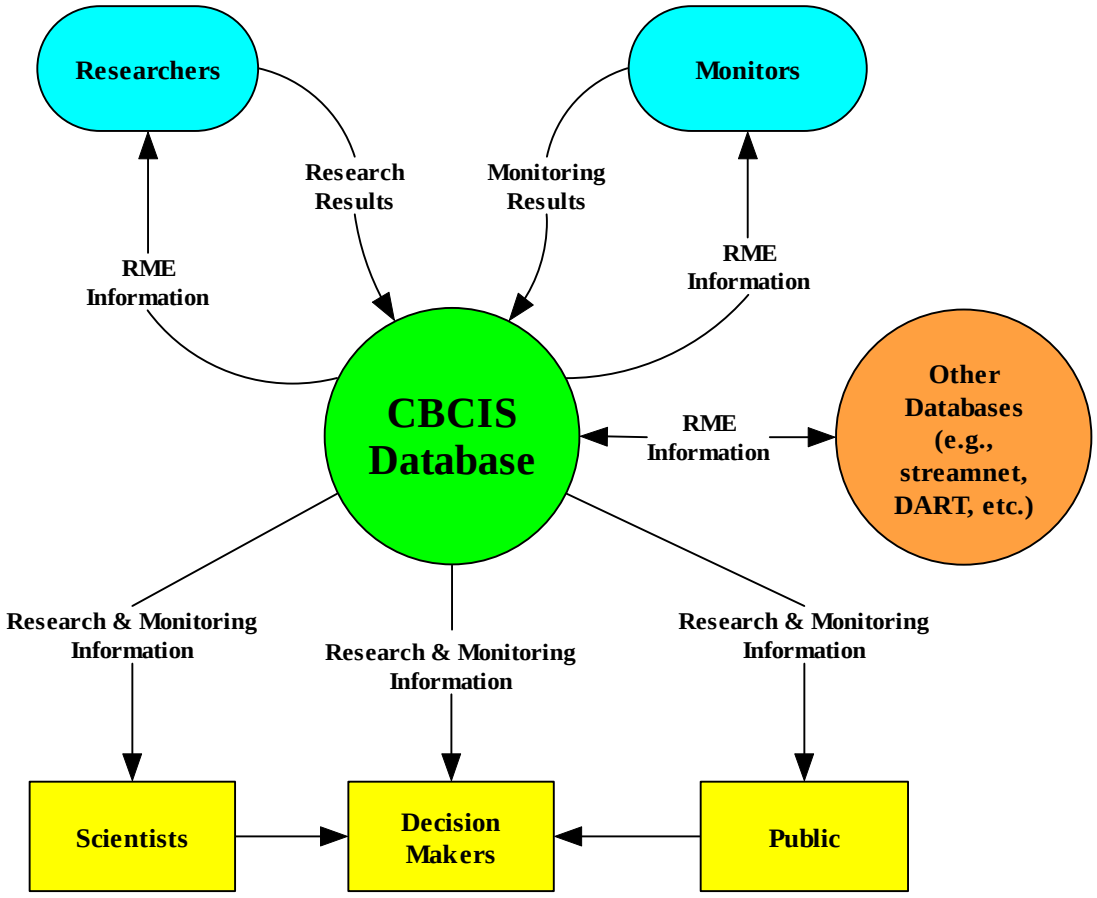

Figure 4.7. Diagram showing the flow of information from researchers and monitors in the Owyhee Subbasin to scientific reviewers, public, and decision makers.

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:

[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.