Draft

Methow
Subbasin Summary

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Northwest Power Planning Council

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Methow Subbasin Summary

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Methow Subbasin Summary

Subbasin Description

Introduction

This Methow Subbasin Summary has been developed as part of the Northwest Power Planning Council's Fish & Wildlife Program. Under the 1980 Pacific Northwest Electric Power Planning and Conservation Act, the Northwest Power Planning Council (NPPC) is directed to prepare a program to protect, mitigate and enhance fish and wildlife of the Columbia River Basin that have been affected by the construction and operation of hydroelectric dams while also assuring the Pacific Northwest an adequate, efficient, economical and reliable power supply. The Act also directs the Council to inform the public about fish, wildlife and energy issues and to involve the public in its decision-making.

In 2000 the NPPC amended its Fish and Wildlife Program. The revised program included adoption of an ecosystem-based approach structured around a basinwide vision for fish and wildlife. This vision is in turn, supported by specific biological objectives and action strategies. To accomplish the goals set out in the Fish and Wildlife Program, the Columbia River Basin has been organized into eleven Provinces with 63 subdivisions called Subbasins. Subbasin summaries are being developed for each of these Subbasins.

These Subbasin summaries are intended to identify and catalogue existing information and activities necessary to make informed choices about the types of fish and wildlife mitigation and restoration projects that are appropriate for support and funding within each Subbasin. The Subbasin summaries are the first step in a process that will culminate in the development of Subbasin Plans that will ultimately guide fish and wildlife enhancement and restoration activities in each Subbasin.

The NPPC has indicated that development of both the Subbasin Summaries and the Subbasin Plans should include participation at the community, city, county, state, and regional level. Achieving this goal requires the cooperative efforts of various agencies, tribes, local governments and others who share an interest and concern for developing and implementing ecosystem-based management, regardless of whether their activities or projects may be funded through the NPPC Fish and Wildlife Program.

The Methow Subbasin is a truly unique place; extraordinarily beautiful, both accessible and remote, home to diverse fish and wildlife species including some of the upper-most limits of current anadromous salmonid distribution, and populated by people who care passionately about the place they call home. The Subbasin is also unique in the extraordinary level of interest and active involvement, sometimes accommodating, and sometimes contentious, of the Subbasin's citizenry in natural resource questions and issues. Current participation in discussions and decision-making regarding the Subbasin's natural resources involves private citizens, irrigation districts, environmental groups, county government, state and federal agencies. Both the Confederated Tribes of the Colville Indian

Reservation and the Yakama Nation also take an active interest in fish, wildlife and habitat management issues within the Methow Subbasin.

Six fish species and fourteen wildlife species are federally listed as endangered, threatened or as species of concern within the Methow Subbasin. Over 80% of the land within the Subbasin is owned and managed by the federal government. Less than 2% of the Subbasin's land is irrigated. On one hand the Methow Subbasin is characterized by large tracts of relatively pristine habitat; while on the other hand the potential of habitat in the Subbasin to support self-sustaining populations of fish and wildlife, is hampered by low instream flows, the inescapable and devastating long-term impacts on all anadromous salmonids of the Columbia River Hydropower System, and human population growth and related development.

The Methow Subbasin is also a microcosm of current natural resource management and public policy challenges. Individuals and agencies involved in the Methow Subbasin wrestle with the difficulties of balancing federal versus local control of natural resources; finding effective means for coordinating among tribal, state and local governments; balancing competing demands for limited water resources; and maintaining and promoting healthy rural economies, while simultaneously protecting and preserving fish and wildlife habitat and species. As is increasingly true in many areas throughout the Columbia Basin, demand for water often exceeds available water resources, and the challenge of balancing competing demands informs both planning and reactive activities. Finding means to balance those demands in the long-term will require adaptability, creativity, patience and cooperation.

Involving all the different interest groups in a cooperative effort to summarize existing conditions in the Methow Subbasin within the very abbreviated development timeline for the Subbasin Summaries is a challenging proposition. In the process of developing this summary, many organizations and individuals expressed frustration at their inability to participate effectively because of the short development period. It is therefore important to note that while every effort was made to provide an inclusive summary of existing conditions within the Methow Subbasin--the parties participating in the development and submission of this summary do not imply that they agree with or otherwise support all or any of the information submitted by any other party.

General Description

Subbasin Location

The Methow Subbasin is located in north central Washington State. The watershed rests entirely within Okanogan County and includes within its geographic scope the towns of Carlton, Mazama, Methow, Pateros, Twisp, and Winthrop.

At its furthest reach the Methow Subbasin extends about 68 miles from north-to-south and approximately 40 miles from east-to-west. The Subbasin is bordered on the west by the Cascade Mountains, on the north by Canada, on the east by the Buckhorn Mountains and the Okanogan River drainage, and on its southern edge by the Columbia River and the Sawtooth Ridge.

The Methow River flows southward from its headwaters on the eastern slopes of the Cascade Mountains, descending some 7,700 feet over the course of its 86-mile journey to the Columbia River before entering the Columbia (RM 524) immediately south of the town of Pateros, Washington.

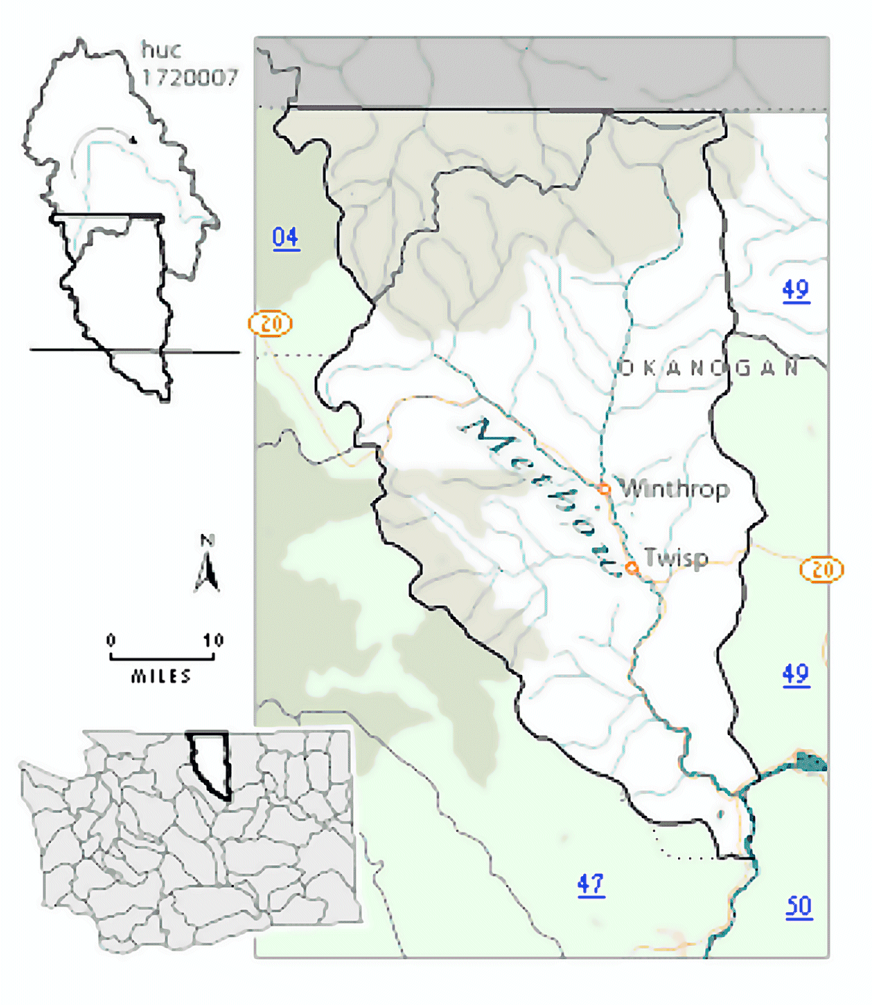

Figure 1. Methow Subbasin (WRIA 48)

Source: WDOE Website

Drainage Area

The Methow River drains an area of approximately 1,890 square miles (about 1,193,933 acres) (Golder 1993; Methow Valley Water Pilot Planning Project Planning Committee 1994; CRITFC 1995). For the purposes of this document, the Methow River Subbasin has been subdivided into seven constituent subwatersheds. They are the Upper Methow River, Lost River, Early Winters Creek, Chewuch River, Middle Methow River, Twisp River, and Lower Methow River.

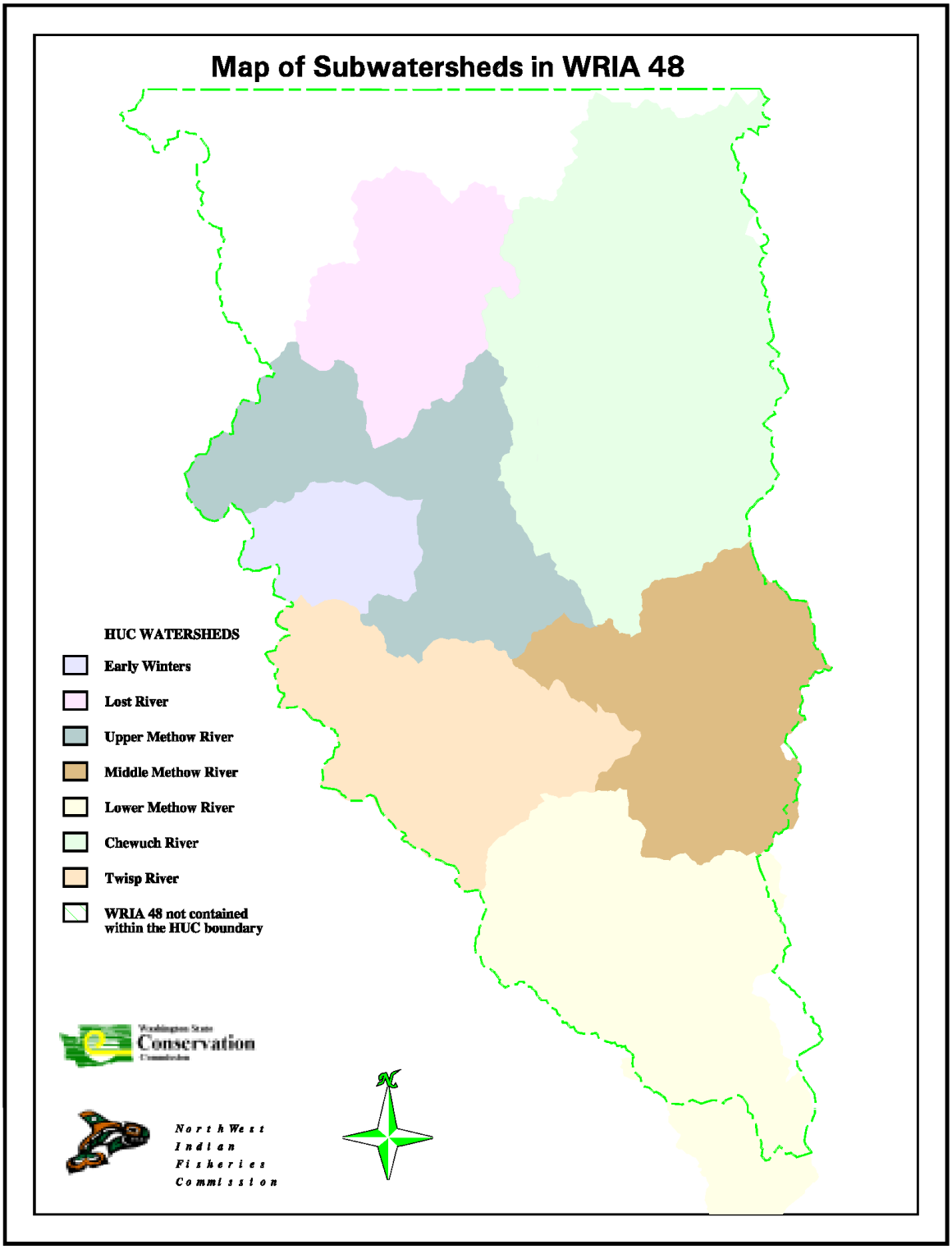

Figure 2. Map of subwatersheds in Methow Subbasin

The Upper Methow River subwatershed drains an area of approximately 322,385 acres. It is the second largest subwatershed within the Methow Subbasin, comprising approximately 27% of the total basin's drainage. Included within this region is the upper Methow River from its headwaters (RM 73.0) downstream to the Chewuch River's confluence (RM 50.1), with the Methow at the town of Winthrop. Tower Mountain (elevation 8,844 feet), Mt. Hardy (8,880 feet) and Hart's Pass (6,178 feet), rim the upper edges of the Methow's headwaters along the slopes of the Cascade Crest. This stretch of the Methow takes in approximately 35 river miles from the headwaters to the southern tip of the subwatershed at town of Winthrop (1,760 feet). The town of Mazama also lies within the subwatershed about 1.5 miles upstream from Goat Creek's confluence with the Methow River. The upper reaches of the Methow and its main tributaries within this drainage, Goat Creek and Wolf Creek, flow through relatively high gradient gorges and steep valleys. The river begins to meander and braid below the Goat Creek confluence where the river's gradient is much lower (approximately 0.37%, a drop of 264 ft in 13.4 miles).

Table 1. Creeks and streams of note within the Upper Methow River Subwatershed (listed from upstream to downstream reading across the table)

The Upper Methow River Subwatershed (322,385 acres)		
Brush Creek	Trout Creek	Rattlesnake Creek
Robinson Creek	Gate Creek	Little Boulder Creek
Goat Creek	Fawn Creek	Hancock Creek
Wolf Creek	Little Falls Creek	

The Lost River subwatershed is aligned from north-to-south. At 107,400 acres, this subwatershed makes up roughly 9% of the Methow Subbasin's total acres. Nearly 95% of that land lies within the Pasayten Wilderness. Descending steeply from its nearly pristine headwaters at elevations close to 6,900 feet, Lost River flows roughly 22.5 miles before joining the Methow River (RM 73.0) about six miles upstream from the Early Winters Creek confluence at about 2,600 feet (USFS 1999c). No towns are located within this drainage.

Table 2. Creeks and streams of note within the Lost River Subwatershed (listed from upstream to downstream reading across the table)

Lost River Subwatershed (107,400 acres)		
Drake Creek	Monument Creek	Eureka Creek

The Early Winters Creek drains a north-to-south oriented watershed of some 51,548 acres. The drainage, which is capped by North Gardner Mountain (8974) and Cutthroat Peak (7046 feet), comprises nearly 4% of the entire Methow Subbasin (USFS 1996a). The mainstem originates near Liberty Bell Peak at 6,500 feet and drops approximately 4,360

feet over the course of 15.7 miles before meeting the Methow River (RM 67.3) some 3.5 miles upstream from the town of Mazama. The drainage's headwaters are defined by cirques and glaciated head walls which in turn give way to U-shaped glacial valleys and then to valley bottoms lined with glacial till. An impassable waterfall exits at RM 8 of Early Winters Creek. There are no towns located within the Early Winters subwatershed.

Table 3. Creeks and streams of note within the Early Winters Subwatershed (listed from upstream to downstream reading across the table)

Early Winters Subwatershed (51,548 acres)	
Varden Creek	Cedar Creek

The Chewuch River drainage is the largest subwatershed within the Methow Subbasin. The Chewuch empties a 340,000 acre basin over the course of its 44.8 mile north-to-south journey from its headwaters to its mouth at the town of Winthrop (1,700 feet) (USFS 2000c). Nearly 108,000 acres (34%) of the subwatershed's northern and western reaches sit within the Pasayten Wilderness. Cathedral Peak (8,601 feet), Windy Peak (8,331), and Andrew Peak (8301 feet) stud the subwatershed's defining crest. The U-shaped valley in the upper reaches of the Chewuch drainage features dramatically steep slopes often in excess of 60-70%. Upstream migration routes along the uppermost reaches of all of the Chewuch's tributaries are blocked by naturally occurring impediments including waterfalls and steep gradients.

Table 4. Creeks and streams of note within the Chewuch River Subwatershed (listed from upstream to downstream reading across the table)

Chewuch River Subwatershed (340,000 acres)		
Dog Creek	Thirtymile Creek	Andrews Creek
Lake Creek	Twentymile Creek	Falls Creek
Eightmile Creek	Cub Creek	Boulder Creek

The Middle Methow River subwatershed contains 15,600 acres (about 1% of the Subbasin total). This subwatershed includes the mainstem Methow River from its confluence with the Chewuch River at Winthrop (1,700 feet) downstream to the town of Carlton (1,420 feet), a distance of approximately 23 river miles. In the lowest reaches of this subwatershed, the river meanders at a low gradient through a flood plain that is largely confined by roads and that has, in many cases, given way to agricultural and residential development. County roads and state highways parallel both sides of the Methow River along its entire length within the subwatershed. Road densities within the Beaver Creek drainage of the subwatershed are the highest in the Methow watershed with 41% of the drainage having road densities of 2.1 to 5 miles/sq. mile (USFS 1997). Timber has been harvested extensively from the Beaver Creek drainage since the 1960s (USFS 2000a). The towns of Twisp and Carlton also lie within this subwatershed.

Table 5. Creeks and streams of note within the Middle Methow River Subwatershed (listed from upstream to downstream reading across the table)

Middle Methow River Subwatershed (15,600 acres)		
Bear Creek	Alder Creek	Beaver Creek
Blue Buck Creek	Frazer Creek	Benson Creek

The Twisp River drains a subwatershed of roughly 157,000 acres, comprising approximately 13% of the Methow Subbasin. Extending about 28 river miles from its headwaters in the Lake Chelan-Sawtooth Wilderness to its mouth, the river flows generally east-to-west before joining the Methow River at the town of Twisp (RM 40.2). Nearly half of the subwatershed is part of the Lake Chelan-Sawtooth Wilderness and the upper fringe is ringed by multiple peaks and razor ridges including Star Peak (8,680 feet) and Gilbert Mountain (8,023 feet). From these steep headwaters the Twisp descends to an elevation of 1,600 feet at its confluence with the Methow River. In the upper reaches, natural falls block migration passage along some tributaries. Within its lower reaches, the Twisp River follows a low-gradient meander through a floodplain defined by agricultural, logging and residential development activity.

Table 6. Creeks and streams of note within the Twisp River Subwatershed (listed from upstream to downstream reading across the table)

Twisp River Subwatershed (157,000 acres)		
North Creek	South Creek	Reynolds Creek
Eagle Creek	War Creek	Buttermilk Creek
Canyon Creek	Little Bridge Creek	Newby Creek
Poorman Creek		

The Lower Methow River subwatershed includes a low-gradient 27-mile stretch of the Methow starting at the town of Carlton and flowing northwest-to-southwest towards the town of Pateros. The least studied of the basin's subwatersheds (WSCC 2000), this area includes about 200,000 acres, with the majority of those contained in the Okanogan National Forest. A small portion of the subwatershed falls within the Lake Chelan-Sawtooth Wilderness. Elevation ranges from 8,646 feet at Hoodoo Peak to 800 feet at the confluence of the Methow and Columbia Rivers (USFS 1999a). The upper valley is about a mile-wide narrowing in the lower reaches to less than a half a mile (USFS 1999a). State Highway 153 parallels and laces the entire stretch of the Methow River in this reach, crossing the river seven times between the towns of Methow and Carlton.

Table 7. Creeks and streams of note within the Lower Methow River Subwatershed (listed from upstream to downstream reading across the table)

Lower Methow River Subwatershed (200,000 acres)		
Texas Creek	Libby Creek	Gold Creek
McFarland Creek	French Creek	Black Canyon Creek

Climate

The Methow Subbasin's climate is influenced by maritime weather patterns, elevation, topography, and its location on the leeward side of the Cascade Mountains. Pacific storms driven by prevailing westerly winds are routinely interrupted by the Cascade Mountains, dropping heavy precipitation throughout the upper elevations. Precipitation falls off significantly as elevation decreases and as the distance from the Cascade Crest increases. Continental weather patterns insinuate themselves periodically throughout the winter months, forcing blasts of cold air masses southward from Canada.

Nearly two-thirds of the watershed's annual precipitation occurs between October and March, arriving primarily as snow. In the summer, long spells of hot, dry weather are punctuated by intense, but short lived, thunderstorms. Fall brings increased precipitation which generally climaxes as winter snowfall between December and February. Snow usually blankets the ground from December through February at lower elevations, while at higher elevations snow cover lingers from October through June. The upper reaches of the watershed along the Cascade Crest (at elevations of approximately 8,600 feet) receive as much as 80 inches of precipitation a year, this drops to about 60 inches in adjacent upland areas, while the town of Pateros (800 feet), at the far southern end of the Subbasin, receives only about 10 inches of precipitation annually (Richardson 1976).

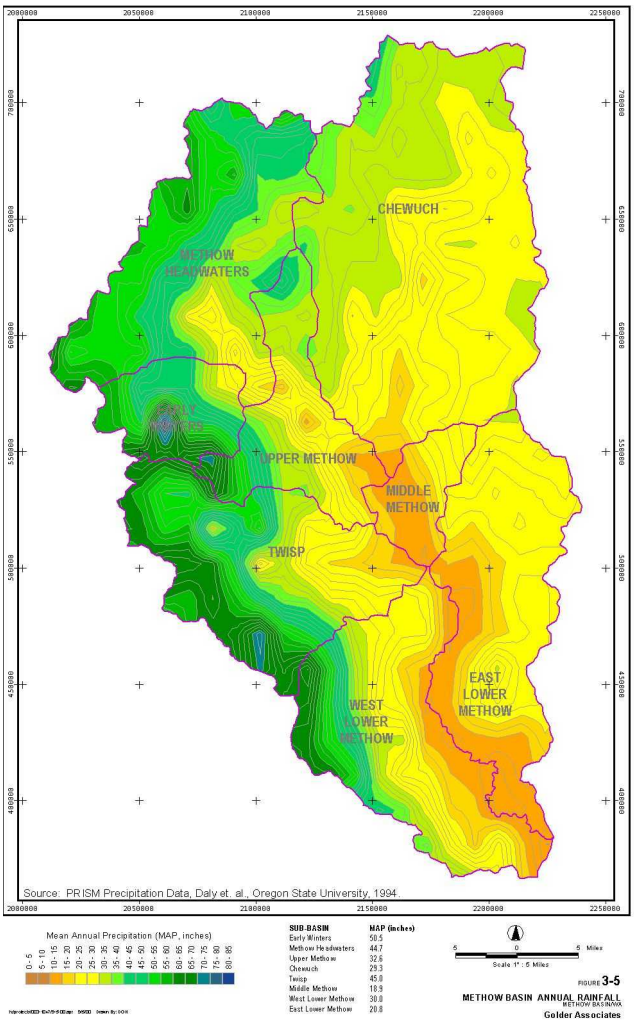

Figure 3. Mean annual precipitation in the Methow Subbasin

Source: Golder Associates

The Methow Subbasin falls within the coldest of twenty-four western climate zones. The watershed is at the same latitude as Duluth, Minnesota and Bangor, Maine. Additionally, temperatures within the basin are dictated by the fact that mean elevation within the basin is roughly a mile above sea level. Winter low temperatures in the Methow range down to –35 F with the monthly mean January temperatures between 1970 and 1990 at Mazama of 8.6 F. Average maximum temperatures in August for the upper watershed elevations range from 60 F to 70 F with occasional highs up to 80 F. At lower elevations August high temperatures range from 80 F to 95 F with temperatures occasionally exceeding 100 F.

Topography

Topography within the Subbasin ranges from mountainous sub-alpine and alpine terrain along the Cascade Crest to the gently sloping wide valley found along the middle reaches of the Methow River. Elevation varies from over 8,500 feet in the headwaters of the basin

along the crest of the Cascade Mountains, to approximately 800 feet at the confluence of the Methow and Columbia Rivers. Topographic features in, and adjacent to, the Methow Valley provide evidence of both alpine and continental ice-sheet types of glaciation (Waitt 1972).

The western upper reaches of the Methow watershed carve deeply into the Cascade Crest's peaks. Avalanche chutes, knife-edge ridges, and cirques typify the upper elevations of the watershed following the crest. The upper Methow River valley is a u-shaped, glaciated intermountain valley. The valley margins are bounded by bedrock uplands which rise steeply, and at some locations nearly vertically, from the valley floor to elevations over 5,000 feet. The elevation of the valley floor within the upper valley varies from approximately 2,600 feet above Lost River to about 1,765 feet at Winthrop, a distance of roughly 21 miles. The valley floor from Lost River to Winthrop ranges between 0.5 mile to 1.5 miles wide and consists of irregular terraces, alluvial fans, and floodplain meadows. From Winthrop downstream to the town of Twisp, the valley opens out and the slope decreases to approximately 17.0 feet/river mile (Okanogan County 1996).

Geology

Roughly 50 to 65 million years ago the North Cascade subcontinent docked against the Okanogan subcontinent. As the two continents collided numerous north-to-south faults formed throughout the region that presently includes the Methow watershed. The dominant tectonic feature distinguishing the area is the Tertiary Methow-Pasayten Graben. Over millions of years, repeated occurrences of folding transformed and redefined the Methow-Pasayten Graben, with at least four distinct episodes culminating in the present geologic composition of the region (Barksdale 1975).

The resulting bedrock geology of the Methow Valley area is characterized by folded Mesozoic sediments and volcanic rocks downfaulted between crystalline blocks. The sediment strata include varieties of sandstones, shales, siltstones, conglomerates and andesitic flows, breccias and tuffs. The crystalline rocks include various granitic type igneous intrusive rocks and high-grade metamorphic types, including gneiss, marble, and schist (Barksdale 1975).

The valley's bedrock is overlain with a thick sequence of highly permeable unconsolidated sediment composed of pumice, ash, alluvium and glacial outwash. Geophysical surveys of mid-valley locations from Weeman Bridge (RM 62.2) to above Early Winters Creek (RM 67.5) indicate sediment depths between 800 to 1,200 feet (EMCON 1993). Those surveys also suggest a large fault structure with an offset of over 500 feet within the unconsolidated sediments which may influence groundwater flow (EMCON 1993). The majority of the Methow basin's aquifers rest within this unconsolidated sediment layer, confined from below by the relative impermeability of the underlying bedrock (EMCON 1993). Quartz and feldspar are the dominant minerals in the silt and sand fractions of sediment from the Methow River.

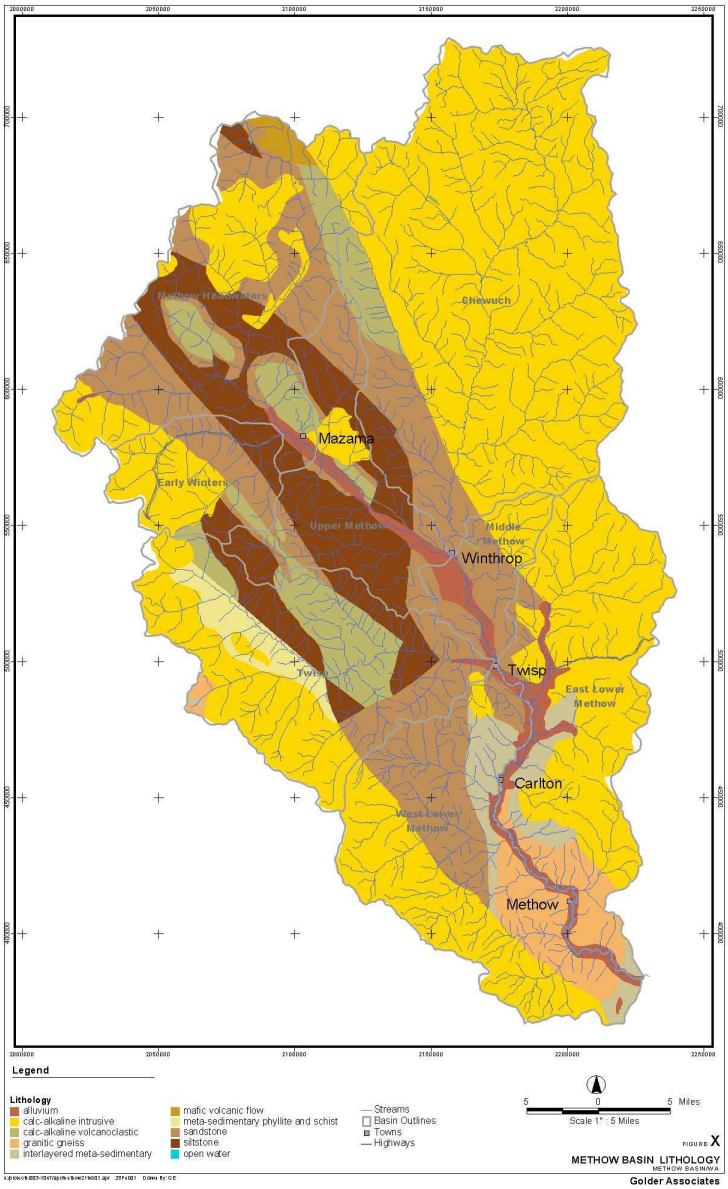

Figure 4. Lithology in Methow Subbasin
Source: Golder Associates

Hydrology

The Methow River near Pateros has a long-term mean discharge rate of 1600 cfs (45 m3/s) or a mean annual yield of 1.2 x 106 acre-ft/yr (1400 x 106 m3/yr). Average annual runoff from the Methow basin is 12 inches (31 cm). Snowmelt from the upper elevations of the Methow basin in spring and early summer generates most of the runoff in the basin with between 44 and 71% of the annual runoff volume occurring during May and June. Annual peak discharge occurs during May and June as well with the flood of record occurring on May 29, 1948 (Kimbrough et al. 2001). The timing of spring snowmelt is triggered by a combination of seasonal temperature changes and elevation. Low summer precipitation,

higher temperatures, and declining snow pack contribute to receding streamflow beginning in July and continuing through September. The lowest streamflows occur in mid-winter (December to February) and early autumn (September) when streamflow is primarily the result of groundwater discharge, supplemented to a limited extent by snowmelt and storm runoff. During these periods, surface flow ceases in some streams and along reaches of rivers where streamflow is lost to groundwater, though the relationship between surface and ground water in the Methow Subbasin is not fully understood.

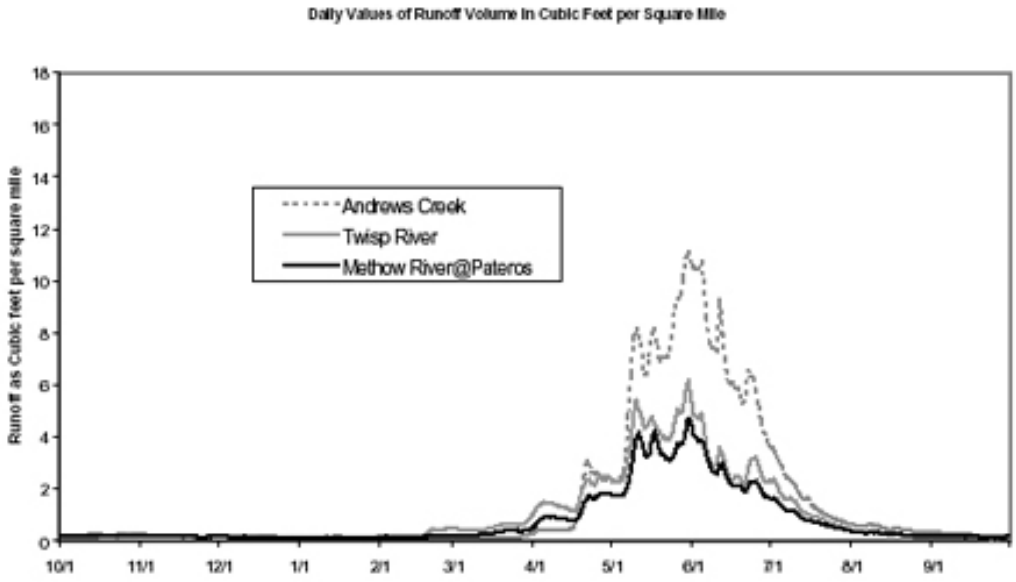

Figure 5. Daily values of runoff volume in cubic feet per square mile
Source: Draft Methow River Basin Plan, 1994

Soils

Methow valley soils are generally coarsely textured compositions of glacial till. The primary constituent materials are granitic, volcanic, and sedimentary. Unconsolidated materials including glacial drift, pumice and ash deposits, alluvial plain and fan deposits, are also present. (EMCON 1973). The valley's topsoil generally consists of sandy loams with permeability ranges between 2.0 to 6.0 inches per hour. Underneath these topsoils lie alluvium and glacial outwash materials that exhibit permeability greater than 6 inches per hour (Waitt 1972). In some areas of the valley, relatively non-porous layers of soils with permeability less than .01 inches per hour lie between the layers of alluvium (Waitt 1972).

Vegetation

The majority of land within the Methow Subbasin is forested. Topography, climate, and soil characteristics determine the blend of vegetative compositions and locations throughout the basin. Human activities including agricultural and rangeland uses, primarily at lower and mid elevations, and often in riparian areas, have created disturbances which in

many cases displaced native plants with aggressive and invasive non-native species such as exotic grasses and noxious weeks (Okanogan County 1996). Periodic outbreaks of fire, disease and insect infestation have also played a role in revising the vegetative species mix throughout basin.

In the valley's lower elevations, where moisture is limited, shrub-steppe and steppe plant communities dominate. High water table or seasonal flooding conditions found at some lower elevations support development of deciduous riparian communities. Higher elevations bring more moisture and lower year-round temperatures. Increased moisture in the basin's mid elevations support a transition from the dominant ponderosa pine forests along the basin's lower slopes and valleys to Douglas fir communities. The colder temperatures and increased access to moisture that characterize the basin's uppermost elevations support subalpine fir communities which in turn give way at the highest elevations to subalpine and alpine meadow grasses and forb species (USFS 1994). Riparian sites within the basin's uppermost elevations remain largely undisturbed.

Table 8. Vegetation types in the Methow Subbasin

Vegetation Zone	Environment	Examples of Vegetation Types
Grass and Shrub Zone	Lowest elevations, arid conditions.	Big sagebrush, three-tip sagebrush, bitterbrush, grey rabbit brush, bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, arrowleaf balsamroot, lupine and western yarrow.
Ponderosa Pine Zone	Elevations around 1,000 to 3,000 feet generally semi-arid.	Ponderosa pine, bitterbrush, Idaho fescue, pinegrass, bluebunch wheatgrass, elk sedge, arrowleaf balsamroot, and ceanothus, quaking aspen, alder and Rocky Mountain maple.
Lodgepole Pine Forest	Elevations around 3,000 to 5,000 feet, generally related to historic fire outbreaks.	Lodgepole pine.
Douglas Fir Zone	Elevations around 3,000 to 5,000 feet, better access to moisture.	Douglas fir, Ponderosa pine, western larch, Engelmann spruce, Pacific silver fir, western red cedar and quaking aspen.
Subalpine Fir Zone	Elevations from 5,000 to 7,400 feet, relatively good moisture access.	Subalpine fir, Engelmann spruce, Douglas fir, lodgepole pine, whitebark pine, subalpine larch, mountain hemlock, Pacific silver fir, grouse whortleberry, pine mat manzanita, pinegrass, dryland sedge, green fescue, lupine sedge and subalpine big sagebrush.
Alpine Zone	Above elevations of 7,000 feet. Trees give way to stunted shrubs and herb layers at uppermost elevations.	Subalpine fir, whitebark pine, subalpine larch and lodgepole pine, includes giant horsetail, bunchberry dogwood, Sitka alder, prickly currant and twinflower

Land Uses

Humans have occupied the region in and around the Methow Valley for at least 7,500 years. Ancestors of tribes that are presently part of the Confederated Tribes of the Colville Indian Reservation hunted, fished, and gathered food in the Methow Subbasin area for

thousands of years. The Methow Valley is named for its first inhabitants, the Methow Indians. The Methows are a Plateau Salish people who speak a dialect of the Okanogan language that is very similar to the language of their close neighbors and relatives, the Entiat, Wenatchee, Okanogan and Columbia tribes.

The Methow Indians relied on deer, elk, bear, mountain sheep, mountain goat, antelope and many other animals in addition to roots, berries, and nuts for their traditional diet. But the most important part of the Methows' diet consisted of large amounts of chinook, sockeye and coho salmon that were caught in the Methow River drainage and near the mouth of the river along the Columbia.

When the first European trappers arrived at the mouth of the Methow River in 1811, the Methows had at least ten villages stretching from the mouth of the river to the Chewuch. Small numbers of European trappers and travelers visited the region between 1811 and 1848 when the area became part of the United States. In 1855 the first Washington Territorial Governor, Isaac I. Stevens, attempted to involve the Methows in a treaty to cede their territory, however, the tribe chose not to participate.

The tribe remained largely isolated from incoming settlers until the latter 19th century, when their territory was encompassed in what was known as the Moses Columbia Reservation, which was set aside by executive orders of 1879 and 1880. As increasing numbers of settlers arrived, the United States negotiated an opening of the reservation amongst several Indian leaders (none of them Methow Indians). In 1886 the reservation was opened to non-Indian settlement and the Methows were promised a choice between taking allotments near where they lived or moving to the Colville Reservation. However, only the Methows near the mouth of the river were given the option and almost all Methows eventually moved to the Colville Reserve, where they became a constituent member of the Confederated Tribes of the Colville Indian Reservation, the continuing legal representative of the tribes.

Almost all of the Methow Indian allotments in the Methow Valley were lost to non-Indians in ensuing years and today only a few hundred acres within the Methow Subbasin continue to be held in trust for the Methows of the Colville Indian Reservation. However, descendents of the Methows continue to hunt, gather and fish for salmon in their usual and accustomed places and Methows continue to assert a right to fish for salmon in their ancient ancestral lands.

At present, approximately 4,500 people live within the 1,890 square mile Methow Subbasin (2000 Census; Washington State Office of Financial Management). Most of the population is concentrated on private lands within and near the towns of Carlton, Mazama, Methow, Pateros, Twisp and Winthrop. Private land holdings within the Methow Subbasin comprise roughly 15% of the total land. Between 1990 and 2000 the population of Winthrop increased 27.5% to reach its current population of approximately 385 people. From 1990 to 2000 the town of Twisp (current population approximately 990) had a population increase of about 13.5%, and Pateros (current population approximately 635) experienced a population gain of 11.4% (Washington State Office of Financial Management).

Roughly 12,800 acres of the Methow basin is cultivated (Methow Valley Water Pilot Planning Project Planning Committee 1994). Orchards and small farms growing alfalfa and other irrigated crops constitute the majority of the Subbasin's agricultural activities. Forestry and ranching also play roles in the area's economy. Farming and grazing are confined primarily to the lower and mid reaches of the Subbasin. Activities related to timber harvest take place in the middle and upper reaches of the watershed. Recreation, tourism and related development play an increasing role in the area's economy. In portions of the lower Subbasin residential development resulted in conversions of natural habitat (particularly riparian habitat) to pasture and residential uses.

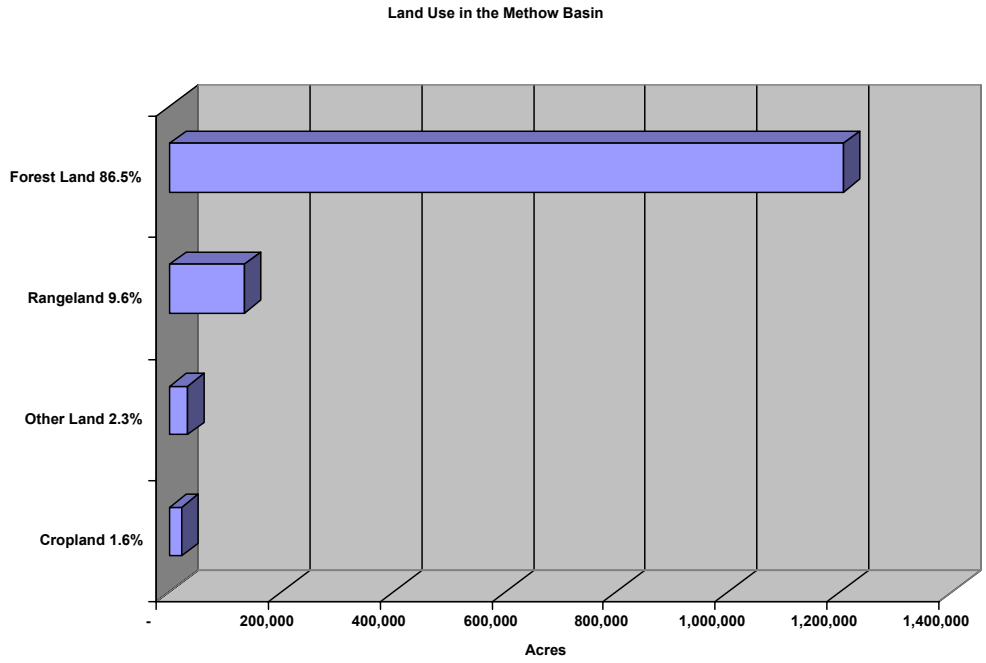

Figure 6. Land use in the Methow Subbasin (PNWRBC 1977a)

Over 80% of all of the lands in the watershed are owned by the federal government and managed by the United States Forest Service (USFS) (Methow Valley Water Pilot Planning Project Planning Committee 1994). The Pasayten Wilderness bounds the upper northern reaches of the Methow watershed and the Lake Chelan-Sawtooth Wilderness sits along the southwest rim of the basin. Both areas range from over 5,000 feet in elevation to peaks approaching 9,000 feet and are managed as wilderness ecosystem reserves and wildlife habitat, including non-motorized recreation as well as limited mining and grazing activity. The remainder of the USFS-managed land lies in the Okanogan National Forest and is managed for multiple use, including commercial logging, cattle grazing, mining, wildlife habitat, and recreation (Methow Valley Water Pilot Planning Project Planning Committee 1994).

The Federal Bureau of Land Management (BLM) manages approximately 1% of the land in the Subbasin. BLM land consists mainly of mixed forest and grassland and is used for commercial logging, grazing and recreation. The State of Washington owns 5% of the land in the basin, of which a portion is managed by the Department of Natural

Resources for timber harvest, wildlife habitat, recreation, and grazing. The remaining State lands comprise the Methow Wildlife Area, which is managed for wildlife habitat, recreation, and grazing (Methow Valley Water Pilot Planning Project Planning Committee 1994).

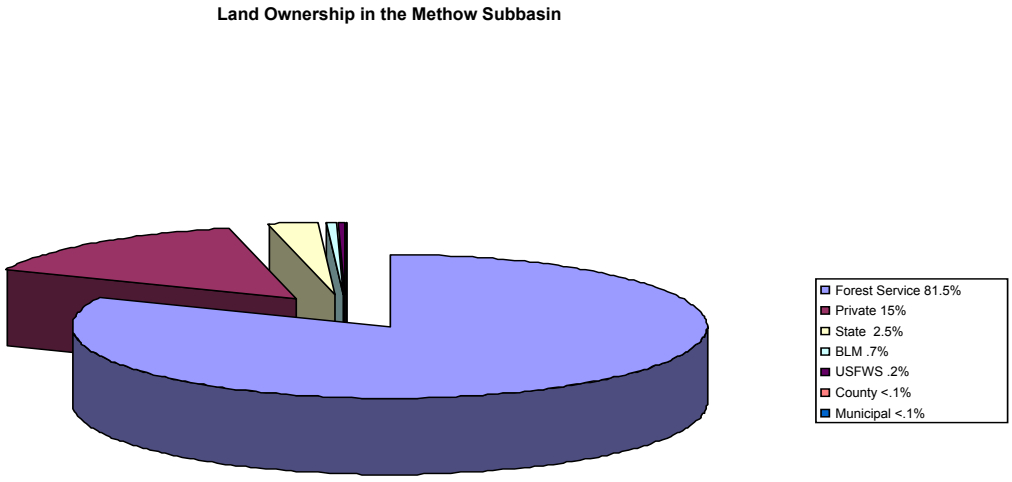

Figure 7. Land ownership in the Methow Subbasin (PNWRBC 1977a)

Impoundments and Irrigation Projects

There is currently no hydropower development within the Methow Subbasin. A hydroelectric project constructed by Washington Water Power blocked the Methow River at Pateros between 1915 and 1929. That dam blocked all fish passage during those years and by the time is was removed, the Methow River run of coho was extinct, and runs of spring and summer chinook, as well as steelhead were severely depressed. Today, anadromous fish migrating to the ocean encounter Wells Dam just downstream from the Methow's confluence with the Columbia River. Beyond Wells Dam, eight more downstream dams along the Columbia River impede fish passage to the ocean.

Irrigated land within the Methow Subbasin makes up less than 2% of the basin's total acreage. Historically, the majority of irrigation within the basin was delivered through a network of unlined ditches. Currently there are at least 27 irrigation canals operated by both public and private entities in the Methow Subbasin. Okanogan County and the Methow Basin Planning Unit are attempting to inventory and map irrigation diversions within the Subbasin and to measure the amount of water diverted (see *Existing and Past Efforts* and *Fish and Wildlife Needs*). At this time a complete accounting of the location and amount of water diversion associated with irrigated land in the Methow Subbasin is not available.

Table 9. Preliminary Methow Subbasin Irrigation Canal Inventory

Ditch Name	Subwatershed	Estimated Length (Miles)	Estimated Flow (cfs)
Aspen Meadows	Twisp	2	1.3
Barkley	Middle Methow	4.2	18
Beaver	Lower Methow	NA	NA
Black Canyon	Lower Methow	NA	NA
Buttermilk	Twisp	1.2	7
Chewuch	Chewuch	12	28
Culbertson	Twisp	7000' ~1.5 miles	1
Early Winters	Upper Methow	5	12
Eightmile	Chewuch	0.1	1.6 - 2.2
Foghorn	Middle Methow	5.4	18
Foster	Beaver	1200' .0227 miles	1.2 - 3.5
Fulton	Chewuch	4	22
Gold Ck - Campbell	Lower Methow	NA	NA
Gold Ck - Krevlin	Lower Methow	NA	NA
Gold Ck - Umberger	Lower Methow	NA	NA
Hottell	Twisp	0.2	1.3 max
Kumm-Holloway	Upper Methow	2.24	4.7
Libby/ Larson	Lower Methow	NA	none
Mason	Chewuch	600'	0.5
McFarland Creek	Lower Methow	NA	NA
McKinney Mountain	Upper Methow	3.8	6 - 10 cfs
MVID East	Middle and Lower Methow	15.5	21
MVID West	Twisp and Lower Methow	12.5	20
Rockview	Chewuch	5	
Skyline	Chewuch	6.2	26
Twisp Power (TVPI)	Twisp	4	9
Wolf Creek	Middle Methow	5	<16

Source: Golder Associates

Many of the irrigation systems within the Methow Subbasin have upgraded their facilities in recent years. Those upgrades include elimination of fish passage barriers, replacement and repair of screens, and improvements to overall irrigation system efficiencies such as lining some ditches and replacing others with enclosed pipe systems (see *Existing and Past Efforts*).

Based on current information, it appears that over 60% of the total diversion amounts are associated with 7 irrigation systems which typically divert amounts greater than 10 cfs. Those irrigation systems are, Barkley, Chewuch, Early Winters, Foghorn, Fulton, MVID, and skyline.

Three irrigation systems, Early Winters, Skyline, and Wolf Creek, have been assessed by the National Marine Fisheries Service (NMFS) under the Section 7 consultation process enabled by the Endangered Species Act (ESA). Biological Opinions (BiOp's) were prepared for each irrigation system by NMFS between 1999 and 2000 (NMFS 1999b; NMFS 2000). These BiOp's established target flows for Early Winters Creek, the Chewuch River, and Wolf Creek. All of the other irrigation canals in the valley

are exempt from the Section 7 consultation process, but are potentially at risk of enforcement actions through the Section 9 provisions of the ESA. The Wolf Creek Irrigation District initiated a Habitat Conservation Plan (HCP) in 2000 to develop an alternative to the provisions set forth in the BiOp. The Skyline Ditch Company has initiated a collaborative effort with the Chewuch and Fulton systems to pursue an HCP for the Chewuch Basin.

There are two irrigation districts within the Methow Subbasin, Wolf Creek Reclamation District and the Methow Valley Irrigation District. All other irrigation ditches in the Methow Subbasin are privately owned by their shareholders.

Irrigation Districts

Methow Valley Irrigation District

The Methow Valley Irrigation District (MVID) was organized in the early 1900s to supply water for agricultural production. Water rights for the district originate prior to 1911 and serve approximately 1500 acres. MVID is comprised of two main canals. The West Canal diverts water from the Twisp River, and the East Canal diverts water from the Methow River. The District is currently required to provide 12 cfs to the Barkeley ditch on the east diversion on the Methow River. At the time this document is being developed, MVID is participating in facilitated negotiations with the Yakama Nation, the Confederated Tribes of the Colville Indian Reservation, state and federal agencies, to find means to improve district operations and facilities. The district has recently installed temporary ESA compliant screens on its points of diversion.

Wolf Creek Reclamation District

Wolf Creek Reclamation District (WCRD) has operated since 1921. WCRD supplies water for approximately 790 acres of irrigated land including the Methow Valley School District and irrigation and domestic supply for Sun Mountain Resort. Wolf Creek Reclamation District is authorized to divert surface waters from the Wolf Creek and Little Wolf Creek drainage. The diversion structure on Wolf Creek is located approximately 4 miles from the stream's confluence with the Methow River. Diverted water is stored for future use in Patterson Lake Reservoir. The water right is adjudicated, with irrigation and commercial domestic supply as designated beneficial uses. In 1980, WCRD began the process of lining and making other improvements to many of its ditches. The district is continuing to upgrade its delivery system including lining many of the remaining unlined ditches and replacing open ditches with pressurized piping where feasible. The district has also made, and continues to make, improvements to fish screens and to other potential fish passage barriers throughout its service area.

Methow Subbasin Ditches

Chewuch Basin Council

The Chewuch Basin Council represents three ditches, the Skyline Ditch Company, the Chewuch Canal Company, and the Fulton Ditch Company, each of which operate as distinct companies.

The Fulton Ditch Company has been in operation since approximately 1909. Fulton Ditch Company provides water for irrigation users. The ditch's source of water is a surface

diversion at approximately R.M. 0.8 of the Chewuch River. Fulton Ditch Company is currently completing an efficiency audit, has lined approximately 1,600 linear feet of their canals, and has installed approved fish screens meeting NMFS and WDFW requirements.

The Chewuch Canal Company (CCC) has operated since approximately 1910. The Chewuch provides irrigation water to support a variety of agricultural, recreational, and fish recovery projects within the Methow Subbasin. The CCC's source of water is a surface water diversion at approximately R.M. 7.0. of the Chewuch River. The CCC has a separate storage reservoir permit for storage of irrigation water within Pearygin Lake. The CCC operates approximately 20 miles of surface canals and is currently completing an efficiency audit and has upgraded their screening facility to meet NMFS and WDFW requirements.

The Skyline Ditch Company (SDC) has operated since approximately 1900. The SDC provides irrigation water for approximately 366 acres along the west side of the Chewuch River. The source of water is a surface water diversion located at approximately R.M. 7.5 of the Chewuch River. The SDC is in the process of completing efficiency improvements. Specifically, SDC has piped approximately 3.2 miles of the 6.0 mile ditch system, replaced the diversion headgate, and installed approved screening facility to meet NMFS and WDFW requirements.

Some other ditches in the Methow Subbasin (not part of the Chewuch Basin Council) include Aspen Meadows, Beaver, Black Canyon, Culbertson, Early Winters, Eightmile, Foghorn, Foster, Rockview, and Twisp Power.

Table 10. Water returned to Methow Subbasin streams and creeks due to NMFS, WDFW, and WDOE intervention, attrition and measures taken by irrigation systems

Diversion/Irrigation System or Ditch	Action Taken	CFS Saved
Early Winters Ditch Co.	Trigger flow conversion to wells	10
Skyline Ditch	Piping 3 miles of ditch	8
Chewuch Ditch Co.	Reduction of diversion from 57 cfs to 30 cfs upon installation of new screen	27
Fulton Ditch	Reduction of diversion from 28 cfs to 22 cfs upon installation of new screen	6
Wolf Creek Reclamation District	Shut down at 5 cfs trigger flow	12
MVID	Reorganization of lower ditch users to wells	9.2
Dave Schultz	Point of diversion change to well	2
Twisp Power and Irrigation	Reduction of diversion with new screen	3
Sun Mtn/Bud Hover	Point of diversion change to lake from Wolf Creek	4
Eightmile, USFS	Point of diversion change to well	6.3
Jones Ditch	Relinquishment due to washout	7.2

Eagle	Point of diversion to a well	1.5
Tourangeau	Point of diversion to a well	0.5
TOTAL		9.7

Source: Dick Ewing, email communication, September 2001.

Protected Areas

Much of the land within the Methow Subbasin is set aside as protected, particularly in the upper elevations of the watershed. Protected areas include two wilderness areas, the Pasayten Wilderness Area and the Lake Chelan-Sawtooth Wilderness Area. Washington Department of Fish & Wildlife (WDFW) also manages protected lands in the Methow Valley Wildlife Areas.

In addition, in 1988 the Northwest Power Planning Council stated that 1) various studies identified fish and wildlife resources of critical importance to the region; 2) mitigation techniques could not assure that all adverse impacts of hydroelectric development on those fish and wildlife populations would be mitigated; 3) even small hydroelectric projects could have unacceptable individual and cumulative impacts on those resources; and 4) protecting those resources and habitats from hydroelectric development is consistent with an adequate, efficient, economical and reliable power supply. The Council has since that time designated a number of river reaches throughout the Columbia Basin as protected areas. Those protected river reaches total approximately 178.8 miles within the Methow Subbasin and include portions of Bear Creek, Buttermilk Creek, Chewuch River, Early Winters Creek, Lost River, Methow River, South Creek, War Creek, and the Twisp River (StreamNet 2001).

- Approximately 80% of the Upper Methow subwatershed is managed by the U.S. Forest Service (USFS) as Congressionally Withdrawn (Wilderness), Late-Successional Reserve, or Riparian Reserve (USFS 1998d). These designations provide a high level of protection of aquatic areas and the surrounding uplands.
- The Lost River subwatershed contains 102,100 acres (95% of the subwatershed) that is protected within the Pasayten Wilderness.
- The Early Winters Creek subwatershed contains approximately 51,548 acres (approximately 99% of the subwatershed) that are managed by the USFS. The majority of that land is designated as a Scenic Highway Corridor along State Route Highway 20 with the remainder designated as a Late Successional Reserve.
- In the Chewuch River subwatershed, 108,000 acres (34% of the subwatershed) are protected within the Pasayten Wilderness. Other lands within the subwatershed include 5,000 acres (1.5%) managed by WDFW.
- The Twisp River subwatershed, including the headwaters and much of the uplands, contains approximately 72,000 acres (approximately 50% of the subwatershed) which fall within the Lake Chelan-Sawtooth Wilderness area. Additional federally managed land within the Twisp subwatershed is managed as Late Successional Reserves or Matrix (USFS 1995c). Lower elevation Forest Service land above the

confluence with Buttermilk Creek has been allocated as Late Successional Reserves.

- The majority of the Lower Methow River is federally owned and managed by the National Forest Service as the Okanogan National Forest with a small portion of upper Libby Creek lying within the Lake Chelan-Sawtooth Wilderness.

Fish and Wildlife Resources

Fish and Wildlife Status

Fish

An estimated 32 species of fish, including 7 introduced species, are found in the Methow River Subbasin. Historical anadromous production in the Methow Subbasin was represented by spring chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), and summer steelhead (*O. mykiss*). Craig and Suomela (1941) found evidence only of spring chinook salmon, although it was possible some summer chinook once spawned in the lower Methow River (Mullan et al. 1992b). In 1915, Washington Water Power Company constructed an impassable dam without a fishway in the lower Methow River near Pateros, significantly altering the salmonid production. Records from 1928 and 1929 indicate some chinook salmon were dip-netted below the dam and released above it (Mullan 1987; Scribner et al. 1993), but there was no evidence steelhead and coho salmon were passed beyond the dam. When the dam was removed in 1930, coho salmon, once the most abundant salmonid in the Methow Subbasin (Craig and Suomela 1941) were extirpated, chinook were nearly extirpated, and steelhead persisted as resident rainbow trout (Mullan et al. 1992b).

Table 11. Fish species known to occur in the Methow River Subbasin

Species	Origin	Distribution
Spring chinook (Oncorhynchus tshawytscha)	N	MR and major tributaries
Summer chinook (Oncorhynchus tshawytscha)	N	MR
Coho (Oncorhynchus kisutch)	N	Extirpated
Summer steelhead (Oncorhynchus mykiss)	N	MR and major tributaries
Redband trout (Oncorhynchus mykiss gibbsi)	N	Basin wide but not abundant
Bull trout (Salvelinus confluentus)	N	Basin wide
Mountain whitefish (Prosopium williamsoni)	N	MR and major tributaries
Brook trout (Salvelinus fontinalis)	I	Basin wide
Westslope cutthroat trout (Oncorhynchus clarki lewisi)	N	Basin wide
Pacific lamprey (Lampetra tridentata)	N	Unknown
Mottled sculpin (Cottus bairdi)	N	MRT
Torrent sculpin (Cottus rhotheus)	N	MRT
Shorthead sculpin (Cottus confuses)	N	MRT
Northern pikeminnow (Ptychocheilus oregonensis)	N	Lower reaches MR
Chiselmouth (Acrocheilus alutaceus)	N	Lower reaches MR
Peamouth (Mylochelius caurinus)	N	Lower reaches MR
Longnose dace (Rhinichthys cataractae dulcis)	N	MRT
Umatilla dace (Rhinichthys falcatus)	N	MRT

Species	Origin	Distribution
Three-spine stickleback (Gasterosteus aculeatus)	N	MRT
Prickly sculpin (Cottus asper)	N	MRT
Piaiute sculpin (Cottus beldingi)	N	MRT
Largescale sucker (Catostomus macrocheilus)	N	MRT
Mountain sucker (Catostomus platyrhynchus)	N	MRT
Redside shiner (Richardsonius balteatus balteatus)	N	LGS
Brown bullhead (Ameiurus nebulosus)	I	LP and LGS
Black crappie (Poxomis nigromaculatus)	I	LP and LGS
Bluegill (Lepomis macrochirus)	I	LP and LGS
Carp (Cyprinus carpio)	I	LP and lower reaches MR
Walleye ((Stizostedion vitreum vitreum)		Lower reaches of MR
Bridgelip sucker (Catostomus columbianus)	N	MRT
Largemouth bass (Micropterus salmoides)	I	LP
Smallmouth bass (Micropterus dolomieui)	I	LP

N=Native, I=Introduced, MR=Methow River, MRT=Methow River and tributaries, LP=Lakes and ponds, LGS=Low gradient streams

The Methow River Subbasin hosts six (6) fish species that are federally listed as endangered, threatened, or as species of concern.

Table 12. Federal status fish species in the Methow River Subbasin

Species	Status	Species	Status
Spring chinook	Endangered	Redband trout	Species of concern
Summer steelhead	Endangered	Pacific lamprey	Species of concern
Bull trout	Threatened	Westslope cutthroat	Species of concern

Chinook salmon exhibit two main life history strategies (Healey 1991). Different temperature regimes in natal areas seem to cause the variations in run timing that regulate incubation and emergence (Miller and Brannon 1982; Beer and Anderson 2001). The stream-type chinook (Gilbert 1913) is typical of northern populations and headwaters of tributaries in more southern populations. These fish spend at least one year in freshwater before migrating seaward. Stream-type chinook remain in the ocean for 1 to 4 years before returning to spawn in freshwater. Age 3 males are common in this life history strategy, with maturation for some males occurring without ever migrating seaward (Mullan et al. 1992a). The second life history strategy for chinook is known as ocean-type "sea-type" (Gilbert 1913). Ocean type chinook salmon usually migrate seaward during their first summer. They also spend between 1 and 4 years in the marine waters before returning to spawn in freshwater. Mullan (1987) noted early male maturation (age 3 or less) is even more common for ocean-type chinook than for stream-type chinook (>35% and <13%, respectively). Ocean-type chinook salmon spawn in the warmer downstream areas of the mainstems of major tributaries to, and in, the Columbia River (Meekin 1963; Chapman et al. 1982). Hence based upon life history patterns, stream-type chinook are referred to has the spring component, and ocean-type chinook are referred to as the summer component.

Spring chinook

Spring chinook were abundant in upper Columbia River tributary streams like the Methow River prior to the extensive resource exploitation in the 1860s. By the 1880s, the expanding salmon canning industry and the rapid growth of the commercial fisheries in the lower Columbia River had heavily depleted the mid and upper Columbia River spring and summer chinook runs (McDonald 1895). The full extent of depletion in upper Columbia River spring chinook runs is difficult to quantify because of limited historical records. Many factors including, industrial development of the Columbia River, agricultural, forestry and private development of the Methow Subbasin, in combination with historical intensive fishing, have contributed to the decline in abundance of Methow basin spring chinook. Chapman et al. (1995a) estimated a productivity reduction of at least 43% from the 1950s to the 1980s for upper Columbia River spring chinook salmon.

The Methow basin spring chinook migrate past Wells Dam and enter the Subbasin in May and June, peaking after mid-May. Run timing coincides with high spring run-off. Spawning occurs late July through mid-September. Age 4 fish represent the majority of adult returns, but age 5 fish can represent 20-30% of the annual escapement (Bartlett and Bugert 1994, Bartlett 1995-1997). An average of 5% of the escapement is age 3 fish. Fecundity averages 4,000 eggs/female for age 4 (n=93) and 5,300 eggs/female for age 5 (n=99), with a range 2,938 to 8,056 eggs/female. Methow basin spring chinook spawn primarily in the upper reaches of the Chewuch, Twisp and Methow rivers, including the Lost River, Early Winters and Wolf Creek tributaries. Fry emerge the following spring and are assumed to smolt as yearlings, although fall parr migrations from upper reaches have been observed (Hubble 1993; Hubble and Harper 1995). Juvenile chinook have been found rearing in most of the spawning areas, mainstem margins and side channels associated with the rivers, as well as some of the mouths of smaller tributaries (Mullan et al. 1992b; Hubble and Sexauer 1994; Hubble and Harper 1995).

Table 13. Periodicity of summer steelhead and chinook salmon life history in the Methow Subbasin

In 1935, the Methow basin was estimated to have a run of 200 to 400 spring chinook (Scribner et al. 1993). Although redd counts in the index reaches show a negative trend, Chapman et al. (1995a) recognized large fluctuations in redd counts between 1954-1994, without long term declines in numbers. The most comprehensive set of spawner survey data covers 1987 through 1999. Estimated spring chinook migration past Wells Dam between 1987 and 1999 has ranged from 103 to 2,444 fish.

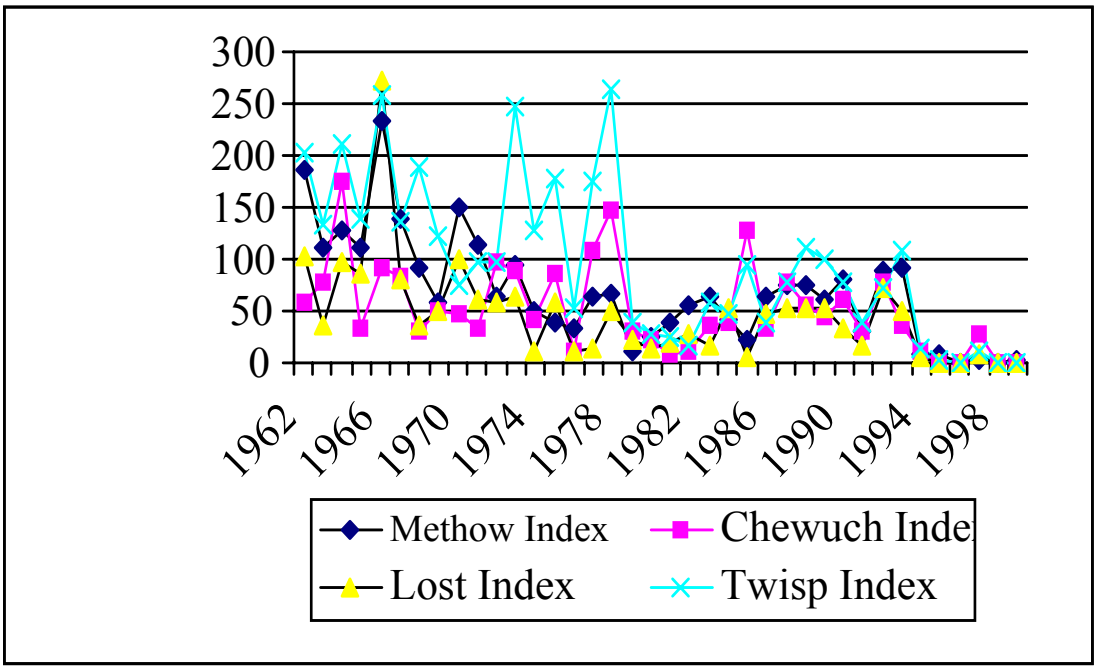

Figure 8. Methow Subbasin index redd counts 1962-1999

Table 14. Historical Methow Subbasin spring chinook redd counts and estimated escapement

Year	Wells Dam count	Winthrop NFH collection	Methow Hatchery collection	Wild by subtraction	Redd count	Wild run by redd expansion[1]
1962					552	3973
1963					355	2555
1964					612	4405
1965					369	2659
1966					852	6132
1967	1157			1157	377	2713

[1] Index redd counts 1962-1986 (Scribner et al. 1993), total 1987-1999 (Theiss, Yakama Indian Nation, personal communication).

Year	Wells Dam count	Winthrop NFH collection	Methow Hatchery collection	Wild by subtraction	Redd count	Wild run by redd expansion[1]
1968	4931			4931	350	2519
1969	3599			3599	292	2102
1970	2670			2670	373	2685
1971	3168			3168	319	2296
1972	3618			3618	328	2361
1973	2937			2937	502	3613
1974	3420			3420	244	1756
1975	2225	0		2225	375	2699
1976	2759	0		2759	121	871
1977	4211	0		4211	360	2591
1978	3615	38		3577	532	3829
1979	1103	102		1001	109	785
1980	1182	155		1027	91	655
1981	1935	399		1536	97	698
1982	2401	601		1800	116	835
1983	2869	755		2114	179	1288
1984	3280	900		2380	193	1389
1985	5257	1201		4056	256	1843
1986	3150	836		2315	186	1339
1987	2344	594		1750	681	1481
1988	3036	1327		1709	733	1613
1989	1740	195		1545	517	1137
1990	981	121		860	498	1060
1991	779	92		687	250	550
1992	1623	332	50	1241	738	1624
1993	2444	646	251	1547	617	1357
1994	257	29	32	196	133	293
1995	103	0	14	89	15	33
1996	335	146	318	0	NS	0
1997	971	231	328	412	150	330
1998	409	110	310	0	NS	0
1999	735	118	402	167	36	79

Genetic data collected from samples of the Winthrop National Fish Hatchery (NFH) population in 1992 (n=100) and Winthrop Hatchery-origin adults intercepted at Methow Hatchery in 1994 (n=25), and from Twisp and Chewuch rivers naturally produced adults in 1992, 1993, and 1994 (n=112 and n=158 in total, respectively) showed significant genetic differentiation among the wild and hatchery populations. Methow River mainstem natural spawners sampled in 1993 and 1994 showed significant genetic differentiation from Twisp and Chewuch populations, but were less differentiated from the Winthrop NFH population. Some of the Methow mainstem spawners were found to have hatchery scale patterns, and were believed to be Winthrop NFH-origin. (See also *Artificial Production section*). In general, the three naturally reproducing populations, prior to start-up of Methow Hatchery supplementation operations, were more closely aligned with each other than with the Winthrop NFH population, which was genetically closer to Leavenworth, Entiat and

Carson NFH populations. Twisp River spring chinook were the most highly divergent among the three naturally reproducing Methow Basin populations.

Few upper Columbia River origin spring chinook are harvested in marine or freshwater fisheries (TAC 1991). Spring chinook from the Columbia River move northward along the continental shelf within the first few months of marine life. However, low recovery rates of upper Columbia River spring chinook in ocean troll fisheries suggests these fish spend more time in far off-shore waters than do upper Columbia River summer chinook. Assuming Methow Subbasin spring chinook make similar contributions to the fishery as other upper Columbia River spring chinook, less than 20% of the run is caught annually. Harvest is limited to incidental catches in the marine fisheries and mainstem Columbia River sport, commercial, and tribal fisheries.

Summer chinook

High harvest rates in the lower Columbia River depleted populations of upper Columbia River summer chinook by the late 1800s (McDonald 1895). In the 1930s, the fishing rate remained at almost 90% and summer chinook escapement to Rock Island Dam hovered around 5,600 fish (Chapman et al. 1994a). Industrial development of the Columbia River system coupled with historical over-harvest reduced escapement. Although harvest rates were reduced in 1951, and the run rebounded to an average escapement range of 20,000 to 35,000 fish at Rock Island Dam, hydropower development remains a key limiting factor to harvest and escapement. Even though Craig and Suomela (1941) found evidence only of spring chinook salmon in the Methow basin, it is possible some summer chinook once spawned in the lower river (Mullan et al. 1992b).

Summer chinook migrate past Wells Dam from July through August, and spawn in the lower mainstem reaches of the Methow River from the town of Winthrop down to the Methow's confluence with the Columbia River. Annual dominant age class varies between age 4 and age 5. Preliminary carcass recoveries indicate the higher the recovery rate of hatchery fish, the older the modal age (T. Miller, WDFW, personal communication). Spawning begins in late September and continues through mid-November. The eggs incubate through the winter, with fry emergence the following spring. Historic data indicated smoltification and seaward migration occurred during the summer months when the fish were subyearlings. Current data suggests as much as 60% of the natural production over-winter in the reservoirs of the Columbia River hydropower system (Langness 1991; Chapman et al. 1994a; Sneva, WDFW, personal communication). The juveniles migrate seaward as yearlings the following spring. It has not yet been determined if this is an artifact of the artificial production (Bugert et al. DRAFT) and higher carcass sample rates on spawning and hatchery grounds or if the fish have undergone an environmental adaptation.

Methow and Okanogan Subbasin summer chinook are managed for natural production, with an informal escapement goal of 3,500 fish past Wells Dam. This natural run is a mixture of strays from Wells Dam Hatchery, descendents of remnant native summer chinook, and stocks transferred during the Grand Coulee Fish Maintenance Project (GCFMP). They are genetically homogenous with other upper and mid-Columbia River summer and fall chinook populations, likely because of post-GCFMP and current hatchery

practices (Chapman et al. 1994a). In the 1998 *Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California*, NMFS indicated that summer/fall chinook salmon in this ESU were not in danger of extinction, nor were they likely to become so in the foreseeable future (Myers et al. 1998). Although travel distance and dam passages are essentially equal for fish from the Methow and Okanogan basins, the Methow basin summer chinook escapement has experienced a significant decline (Chapman et al. 1994a). Chapman et al. (1994a) recommended prompt attention to studies of microhabitat, distribution, growth, egg-to-smolt survival, and pilot riparian modification. Escapement during 1980-2000 averaged only 36% of the total in 1956-1979. Since 1980, run sizes have ranged from 350 to 1,900 adults based upon redd count expansions with an average run size of about 1,000 fish (Murdoch et al. 2001).

Table 15. Methow Subbasin summer chinook counts 1956-2000

Spawn year	Total aerial count	Total ground count	Estimated escapement
1956	109	--	605
1957	451	--	2503
1958	335	--	1860
1959	130	--	721
1960	194	--	1077
1961	120	--	666
1962	678	--	3762
1963	298	--	1654
1964	795	--	4411
1965	562	--	3119
1966	1275	--	7075
1967	733	--	4067
1968	659	--	3657
1969	329	--	1826
1970	705	--	3912
1971	562	--	3118
1927	325	--	1803
1973	366	--	2031
1974	223	--	1237
1975	432	--	2397
1976	191	--	1060
1977	365	--	2025
1978	507	--	2813
1979	622	--	3451
1980	345	--	1914
1981	195	--	1082
1982	142	--	788
1983	65	--	360
1984	162	--	899
1985	164	--	910
1986	169	--	938
1987	211	--	1171
1988	123	--	683
1989	126	--	699
1990	229	--	

Spawn year	Total aerial count	Total ground count	Estimated escapement
1990[2]	--	*409*	1268
1991	120	--	
1991	--	*153*	474
1992	91	--	
1992	--	*107*	331
1993	116	--	
1993	--	*154*	477
1994	280	--	
1994	--	*310*	961
1995	296	--	
1995	--	*357*	1107
1996[3]	*151*	--	
1997	*173*	--	
1997	--	205	636
1998	*192*	--	
1998	--	225	698
1999	--	448	1389
2000	--	500	1550

Summer chinook from the region are harvested only incidentally in lower Columbia River fisheries directed at other species, and no directed commercial fisheries on upper Columbia summer-run fish have occurred in the mainstem since 1964 (BAMP 1998). The 1982-89 brood year average ocean fisheries exploitation rate was 39%, with a total exploitation rate of 68% estimated for the same years (Myers et al. 1998).

Coho

Prior to the 1940s, runs of Methow River coho salmon were essentially destroyed as a result of over harvest, early hatchery practices, and impassable dams. Much of the failure of the GCFMP to re-establish self-perpetuating populations was related to a reliance upon stocks lacking genetic suitability (Mullan et al. 1992b). Long run coho are unique among a species that usually migrates very short distances to spawn in freshwater. Historical pictures of the native Methow coho indicate the fish were equal in size to the spring chinook (Mullan et al. 1992b).

Currently, plans to reintroduce coho salmon by the Yakama Nation, in cooperation with Washington Department of Fish and Wildlife and the U.S. Fish and Wildlife Service, are in the feasibility stage. The proposed reintroduction would involve various facilities throughout the lower and upper Columbia River basins (see *Artificial Production, Appendix A, and Goals, Strategies and Objectives*). At this time, there is no central hatchery facility for coho salmon in the Methow River basin. Releases rely on transfers of up to 250,000 pre-smolts from lower Columbia River hatcheries to available rearing ponds at Winthrop NFH for acclimation (the ESA limit is currently capped at 400,000 however, the Winthrop NFH capacity for coho is 250,000). The source lower Columbia River

[2] Ground counts 1990-1995 based on aerial count expansion factor of 1.79 (Langness 1991).
[3] Peak aerial counts were estimated from total groud counts 1996, 1997, 1998.

hatchery stock originated from indigenous Toutle River coho stock, with recent infusions of Sandy River stock (BPA 1999).

Sockeye

The Methow River basin never supported an indigenous sockeye run (Mullan 1986). A very limited number of remnant sockeye spawn in the mainstem Methow River. Sockeye adults are observed nearly every year during the annual chinook spawning ground surveys (Chapman et al. 1995b; Murdoch, Washington Department of Fish and Wildlife, personal communication). Average estimated escapement is about 50 fish. These fish are most likely a product of strays from the Lake Osoyoos population and remnants from the Winthrop NFH sockeye program (Chapman et al. 1995b). The progeny are fluvial and probably rear in the reservoirs of the Columbia River system.

Summer steelhead/rainbow trout

Summer steelhead, native to the Methow basin, is the exclusive ecotype of the inland waters. Steelhead were not extirpated in the Methow River, as were coho, probably because headwater resident forms sustained the run (Mullan et al. 1992b). Anadromy is not obligatory in *O. mykiss* (Rounsefell 1958; Mullan et al. 1992b). Progeny of anadromous steelhead can spend their entire life in freshwater, while progeny of rainbow trout can migrate seaward. Anadromy, although genetically linked (Thorpe 1987), runs under environmental instruction (Shapovalov and Taft 1954; Thorpe 1987; Mullan et al. 1992b). It is difficult to summarize one life history strategy (anadromy) without due recognition of the other (resident). The two strategies co-mingle on some continuum with certain residency at one end, and certain anadromy on the other. Upstream distribution is limited by low heat budgets (about 1,600 temperature units) (Mullan et al 1992b). The response of steelhead/rainbow complex in these cold temperatures is residualism, presumably because growth is too slow within the time window for smoltification. However, these headwater rainbow trout contribute to anadromy via emigration and displacement to lower reaches, where warmer water improves growth rate and subsequent opportunity for smoltification.

The Methow Subbasin once was a productive wild steelhead system, but has declined significantly since the early 1900s. The intensive commercial fisheries in the late 1800s and industrial development of the Columbia River were largely responsible for the decline of the wild steelhead run (Mullan et al. 1992b; Chapman et al. 1994b). Curtailing the commercial fisheries resulted in a resurgence of wild steelhead productivity in the upper Columbia River region, where the run size tripled (5,000 fish to 15,000 fish) between 1941-1954 (Mullan et al. 1992b). Wild productivity declined again with completion of the Columbia River hydropower system. Additionally, wild fish were subjected to, and suffered as a result of, mixed stock fisheries in the lower Columbia River directed at their abundant hatchery cohort.

Wells Dam fishway, which became operational in 1967, estimated wild run size above the dam at 1,500 to 2,000 fish in the late 1960s. Hatchery fish made up an increasing fraction of the steelhead run after the 1960s, as wild runs were already depleted (Chapman et al. 1994b). Mullan et al. (1992b) spawner-recruit analysis calculated the maximum sustainable yield (MSY) run size and escapement for the Methow Subbasin at 7,234 fish

and 2,212 fish, respectively. When hatchery produced steelhead (see *Artificial Production*) are combined with the naturally produced steelhead, no long-term trend in decline is evident. But, wild steelhead sustain themselves only at threshold population size today. The high hatchery return rate, genetic homogeneity of hatchery and wild steelhead (Chapman et al. 1994b), and maintenance of near MSY levels in most years suggest a truly wild fish does not exist. Rather, natural production sustains them only at threshold levels, and without hatchery supplementation the Methow River steelhead would suffer dire consequences.

Table 16. Hatchery and wild steelhead counts at Wells Dam

Year	Run to Wells Dam	Number in broodstock			Wild%	Run over Wells Dam		
		Hatchery	Wild	Total		Hatchery	Wild[4]	Total
1967	2199			171				2028
1968	2667			413				2254
1969	1299			530				769
1970	2023			399				1624
1971	4257			358				3899
1972	2069			354				1715
1973	2473			627				1846
1974	632			260				372
1975	732			227				505
1976	4973			337				4636
1977	5819			355				5464
1978	1831			356				1475
1979	4138			367				3771
1980	3735			372				3363
1981	4757			650				4107
1982	8395	552	38[5]	590	0.065	7298	507	7805
1983	20200	661	9	670	0.013	19276	254	19530
1984	17353	673	17	690	0.025	16246	417	16663
1985	20462	718	32	750	0.043	18864	848	19712
1986	13901	631	20	650	0.030	12853	398	13251
1987	6168	528	75	603	0.124	4875	609	5565
1988	5010	581	70	651	0.108	3888	471	4359
1989	5301	629	95	724	0.131	3977	600	4577
1990	4577	644	91	735	0.124	3366	476	3842
1991	8481	588	70	658	0.107	6986	837	7823
1992	7628	599	34	633	0.054	6617	378	6995
1993	3043	534	46	586	0.079	2263	194	2457
1994	2800	581	38	619	0.062	2045	136	2181
1995	1472	521	0	521	0.123	834	117	951
1996	4523	350	19	369	0.051	3942	212	4154
1997	4534	449	11	460	0.024	3976	98	4074

[4] Assumes wild fish were representative of the entire run.
[5] 1982-1986 wild fish estimated by dorsal fin condition and otoliths. 1987-1999 adipose fins were clipped on all hatchery fish.

1998	3083	379	31	410	0.076	2470	203	2673
1999	3958	341	47	388	0.121	3138	432	3570

Steelhead destined for the Methow Subbasin pass Wells Dam in July through the following May, with peak migration in September (Fig HB2). Mullan et al. (1992b) was unable to detect a significant difference between run timing of hatchery and wild fish passing Wells Dam. Most adults hold in the mainstem Columbia River through the winter, although some hold in large, deep pools associated with the Methow River downstream of Winthrop. Summer steelhead spawn in late winter, spring and early summer in the mainstem Methow River and its tributary streams. Although steelhead are iteroparic (life after spawning), kelts represent less than 1.0% of the annual spawning population (Brown 1995). The low occurrence of repeat spawners may be related to post-spawn Columbia River discharge or spill frequency, duration and/or sequential timing (Brown 1995). However, Chapman et al. (1994b) suggested the number of repeat spawners pre-development was never high.

Spawning grounds are not surveyed for steelhead because the adults generally spawn over a 4-5 month period coinciding with high spring flows when water visibility is low and discharge high. Preliminary surveys conducted during the low water season in 2001, supported expected redd locations (Chapman et al. 1994b). Spawning and rearing distribution correlate closely (Mullan et al. 1992b). Unlike other species in the *Oncorhynchus* genus, steelhead eggs incubate at the same time temperatures are increasing. Fry emerge in July through October (Chapman et al. 1994b), with time of hatching varying largely with water temperature, region, habitat and season (Bjornn and Reiser 1991). Juveniles rear in freshwater for 1-7 years (Mullan et al. 1992b; Peven et al. 1994) before migrating seaward during the spring months, with the highest percentage smolting at ages 2 and 3. Upper Columbia River summer steelhead spend one to three years in the ocean, with two years representing the largest percentage (Mullan et al.1992b; Brown 1995; Bartlett 1999-2000). A high percentage of hatchery males can return after one winter (Brown 1995; Bartlett 1999-2000).

Despite the natural production sustaining them at threshold population size, the biological fitness of the hatchery spawners allows the population to meet pre-development MSY escapement and smolt production in most years (Mullan et al. 1992b). This does not mean that the hatchery fish are the "ecological equivalents of wild fish in all life history phases" (Chapman et al. 1994b), although Mullan et al. (1992b) found no difference in smolt to adult survival for hatchery versus wild steelhead. A portion of the hatchery-released steelhead remain in the freshwater for another winter (Bartlett 1997, 1999-2000; K. Williams, personal communication), increasing the fitness of returning adults (Chapman et al. 1994b). In addition, the resident form contributes to anadromy, at varying degrees, inversely related with the steelhead productivity.

Table 17. Return percentage of hatchery-origin adults to and over Wells Dam

Release year	Smolts released[6]	Adult return to Wells Dam[7]	1-salt fish[8]	2-salt fish	% to Wells Dam	Adult return over Wells Dam	1-salt fish	2-salt fish	% return over Wells Dam
1966	199720				1.19				1.06
1967	187676	2199	1319	880	1.13	2028	1217	811	0.88
1968	100644	2667	1600	1067	1.57	2254	1352	902	1.10
1969	205457	1299	779	520	1.42	769	461	308	1.23
1970	322462	2023	1214	809	1.05	1624	974	650	0.94
1971	220384	4257	2554	1703	1.02	3899	2339	1560	0.81
1972	327902	2069	1241	828	0.59	1715	1029	686	0.42
1973	170602	2473	1459	1014	0.16	1846	1089	757	0.10
1974	182111	632	145	487	0.90	372	86	286	0.76
1975	249279	732	600	132	2.14	505	414	91	2.00
1976	238405	4973	3929	1044	2.52	4636	3662	974	2.27
1977	147922	5819	4422	1397	0.29	5464	4153	1311	0.24
1978	164259	1831	256	1575	2.99	1475	207	1269	2.72
1979	268252	4138	3972	166	2.69	3771	3620	151	2.36
1980	471420	3735	2801	934	0.95	3363	2522	841	0.94
1981	358234	4757	333	4424	1.25	4107	287	3820	1.24
1982	379472	7849	3689	4160	7.54	7805	3668	4137	7.27
1983	494784	19937	19140	797	3.48	19276	18505	771	3.35
1984	466545	16919	7444	9475	3.95	16246	4148	9098	3.78
1985	413066	19582	9791	9791	1.83	18864	9432	9432	1.71
1986	452844	13484	4854	8630	1.22	12853	4627	8226	1.08
1987	564315	5403	2702	2702	0.57	4875	2437	2437	0.49
1988	826208	4469	1654	2815	0.69	3888	1439	2450	0.59
1989	623003	4607	3040	1566	0.67	3977	2625	1352	0.60
1990	740433	4009	1323	2686	1.19	3366	1111	2255	1.10
1991	656997	7574	4696	2878	0.82	6986	4331	2655	0.71
1992	541610	7216	3067	4149	0.42	6617	2812	3805	0.22
1993	511295	2803	477	2326	0.35	2263	385	1878	0.35
1994	420110	2626	945	1681	0.44	2045	1248	757	0.36
1995	450345	1355	501	840	1.19	834	309	517	1.08
1996	347950	4292	2962	1331	0.99	3942	2720	1222	0.87
1997	427900	4425	2036	2390	0.64	3976	1829	2147	0.57
1998	543030	2849	1453	1396		2470	1260	1210	
1999	843385	3479	2192	1287		3138	1977	1161	

Commercial harvest of steelhead by non-tribal members was prohibited beginning in 1975. Incidental catches of steelhead do occur in present-day sockeye and fall salmon fisheries within Zones 1-5, but are minimized with time, area, and gear restrictions. Above

[6] Includes only smolts planted at or above Wells Dam.
[7] Includes broodstock plus dam count. 1967-1982 is combination of hatchery and wild. 1982-1999 is hatchery fish only.
[8] 1967-1972 ocean age unknown, but estimated by 0.6 and 0.4 for 1-salt and 2-salt, respectively. Return rates prior to 1982 were combination of hatchery and wild.

Bonneville, in Zone 6, only the treaty tribes conduct commercial harvest. The Zone 6 tribal commercial fishery does not selectively remove wild steelhead from gill nets, thus both marked and unmarked fish are retained. Total catches in recent years (1985 through 1996) ranged from 86,000 in 1985 down to 5,300 in 1998. Between 1990 and 1998, tribal catches have averaged 22,100 (WDFW & ODFW 1999). Current information however, based on GSI analysis, indicates an impact of less than 10% for upper Columbia stocks (Rawding et al. 1998).

Recreational fisheries occur throughout the Columbia and Snake River watersheds. Fisheries that harvest upper Columbia steelhead occur in Zone 6 waters above the Snake River confluence including Hanford Reach up to Chief Joseph Dam and major tributaries, namely Wenatchee, Entiat, Methow and Okanogan watersheds. Since 1984, wild steelhead release has been required in these waters (i.e., steelhead with adipose fins), and since 1997 no recreational fishery targeted at steelhead has been permitted above Priest Rapids Dam. The Confederated Tribes of the Colville Indian Reservation do take steelhead incidental to their summer chinook snag fishery below Chief Joseph Dam and in the Okanogan River net fishery, but Chapman et al. (1994b) concluded tribal fishing above Zone 6 was insignificant and despite large numbers being taken in some years, the overall percentage of the catch to the total run was low.

Bull trout

Bull trout once filled most every cold-water niche in the Methow Subbasin. However, within the Methow Subbasin the presence of natural barriers such as waterfalls or small stream size blocked their access to many headwater streams. Three life history forms of bull trout were probably dispersed throughout the Methow Subbasin; resident, fluvial, and adfluvial. In Early Winters Creek and the Lost River there are significant falls to negotiate, although in the Lost River the barrier may have formed in recent times. In other Methow drainage tributaries bull trout spawning and early rearing is confined to streams cold enough (less than 1,600 C annual temperature units) to support them in the areas below the falls (Mullan et al. 1992b). In most cases such reaches are very short (less than 5 miles). An estimated 14 breeding populations, occupying less than 5% of the Subbasin existed prior to Anglo settlement in the late 19th century. Today, only 1.4% of the original 5% of critical bull trout habitat remains (Mullan et al. 1992b); this habitat represent spawning and initial rearing habitat for the fluvial and adfluvial ecotype, and spawning and all stages of rearing for the resident ecotype. Once bull trout reach parr size (ages 2 and 3) (Mullan et al. 1992b), cold temperatures are no longer required, and some portion of the population(s) move downstream to warmer water, where they compete with other fish until they change trophic levels and become the apex predator.

Adult bull trout migrate from some of the warmest water in their range, the Columbia River, back to cold headwater streams to spawn. The coldest water is most often found in isolated headwater stream locations. Migration for Methow Subbasin bull trout from the Columbia River begins around July. Spawning begins in headwater streams in late September and continues through October, with commencement closely tied to water temperature less than 9 C (Brown 1994). After spawning, fluvial and adfluvial kelts return to their more moderate environments, while resident forms seek winter refuge.

Methow Subbasin juvenile bull trout rear in the coldest headwater locations until they reach a size that allows them to compete with other fish (75-100mm) (Mullan et al. 1992b). Resident forms above barrier falls probably experience a limited amount of recruitment downstream, nevertheless, this recruitment contributes to fluvial and adfluvial productivity. The fluvial forms migrate to the warmer mainstem Methow and Columbia rivers (e.g. Twisp River, Wolf Creek), while the adfluvial populations (e.g. Lake Creek, Cougar Lake) migrate to nearby lakes.

Twelve bull trout populations remain in the Methow Subbasin. Recent comprehensive redd surveys, coupled with preliminary radiotelemetry work in the Wenatchee basin suggest the 12 remaining spawning populations are not complete genetic isolates of one another, but rather co-mingle to some degree. It is possible five spawning aggregates represent the Methow Subbasin, but more monitoring and DNA analysis is necessary. The Lost River aggregate gene flow occurs only in high water years and not always between all represented groups.

Table 18. Bull trout survey summary for Methow Subbasin 1989-1999

Stream	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00
Chewuch River												
Lake Creek							22	13*	9	9	0	12
Methow River												
Goat Creek.							0					11*
Lost River				5*		0	0*			0*		
Monument Creek.				2*	0							
Crater Creek								2*	1	1	0	
Wolf Creek								7	3*	27	29	15
Early Winters Creek								9*	0*	2	0	3
Cedar Creek.								1	2*		0	
West Fork Methow River							27	10	13*	11*	1	2
Twisp River												
Twisp River				3*	5*	4*	18	10	3	67	38	72
E.F. Buttermilk Creek							4*	0*	0	0	0	0
Reynolds Creek				1*				0*				
North Creek										19	63	33

*Incomplete counts as to time (single survey) and/or space (only part of index area surveyed). This table summarizes redd counts of most known spawning populations. Full inventories of all streams for bull trout presence and redd counts are not complete.

Table 19. Five potential bull trout spawning aggregates with life history representation

Aggregate	Resident	Fluvial	Adfluvial
Chewuch River (including Lake Creek)			
		X	X
Upper Methow R. (including West Fork Methow, Early Winters/Cedar creeks, Wolf Creek, Goat Creek)			
	X	X	X
Lower Methow R. (including Blue Buck/Beaver creeks, Crater/Gold creeks)			
		X	
Twisp River (including North Creek, Buttermilk Creek, Reynolds Creek)			
	X	X	
Lost River (including upper Lost River, Monument Creek, Cougar and Hidden lakes)			
	X	X	X

Two historically recognized populations of bull trout were extirpated through brook trout introgression (Eightmile and Beaver creeks). Brook trout probably represent the greatest immediate risk to the Methow Subbasin bull trout populations. Cold water is not a deterrent for brook trout and maturation of brook trout occurs at ages 2-4, whereas maturation for bull trout occurs at ages 6-9 (Mullan et al. 1992b). Replacement of bull trout through introgression is a matter of time unless the brook trout population(s) are removed. Since there are no barriers to block their passage, brook trout, found in the Twisp River, can easily invade the bull trout zone upstream, although competition with other species has probably limited brook trout productivity.

Because of short cold water reaches, suitable spawning habitat, critical to the productivity of the Methow Subbasin bull trout is limited in the East and West Forks of Buttermilk Creek, Crater Creek, Goat Creek, Cedar Creek, Monument Creek and Reynolds Creek. Resident stocks are not heavily fished because of their relative isolation. Migratory bull trout were negatively impacted in the past by steelhead fisheries, but discontinuance due to the steelhead ESA listing coincidentally improved bull trout survival.

Westslope cutthroat trout

The key piece of evidence for the historical distribution of fish in the Methow Subbasin is a wildlife atlas compiled by the US Forest Service in December 1937. This document and the handwritten entries in it listed species present, but did not distinguish between native and non-native species. A pioneer packed cutthroats from Foggy Dew Creek and released them into Cooney Lake in 1917. Whether these cutthroat from Foggy Dew Creek were native or introduced from the Stehekin Hatchery, which began operation in 1907, is a mystery. Cedar, Early Winters, Eightmile, Eureka, Goat, Horseshoe, North Fork Wolf and Robinson creeks and the Lost River and West Fork Methow River, were also listed as streams that supported cutthroat trout in the 1932 atlas. Of these waters Cedar, Eightmile, Goat, and North Fork Wolf creeks and the Lost and West Fork Methow rivers have the potential to support *O.c.lewisi*. However, their designation as native populations is equivocal by the absence of early stocking records. Mullan et al. (1992b) indicated pure or essentially pure westslope cutthroat trout were found above natural rainbow/cutthroat

hybridization zones, and in alpine lakes with no history of non-native introductions. Extensive stocking of Twin Lake cutthroat trout in alpine lakes and mountain streams for decades has vastly increased the distribution of cutthroat in the Methow Subbasin (Williams 1998). Furthermore, the hatchery brood stock (indigenous Lake Chelan stock) used is an excellent representation of pure westslope cutthroat trout (Behnke 1992).

Allopatric cold-water species such as cutthroat can flourish in much warmer environments than in sympatry, but they are vulnerable to displacement by species better suited to warmer temperatures such as the rainbow trout (Mullan et al. 1992). The interactions have long ago been resolved and the distributions stabilized with no further threat unless thermal conditions change. Westslope cutthroat trout reside in cold-water refugia where interactive threats from other species are absent because many populations are protected from invasion by barrier falls and most invaders are competitively debilitated by cold temperature. The brook trout is the lone exception. Brook trout, a cold-water species itself, may replace cutthroat in low gradient streams with sandy substrates. The threat from brook trout results from stocking them above an existing cutthroat trout population. The replacement of native westslope cutthroat trout in Eightmile Creek was due to stocking brook trout in a small, flat stream, ideally suited to the latter. Brook trout co-inhabit a number of streams with cutthroat, but the effect in production decreases for both species, not elimination of either. Hybridization with steelhead/rainbow trout results from the natural spawning interaction of cutthroat and steelhead/rainbow at their distributional point of contact where water temperature favors neither species (Mullan et al. 1992b; Williams 1998). These hybridization zones are short, limiting the negative impact to either species.

Non-anadromous salmonids are seldom planted in Washington streams today. Stocking in alpine lakes is ongoing and intra-agency safeguards to filter out ill-advised plants include the Wild Salmonid Policy, the State Environmental Policy Act, and disease prevention stocking policies. Interagency agreements, MOUs, and mandates with National Parks and the U.S. Forest Service also play discriminating roles.

Although current numbers of fluvial fish may be lower than pre-Anglo abundance due to over harvest, their preservation is assured through regulatory protection, annual stocking, and egress from a host of resident populations. Discontinuing the steelhead fishery also provided protection to the fluvial cutthroat. The resident stream populations attract few anglers because of remote locations and small fish sizes. The oldest westslope cutthroat trout ever reported in the literature (Mullan et al. 1992b) flourished for 13 years amidst summer parades of visitors to the Gardner Meadow campsite at the head of Wolf Creek because there was little demand for this 6.3 inch trout. In addition, the state regulation minimum size of 8 inches, precluded retention.

Pacific lamprey

The Pacific lamprey is anadromous. Like salmon they are born in freshwater streams, migrate out to the ocean, and return to fresh water to spawn as mature adults to spawn. Historic data suggests Pacific lamprey were once abundant in the Methow Subbasin (Visalli 2000). Although masses of migrating lamprey have been known to block the

salmonid counting windows at Wells Dam, counts dropped from 409 in 1998, to 94 in 2000. Pacific lamprey fall prey to a wide variety of species including trout, crayfish, and birds.
Lamprey have similar freshwater habitat requirements to salmon. Though absolute historical population sizes of the lamprey are not known, it is clear that the fish, once a significant tribal subsistence food, have declined considerably (Visalli 2000).

Lamprey enter streams from July to October. They spawn the following spring when water temperatures are between 10-12 C. They then ascend the rivers by swimming upstream briefly, then sucking to rocks and resting. Lamprey spawn in low gradient sections of water where they can find gravel and sandy bottoms. Adults die within four days of spawning, after depositing about 10,000 to 100,000 extremely small eggs in their nest. The young hatch in 2-3 weeks and swim to backwater or eddy areas of low stream velocity where sediments are soft and rich in dead plant materials. They quickly burrow into the muddy bottom where they filter the mud and water, eating microscopic plants (mostly diatoms) and animals. The juvenile lamprey stay burrowed in the mud for 4 to 6 years, moving only rarely to new areas. After a two-month metamorphosis, triggered by unknown factors, they emerge as adults averaging 4.5 inches long. In early spring the young adults migrate seaward. It is unknown if the Methow Subbasin Pacific lamprey migrate seaward or remain in the Columbia River reservoirs. During its ocean phase of life the Pacific lamprey are scavengers, parasites, or predators on larger prey such as salmon and marine mammals. After 2 to 3 years in the ocean they return to freshwater to spawn.

Recent surveys for Pacific lamprey in the Methow Subbasin found the highest concentration of ammocoetes (juveniles) near 30-Mile Campground on the Chewuch River. Fifteen were encountered in one debris pile (Visalli 2000). Adults are almost never encountered, although the Yakama Nation screw trap in the Chewuch River may have entrained some (Hubble 1993).

Mountain Whitefish

The Mountain Whitefish, the most common whitefish in Washington, is found throughout the state (Wydoski and Whitney 1979). Whitefish encountered in the Methow basin utilize various habitat types throughout the summer, although preference seems to be given to riffle areas. In the winter, they prefer large, deep pools where they congregate after spawning. Although general biology about spawn timing, age at maturation, and fecundity are known, more specific information about growth rate, recruitment, spawn locations, productivity and abundance trends are unknown (*See Fish and Wildlife Needs*).

WDFW manages a target whitefish fishery during the winter months in the Methow Basin. The fishery has a fairly liberal daily limit of 15 fish. Three consecutive years of creel monitoring suggests effort for this fishery is low, but catch rate is high. Effort occurs in early December and late February through March when mild winter conditions prevail.

Wildlife

The Methow River Subbasin is one of the most biologically diverse watersheds in Eastern Washington, containing some of the region's highest quality wildlife habitats. Nearly 350 vertebrate species have been identified with the Methow Subbasin. The upper Methow watershed supports a unique assemblage of imperiled species and is one of only a few sites in the country where the grizzly bear, gray wolf, lynx, bald eagle, spotted owl, and federally listed anadromous fish occur together. This wealth of natural resources supports extensive year-round wildlife based recreation that plays a crucial role in the local economy.

Washington Department of Fish and Wildlife (WDFW) has assigned priority status to over 50 of the species present in the Subbasin. The Priority Species List recognizes all species listed as endangered, threatened, sensitive, or candidate by the federal and state government. This list also includes wildlife species that WDFW considers vulnerable to future listing or important to harvest-based recreation.

Tremendous habitat diversity combined with limited human development has fostered the biological richness of the Subbasin. Habitat diversity within the Subbasin is the largely the result of the watershed's wide range of topographic and climactic variables. Habitats range from riparian/floodplain and shrub-steppe in the lowest elevations, through several forest types, to tundra on the highest peaks and ridges in the watershed. The watershed contains 14 Priority Habitats as identified by WDFW.

The majority (over 80%) of the watershed is publicly owned and enjoys various levels of protection and active management. However, virtually all of the private ownership and most of the human development is concentrated in the riparian/floodplain, shrub-steppe and dry forest habitats at the lowest elevations. These productive habitats and the species that depend on them have been reduced and fragmented in areas within the subbwatershed. The status of some of these species within the Methow Subbasin is discussed below.

Table 20. Status of State Priority Species in the Methow Subbasin

Species	Occurrence	Federal Status	State Status
Rocky Mountain Mule Deer (Odocoileus hemionus hemionus)	Year-round	----	Game
Northwest White-tailed Deer (Odocoileus virginianus ochrourus)	Year-round	----	Game
Moose (Alces alces)	Year-round	----	Game
Mountain Goat (Oreamnos americanus)	Year-round	----	Game
Grizzly Bear (Ursus arctos)	Year-round	Threatened	Endangered
Gray Wolf (Canis lupus)	Year-round	Endangered	Endangered
Fisher (Martes pennanti)	Year-round	Concern	Endangered
Lynx (Lynx canadensis)	Year-round	Threatened	Threatened

Species	Occurrence	Federal Status	State Status
Wolverine (Gulo gulo)	Year-round	Concern	Candidate
Marten (Martes americana)	Year-round	----	Game
Mink (Mustela vison)	Year-round	----	Game
Merriam's Shrew (Sorex merriami)	Year-round	----	Candidate
Myotis Bat spp. (Myotis spp).	Year-round	----	Monitor
Pallid Bat (Antrozous pallidus)	Year-round	----	Monitor
Townsend's Big-eared Bat (Corynorhinus townsendii)	Year-round	Concern	Candidate
White-tailed Jack Rabbit (Lepus townsendii)	Year-round	----	Candidate
Western Gray Squirrel (Sciurus griseus)	Year-round	Concern	Threatened
Common Loon (Gavia immer)	Breeding	----	Sensitive
Great Blue Heron (Ardea herodias)	Breeding	----	Monitor
Cavity Nesting Ducks (Aix sponsa, Bucephala islandica, Buchephala clangula, Bucephala albeola, Lophodytes cucullatus)	Year-round	----	Game
Harlequin Duck (Histrionicus histrionicus)	Breeding	Concern	Game
Bald Eagle (Haliaeetus leucocephalus)	Year-round	Threatened	Threatened
Golden Eagle (Aquila chrysaetos)	Year-round	----	Candidate
Merlin (Falco columbarius)	Breeding	----	Candidate
Northern Goshawk (Accipiter gentiles)	Breeding	Concern	Candidate
Prairie Falcon (Falco mexicanus)	Breeding	----	Monitor
Peregrine Falcon (Falco peregrinus)			
Blue Grouse (Dendragapus obscurus)	Year-round	----	Game
Sharp-tailed Grouse (Tympanuchus phasianellus)	Year-round	Concern	Threatened
Wild Turkey (Meleagris gallopavo)	Year-round	----	Game
Burrowing Owl (Athene cunicularia)	Breeding	Concern	Candidate
Flammulated Owl (Otus flammeolus)	Breeding	----	Candidate
Spotted Owl (Strix occidentalis)	Year-round	Threatened	Endangered
Vaux's Swift (Chaetura vauxi)	Breeding	----	Candidate
Black-backed Woodpecker (Picoides arcticus)	Year-round	----	Candidate
Lewis' Woodpecker (Melanerpes lewis)	Breeding	----	Candidate
Pileated Woodpecker (Dryocopus pileatus)	Year-round	----	Candidate

Species	Occurrence	Federal Status	State Status
White-headed Woodpecker (Picoides albolarvatus)	Year-round	----	Candidate
Sage Thrasher (Oreoscoptes montanus)	Breeding	----	Candidate
Columbia Spotted Frog (Rana luteiventris)	Year-round	Concern	Candidate
Western Toad (Bufo boreas)	Year-round	----	Candidate
Sharp-tailed Snake (Contia tenuis)	Year-round	----	Candidate

Mule deer

The Methow Subbasin supports the majority of the state's largest and most productive migratory mule deer herd, numbering between 15,000-25,000 animals. Herd size likely reached a 25-year low in 1997 following a series of hard winters. Since then, milder winters and conservative harvest have helped the population expand rapidly, perhaps doubling over the last four years. A recent dip in fawn recruitment and heavy utilization of winter browse suggest the population might be nearing carrying capacity, although the data are preliminary. Mule deer are most vulnerable to loss of winter range, and the loss/disruption of migration corridors between winter and summer range.

Sharp-tailed grouse

Historically, sharp-tailed grouse were very abundant in the Subbasin, with large flocks observed in many parts of the valley. Over the last several decades, the population declined precipitously, and is now all but extirpated from the watershed. An active lek site has not been documented since the early 1980s, although sightings of individual birds are occasionally reported.

Dry forest birds

Several bird species including white-headed woodpecker, flammulated owl, pygmy nuthatch, and gray flycatcher are associated with mature/old growth ponderosa pine forests. In the Methow Subbasin, these species each occur in just a few localized areas that contain older forest stands. Historically, these species were likely much more widespread in the watershed.

Riparian Birds

The Subbasin supports a rich diversity of riparian-obligate migratory songbirds. The watershed's large patches of mature deciduous forest along major stream courses are one of perhaps just two places in Washington with breeding populations of veerys, redstarts, and red-eyed vireos. Swainson's thrush, cedar waxwing, and a host of warbler species are also common in these forests. These species are currently doing well where multi-canopied, riverine forest remains intact.

Wide-ranging carnivores

A full compliment of carnivores including three federally listed species occurs in the Methow Subbasin. Grizzly bears and gray wolves are rare inhabitants, having been nearly extirpated in earlier decades. Reliable sightings are received on an annual basis.

About half of the Okanogan lynx management zone, harboring 50-150 animals, occurs within the watershed. This management zone contains the majority of the state's lynx population, and their presence and reproduction is documented in several locations within the Subbasin annually.

Wolverines have been documented in the Methow Subbasin in each of the last four years. Reliable fisher sightings have been received in recent years, but positive confirmation of the species by photograph or capture has not occurred.

Harvested carnivores, including black bear, cougar, and bobcat, are relatively abundant and well distributed throughout the Methow watershed. Harvest data suggest black bear numbers are stable or slowly increasing.

Increases in cougar encounters and nuisance complaints suggest an increasing population. The growing deer herd likely benefits cougar population growth. In addition, stringent regulations on harvest methods have significantly reduced cougar harvest resulting in an increasing cougar population within the Subbasin.

Bats

Bats are found throughout the watershed but are most abundant in lower elevation habitats not too far from water. A total 14 different bat species have been documented in the Methow Subbasin, including the state's largest maternity colony of Townsend's big-eared bats, a state candidate species. Exit counts indicate the colony is stable or increasing; however, they are dependent on old, accessible buildings for raising young. Historic distribution was likely tied to old growth riparian and ponderosa pine forests that provided large hollow snags.

Habitat Areas and Quality

In the following discussion, fish and wildlife habitat are separated for the purposes of this document. However, habitat is by its very nature inter-connected and highly complex. Habitat conditions in riparian, wetland and upland areas affect both fish and wildlife. Habitat degradation of riparian areas caused by agricultural practices, development, logging, uncontrolled grazing and other causes can negatively affect both aquatic and terrestrial species. For instance, changes in compositions of riparian plant communities resulting from grazing activities can decrease available forage for terrestrial species; changes in, or elimination of, riparian plant communities also can decrease bank stability, thereby contributing to sediment loading and changes in channel composition, which in turn, can negatively impact spawning and rearing grounds for salmonid species. On the other hand, improvements to, and preservation of, riparian habitat can provide multiple potential benefits to both fish and wildlife such as increasing overall habitat connectivity, providing cover to maintain cool stream waters, and stabilizing stream banks.

The following discussion of habitat conditions in the Methow Subbasin is based in large part on the Washington State Conservation Commission (WSCC) *Salmon, Steelhead and Bull Trout Habitat Limiting Factors* final report completed for Water Resource Inventory Area 48 (WSCC 2000) (Appendix C). This document was compiled by the Washington State Conservation Commission (WSCC) and represents the efforts and collective professional judgment of a Technical Advisory Group (TAG) comprised of individuals from multiple state and federal agencies including the Confederated Tribes of the Colville Indian Reservation, the Yakama Nation, Okanogan County, Douglas Public Utility District, the Governor's Salmon Recovery Office, Pacific Biodiversity Institute, Methow Biodiversity Project, and Golder Associates in an effort to describe known habitat conditions and data gaps within the Methow Subbasin.

In addition, identification of factors affecting habitat conditions are drawn from a draft document titled, *Strategy To Protect and Restore Salmonid Habitat In The Upper Columbia Region*, which was prepared by the Upper Columbia Regional Technical Team (RTT) for the Upper Columbia Salmon Recovery Board (UCRSB) in July 2001. Development of both the WSCC limiting factors analysis and the RTT document involved broad participation from natural resource agency personnel (federal, tribes, state and local) familiar with the Methow Subbasin.

It is important to note, however, that there is disagreement among some professional scientists and laypeople regarding the causes and quality of existing habitat conditions within the Methow Subbasin. There is also dissent regarding how those existing conditions affect viability of the habitat to support self-sustaining populations of salmon, steelhead and bull trout.

For some residents in the Methow Subbasin the Endangered Species Act (ESA) listing of chinook salmon, steelhead and bull trout highlighted issues of federal versus local control over natural resource management. Partially in response to those three ESA listings Okanogan County, the Confederated Tribes of the Colville Indian Reservation, the City of Twisp and the Methow Valley Irrigation District initiated Washington State's 2514 Watershed Planning Process. The Methow Basin Planning Unit (MBPU) comprising 27 local interest groups and government entities, is the resulting designated committee (see *Existing and Past Efforts* for MBPU activities). As part of their watershed planning efforts and related activities, the MBPU commissioned a review of the WSCC limiting factors analysis. This unpublished review was executed by fish consultant Ken Williams (Williams 2000). Williams' review presents dissenting views regarding elements of the WSCC limiting factors analysis. Some of Williams' comments on habitat conditions have been incorporated into the following discussion of habitat conditions in each subwatershed. The Williams' review of the WSCC limiting factors analysis (Williams 2000) is included with this document in Appendix D.

There is, however, agreement among most parties on one key issue--the necessity of addressing the information and knowledge gaps within the Methow Subbasin with targeted, well designed, coordinated data gathering and research.

Fish

The Methow Subbasin drains an area of approximately 1,890 square miles. Compiled GIS distribution coverages were developed by the WSCC for summer chinook, spring chinook, steelhead and bull trout in the Methow Subbasin using existing state and federal fish distribution data. The coverages were then edited by the 2496 Methow Habitat Limiting Factors TAG to reflect professional knowledge of fish distribution, current as of summer 2000. The middle and upper reaches of the Subbasin's tributaries and the mainstem Methow River provide the majority of spring chinook salmon, steelhead/rainbow, and bull trout spawning and rearing habitat. The lower reaches of the Methow River function primarily as a migration corridor but also provide the majority of summer chinook spawning habitat and rearing habitat for all salmonid species. Both human induced and naturally occurring habitat conditions affect fish spawning, rearing and passage within the Methow Subbasin. While the Methow region has accommodated human habitation for close to 7,500 years, substantial changes to overall habitat conditions caused by human activities have taken place in the mid and lower reaches of the basin during the last century.

Historic and current logging, mining, agriculture, grazing, and residential and commercial development activities, are largely responsible for altering habitat conditions within the Methow Subbasin. Examples of those changes to habitat include construction of diversion dams, dikes and other irrigation related structures; diversion of water from creeks and streams for irrigation purposes; conversion of riparian habitat to agricultural and residential uses; removal of large woody debris to reduce potential flood damage, log drives, construction of logging roads and associated timber harvest, highways, and housing developments.

Naturally occurring habitat conditions also can cause both benefit and harm to fish species. For instance, select creeks and streams throughout the basin, such as the mainstem Methow upstream of Weeman Bridge, are subject to naturally occurring seasonal dewatering. In the upper elevations of the watershed, avalanches, landslides, flooding and creek icing can both negatively and positively affect salmonid habitat. Throughout the Subbasin naturally occurring influences like fire, which can contribute to erosion and sediment delivery; high stream flow events, which potentially alter stream channels and structure; and low stream flow, which can limit fish passage and strand large woody debris, play a role in altering and defining habitat. Although the short-term effects of naturally occurring habitat changes like fire, avalanches, and flooding tend to be detrimental to fish and wildlife, in the long run these changes are often beneficial.

Irrigated agriculture took root in the Methow Valley around 1887. By the 1890s farmers were regularly diverting water from the Methow River and other tributaries to grow crops in the valley. Irrigated land has always comprised a relativity small percentage of the basin's total acreage (currently about 1.7%)(Mullan et al. 1992b). In some areas of the Methow basin irrigation water is still delivered via unlined open ditches, which are often characterized by large water conveyance losses and, in some cases lack adequate fish screens. Numerous diversion dams are also associated with the valley's irrigation ditches. Whether irrigation ditches and diversions contribute to stream dewatering, or groundwater recharge, is a matter of great concern and speculation in the Methow Subbasin, but the exact nature of that relationship is not fully understood. Substantial future growth in

agricultural activity within the Methow Valley is not anticipated nevertheless, ongoing small-scale conversions of riparian habitat to residential, pasture and agricultural uses are likely to continue.

Logging, mining and grazing activities have played a substantial role in the Methow Valley for nearly a hundred years. Timber operations in the Methow watershed played an important role in the Subbasin's economy through the 1980s. Years of logging have contributed to high road densities in some portions of the watershed. The middle reaches of the Methow Subbasin, particularly areas within the Chewuch River and Goat Creek drainages exhibit significant habitat degradation as a result of past logging activities. Historic timber harvest activities and related road building have contributed to erosion and sediment loading, loss of shading for creeks and streams, loss of recruitment material for large woody debris, and overall decrease in nutrients. Construction of logging roads also resulted in the construction of numerous culverts in the Subbasin. Mining activity in the Methow Subbasin is currently minimal; however, abandoned mine sites pierce the valley hillsides and historically have contributed sediment and in some cases, relatively toxic loads to rivers and creeks. Poorly managed livestock grazing has contributed to decreased bank stability and riparian habitat damage in some drainages including portions of the Chewuch and Lower Methow drainages.

Residential and commercial development has also altered habitat in the Subbasin. Approximately 874 building permits were issued in the Methow watershed between 1984 and 1994 (Methow Valley Water Pilot Planning Project Planning Committee 1994). During that time, the majority of development activity occurred in the middle and lower reaches of the watershed.

Quality of habitat functionality in the Methow Subbasin is in many ways connected to topography and elevation. Wilderness designations combined with the steep topography of the upper northern and western edges of the Subbasin have left much of the Methow watershed's headwater habitat largely undisturbed. Human impact has generally been confined to alluvial fans on the lower miles of the Lost River and Early Winters Creek, while the upper reaches of both subwatersheds remain in relatively pristine condition. Much of the Methow watershed's middle reaches are also in functional condition. The impacts of human activity in the middle reaches have been primarily confined to the upper Methow, Chewuch, and Twisp subwatersheds. For instance, in the upper Methow River subwatershed the alluvial fans of every major tributary to the Methow River below Lost River's confluence have been diked and channelized (Lost River, Early Winters Creek, Goat Creek, Wolf Creek). High road densities, poor road placement and grazing have also contributed to persistent sediment delivery to streams in the middle reaches of the Chewuch River subwatershed (USFS 1994). The lower reaches of the watershed host the greatest concentrations of human activity and are the site of the much of the basin's recent habitat changes. For example, diking, channelization, and conversion of riparian areas to agricultural and residential uses have occurred throughout much of the lower reaches of the Twisp, Lost River, and Middle Methow River subwatersheds.

Habitat Areas and Quality by Subwatershed

Lost River Subwatershed

Lost River empties into the Methow from the north at RM 73.0, roughly six miles above the Early Winters confluence. About 95% of the drainage lies within the Pasayten Wilderness and is virtually untouched by human activities. Human impact in this drainage is largely restricted to the river's lower mile. Spring Chinook salmon spawn in Lost River to the confluence with Eureka Creek. Summer steelhead spawn and rear in Lost River. Bull trout spawn and rear in Lost River, as well as in several of its tributaries.

Within the channel migration zone of the first river mile, the construction of roads and dikes associated with home developments has constrained floodplain function and confined the channel, potentially reducing pool quality and quantity as well as side channel habitat. Although pool/riffle ratios are low, the ratio does not improve significantly upstream, suggesting human impacts may not have altered this habitat component. Some riparian habitat in the lower mile has been converted to residential development and pastureland. Residential construction on the alluvial fan may lead to a constrained channel in the future. Large woody debris has been removed from the lower mile of the river for flood control and firewood gathering. However, the potential for large woody debris recruitment is thought to be at natural levels. Low stream flows are a natural condition throughout the Lost River drainage but water temperatures remain cold because dewatered sections in the upper portion go subsurface.

Upper Methow Subwatershed

The upper Methow River drainage includes the mainstem Methow from its headwaters to the Chewuch River confluence (RM 50.1). Other major tributaries in the drainage include Goat Creek, Wolf Creek, Hancock Creek, Little Boulder Creek, Dawn Creek, Gate Creek, Robinson Creek, Rattlesnake Creek and Trout Creek. Spring chinook, summer chinook, steelhead/rainbow trout, westslope cutthroat and bull trout have all been documented in the Upper Methow River drainage. Between 1987 and 1999, approximately 40% of spring chinook spawning in the Methow watershed occurred in the Methow River between the Lost River confluence (RM 73.0) and the Winthrop Bridge (RM 49.8).

Methow mainstem habitat between the Lost River confluence and Winthrop has been greatly affected by human activity. The river has a low gradient throughout this stretch and a number of dikes block access to valuable side channel spawning and rearing habitat, including sites of spring chinook spawning redds (YN spawning ground surveys 1987-1999). Floodplains are constrained by those same dikes as well as riprapping and bank stabilization measures. Riparian habitat has been converted to agricultural and residential use along the mainstem between the Early Winters confluence and the Mazama Bridge, which in some areas has resulted in increased bank erosion. Historic timber harvest activities, livestock grazing, and construction of logging related roads throughout the lower reaches of the Goat Creek and Wolf Creek drainages have also resulted in delivery of large sediment loads to the Methow River. Improvement in grazing practices in this Subwatershed and other areas of the basin has helped lessen the current impact of livestock grazing. The amount of sediment delivered to creeks and streams from natural occurrences

has not been quantified relative to the amount of sediment contributed through human use within the Subbasin.

The Methow River is listed on the State of Washington 303(d) list as exceeding water quality temperature criteria at the inflow to the Winthrop National Fish Hatchery, and as supporting inadequate instream flows due to periodic dewatering (1998 303[d] list). Dewatering just upstream of the Weeman Bridge on the Methow River, and dewatering in the Popular Flats Campground area of the Twisp River are natural seasonal occurrences (Gorman 1899). The potential contribution of irrigation diversions within the upper Methow subwatershed to the duration and extent of stream dewatering is an issue that many individuals feel requires further study (TAG 2000). There are divergent interpretations and observations regarding the effect of low flows on both habitat and fish. In the Wenatchee River, Don Chapman Consultants (D. Chapman 1989) described, documented and assessed both intra- and inter-species behavior and movement of juvenile chinook and steelhead trout related to in-stream habitat factors as affected by seasonal and diurnal changes. Their work and others (Meehan 1991) emphasizes the complex and inter-related factors affecting salmonids in their environment. There are also some studies that suggest stream habitats are not drastically altered until base flow is reduced 70-80% or more (Wesche 1974; Tennant 1976; Newcombe 1981; Mullan et al. 1992b). Some research suggests that how water fills the stream channel may be more important than the quantity of water in the channel (Binns 1982). Mullan et al. (1992b) showed wetted perimeter decreased much less rapidly than volume of flow. Other studies conclude that salmonids appear to do little to avoid the consequences of severely declining flows, although it appears larger fish are more influenced than smaller fish (Corning 1970; Kraft 1972; Bovee 1978; Randolph 1984; Mullan et al.1992b).

Goat Creek, a major Methow River tributary, drains into the Methow from the north about a mile downstream from the town of Mazama. Portions of the upper third of the Goat Creek drainage have been heavily grazed. The lower two-thirds of the drainage have been logged, roaded and grazed (USFS 1995a). Goat Creek supports a tenuous population of resident bull trout in the upper reaches. Spring chinook spawn in the Methow River above and below the confluence with Goat Creek and may rear in the mouth of the creek. Summer steelhead/rainbow also spawn and rear in the creek. The Goat Creek drainage is laced with over 150 miles of roads, more than 4 miles of road per square mile, with almost all of those located in the lower half of the drainage (USFS 2000e). Sediment from roads and slope failures is carried by Goat Creek to chinook salmon spawning grounds in the Methow River (USFS 2000e). Livestock use has also damaged, or suppressed re-growth of riparian vegetation in some tributaries. Goat Creek exhibits both elevated water temperatures and low flows or dewatering in August and September (USFWS 1998.)

Wolf Creek, another major Methow River tributary, drains into the Methow about 3 miles above the town of Winthrop. Wolf Creek provides spawning and rearing habitat for residential and fluvial bull trout, summer steelhead, and spring chinook. Approximately 80% of the drainage is designated wilderness with very good habitat conditions. The forest service manages the remainder of the drainage for multiple uses with the exception of the last 1.5 miles, which is privately owned. Impacts from timber harvest and roads are isolated

primarily to the Little Wolf Creek drainage. Introduction of woody debris and pool formation projects have been completed in 2000 along the lower 1.5 miles of the creek.

Early Winters Subwatershed

Early Winters Creek enters the Methow about 3.5 miles upstream from the town of Mazama. The majority of the watershed is in relatively pristine condition. Roughly 99% of the area is managed by the USFS as a Scenic Highway Corridor with the remainder designated as Late Successional Reserve. Highway 20 follows Early Winters Creek to the Cascade Crest crossing over it in three spots. Human impacts are primarily restricted to the lower 2 miles of Early Winters Creek, including its alluvial fan.

The lower 1/2-mile of the river has been riprapped and diked to keep the channel in a stable location to accommodate Highway 20, the Early Winters Campground development, and to protect private property. Riparian areas at campgrounds have also been degraded resulting in a loss of stream cover and large woody debris recruitment. Levels of large woody debris in the first two miles are low and pool quality and quantity is poor. Severe low flows persist in the lower 1.4 miles of the creek. Low base flows are naturally occurring during the winter months, however, low flows during late summer and early fall may be exacerbated by two irrigation diversions (USFS 1998c). In particular, summer low flows downstream of the Willis ditch (RM 1.4) during some years, may impede fish passage (WSCC 2000; USFS 1998c). The Early Winters Ditch on Early Winters Creek is currently meeting NMFS's target flow of 35 cfs and the irrigation district is using wells to meet the remainder of its irrigation needs. Fine sediment and chemical runoff from State Route 20 may negatively impact water quality.

Chewuch River Subwatershed

The Chewuch River enters the Methow at the town of Winthrop. About 95% of the drainage is managed by the USFS with nearly 34% falling within the Pasayten Wilderness. The majority of human impact has occurred in the lower half of the drainage with the upper 50% remaining generally undisturbed. Spring chinook salmon spawn in the mainstem Chewuch River (up to Thirtymile Creek) and steelhead rear in the mainstem and spawn in the tributaries (USFS 2000c). Bull trout primarily use the Lake Creek tributary for spawning and early rearing. Brook trout are found in the Chewuch River and in all of the fish-bearing tributaries below Twentymile Creek (USFS 2000c). Most are isolated above natural upstream barriers, reducing their potential elimination to the existing bull trout population(s). Natural upstream barriers such as waterfalls or very steep gradients exist on the majority of the Chewuch's tributaries.

Five ditches divert water within the Chewuch subwatershed and two roads parallel segments of the Chewuch. On the lower portions of the Chewuch (downstream from RM 8.0) human activities have altered habitat conditions. Low flows in late summer through winter reduce quantity of rearing habitat in the lower Chewuch River. High water temperatures in the lower river may at times cause a migration barrier. The drainage's upper reaches are also characterized by harsh winters and icing.

Roads border most of the tributaries in the lower two-thirds of the drainage. The Chewuch drainage has approximately 1,000 stream crossings and road densities exceed 3.5-miles/square mile along most of the lower eight miles of the Chewuch River (USFS 1994). Skid roads in riparian areas upstream of Boulder Creek have lead to increased recreational use and resulting impacts to the stream and riparian areas. Road density, road placement, past logging activities and grazing in concert with highly erodible soils have led to chronic sediment delivery to streams particularly in Cub, Eightmile, Doe and Boulder creek drainages (USFS 1994). These conditions are aggravated by low levels of large woody debris, loss of mature riparian habitat, channelization in the alluvial fans of numerous tributaries. Extensive riprap for flood control associated with residential development has also occurred on the lower 8 miles of the Chewuch as well as along several tributaries, although there is some disagreement over the effect this has had on overall habitat quality. Mullan (1992b) suggests that rip rap on this section of the river may actually contribute habitat. Other studies document negative impacts to fish populations and stream channel functions associated with human-induced channel confinement and habitat simplification (Murphy and Meehan 1991, Bjornn and Reiser 1991; Leopold et al. 1992; Kohler and Hubert 1999). On the Chewuch River tributaries, Twentymile Creek and Boulder Creek, the alluvial fan has been channelized. In addition, livestock grazing may have potentially negative impacts on riparian areas of the mainstem Chewuch and its tributaries.

Middle Methow Subwatershed

The Middle Methow drainage includes the mainstem Methow from its confluence with the Chewuch River to the town of Carlton. Summer Chinook, some steelhead and some spring Chinook, and most of the remnant sockeye adults spawn in this portion of the Methow Subbasin.

County roads and state highways parallel both sides of the Methow River throughout this subwatershed. Diking, conversion of riparian areas to agriculture and residential uses, and large woody debris removal along the mainstem Methow River, have resulted in loss of side channel access, riparian vegetation, and overall habitat complexity. However, much of the habitat within this area has not been adequately inventoried or assessed and data gaps exist regarding the extent of habitat alterations. The Methow Valley Irrigation district diverts water to its east canal about 5 miles north of the town of Twisp at RM 44.8. The highest percentage of diversion from the river takes place in September. The average September diversion is 39.3 cfs, about 13% of the mean September flow in the Methow River at this point (BPA 1997). East Canal flows back into the Methow River at RM 26.6.

Beaver Creek, which drains into the Methow 5 miles downstream from the town of Twisp, is a major tributary in this subwatershed. Several man-made fish passage barriers and have been identified in the Beaver Creek drainage (Gower and Espie 1999). However, all diversions in Beaver Creek have now been screened (L. Clark, Okanogan Conservation District, email communication). Road density in the Beaver Creek drainage is the highest in the Methow Subbasin. In 41% of the Beaver Creek drainage, road densities vary between 2.5 and 5 miles/square mile (USFS 1997). Nearly 130 million board feet of timber

have been harvested from the Beaver Creek drainage since the 1960s resulting in heavy sediment loading, slope destabilization, and reduction of recruitment potential for large woody debris (USFS 2000a). Grazing activity has also contributed to stream sediment delivery in this section.

Beaver Creek is listed on the Washington 303(d) list for inadequate instream flows. In low water years, Beaver Creek goes dry in the fall, with the exception of the lowest 0.3 miles which maintain flows via irrigation return. The subwatershed is an adjudicated drainage where water uses are provided for in excess of available water during some part of the irrigation season (USFS 1997). Eastern brook trout in the Beaver Creek drainage are negatively impacting the remaining bull trout populations.

Twisp River Subwatershed

The Twisp River flows into the Methow at the town of Twisp. Like the Early Winters and Lost River subwatersheds, a substantial portion of the Twisp River subwatershed habitat rests within designated wilderness and is in near pristine condition. Nearly 95% of the subwatershed is federally managed and of that approximately 50% lies within the Lake Chelan-Sawtooth Wilderness. The remaining land is managed as Late Successional Reserves or Matrix (USFS 1995c). Spring Chinook salmon and summer steelhead spawn and rear in the Twisp River for nearly its entire length. Bull trout are found in the upper Twisp River and several of its tributaries.

Most human activity and related habitat changes within the drainage have taken place within the lower 15 miles of the Twisp River. Reduced levels of large woody debris, road placement, diking, bank hardening, and conversion of riparian areas to agriculture and residential uses have altered habitat conditions in this area and resulted in loss of channel complexity and floodplain function. After a flood in 1972, the U.S. Army Corps of Engineers used bulldozers to channelize and remove logjams from a tributary of the Twisp River, Little Bridge Creek (Methow Valley News, Vol.70, June 29, 1972.) some effects of these activities still linger.

The Twisp River is listed on the 1998 Washington State 303(d) list for inadequate instream flow and for temperature exceedences. There are seven irrigation diversions on the Twisp River. Maximum irrigation diversions on this stretch of river generally coincide with natural low flows in late summer/early fall. The irrigation diversions contribute to reduced instream flows in summer months, particularly from RM 3.9 (site of the Methow Valley Irrigation District diversion) to the mouth of the river (WSCC 2000). The Methow Valley Irrigation District's East Canal diversion on the Twisp River at RM 3.9 is a rock levee dam that must be pushed up each year, disturbing salmonid rearing and spawning habitat.

The Twisp River from Buttermilk Creek to the mouth, as been diked and riprapped in places, resulting in a highly simplified channel and disconnected side channels and associated wetlands. Levels of large woody debris recruitment potential in the lower Twisp River are far below normal.

Little Bridge Creek, a tributary of the Twisp River, contributes large amounts of sediment to the Twisp as a result of historic logging activities. Excessive sediment delivery

from both private and USFS land in Poorman and Newby drainages also contribute to elevated sediment levels in the lower 15 miles of the Twisp River. The lower two-thirds of the creek have road densities in excess of 3-miles per square mile. Although some restoration activities are currently underway, construction of culverts, erosion and grazing activities have contributed to habitat degradation in this drainage. Finally, beaver activity is very limited in the lower Twisp River where large cottonwood galleries and low gradients would once have supported beaver colonies.

Lower Methow Subwatershed

The Lower Methow River subwatershed includes the Methow mainstem and its tributaries from the town of Carlton to the mouth of the Methow River. Agriculture use in this subwatershed is primarily field crops and cattle at the upper end with orchards along the lower end. Portions of the summer Chinook escapement spawns in the lower Methow River. In addition, this reach provides rearing habitat and acts as a migration corridor for all anadromous salmonids and fluvial bull trout.

Timber harvest, livestock grazing and high road densities characterize much of the Libby Creek drainage, with roads running parallel to every major stream. The lower 2.9 miles of Libby Creek have been channelized. Culverts and irrigation diversion structures impede salmonid passage on a number of tributaries. Upstream passage for salmonids is also limited by heavy beaver activity in some tributaries. Libby creek has no historical evidence of use by spring Chinook or bull trout. The lower mile is used heavily by summer steelhead for spawning and initial rearing. Ground water discharge is likely the attraction for steelhead.

Timber harvest, livestock grazing and elevated road densities also characterize Gold Creek. The lower 3.5 miles of Gold Creek have had riprap placed along the banks. Gold and Libby creeks are characterized by low instream flows and Gold Creek dewaters in a lower reach between RM3 and 2 during some low water years. The timing of dewatering may not preclude passage of adult migrants which pass through the reach prior to dewatering, however, dewatering could negatively impact movement of juvenile salmonids. A spring chinook redd was located in 1987, an extreme drought year, and reported in Mullan et al. (1992b). Standing crop fish estimates for Gold Creek and its main tributary streams are consistently high compared to other creeks (Mullan et al. 1992b).

Wildlife

The Methow Subbasin supports a tremendous diversity of habitat types spread over a large elevation gradient. Much of the watershed remains undeveloped and large tracts of high quality fish and wildlife remain, particularly within the middle and upper elevations. These areas are largely in public ownership and include several thousand acres managed as wilderness/roadless condition by the Okanogan National Forest. Within these management boundaries, plant communities and succession are shaped largely through such natural processes as fire, avalanches, storms and temperature ranges. However, early successional habitats are underrepresented, due largely to historic emphasis on fire suppression.

Outside of these protected areas, little habitat has been lost to development at middle and upper elevations, but acreage within the lower elevations has been altered and/or degraded through road building, grazing, and timber harvest. The most significant changes in wildlife habitat have occurred in the dry forest, riparian/floodplain, and shrub-steppe habitats at lower elevations. Native habitats have been lost or altered by commercial and residential development, conversion to agricultural use, grazing, timber harvest and road building. Fire suppression and noxious weed invasion have also altered the landscape and native plant communities considerably. Since wildlife distribution is related more to habitat type than stream or creek reach, the following discussion of wildlife habitat is presented in terms of vegetative habitat type rather than subwatershed format used to describe fish habitat.

Riparian/floodplain

This habitat type supports the greatest wildlife diversity and abundance, but occupies the lowest percentage of acreage within the watershed. It has been widely quoted that in semi-arid environments like the Methow, riparian habitats typically occupy less than 10% of the land area, but are used by more than 90% of the wildlife species for some or all of their life history requirements. The Methow Subbasin is host to some of Eastern Washington's best remaining tracts of cottonwood gallery forests, found in the wide floodplain portions of the Methow River valley and it's major tributaries. Although, almost all of this habitat type is in public ownership and much has been converted to residential development or agriculture, significant forest parcels remain along the Methow River between Winthrop and Lost River. Additional significant stands are located along the Twisp and Chewuch rivers and more fragmented pockets can be found along the Methow between Winthrop and Carlton. Below Carlton, higher stream gradient and a more constrained channel preclude the development of large patches of this habitat type (J. Foster, WDFW, personal communication). Because of its proximity to roads and other developed areas, much of the remaining riparian/floodplain habitat may be at risk of conversion to housing development.

Shrub-steppe

Shrub-steppe habitat occupies the lowest elevations, and the drier and more southerly aspects of the Methow Subbasin. Variations of this habitat type once occupied most of the non-forested land in Eastern Washington, however, today less than 40% of shrub-steppe habitat remains (Daubenmire 1970). In this watershed, much of the deeper soil shrub-steppe on flat bench lands has been converted to agriculture, or developed as home sites. The majority of remaining shrub-steppe areas have been used as livestock range. In many areas, grazing has reduced the plant diversity and structural diversity of the stand. Long-term fire suppression has favored shrub development at the expense of grasslands in many locations. Noxious weeds are pervasive and generally dominate abandoned agricultural fields and overgrazed range.

Historically, the moister draws and permanent stream courses imbedded in the shrub-steppe landscape supported strands of riparian vegetation dominated by moisture loving shrubs and small trees, including thick stands of water birch, a major component of

the winter diet of sharp-tailed grouse. The drastic reduction of water birch in the watershed by early settlers, is likely a major factor in the decline of sharp-tailed grouse.

Despite these factors, sizable pieces of healthy shrub-steppe still remain in the watershed. These occur primarily on public lands and the few remaining large private ranches in the Methow Valley. As agriculture increasingly gives way to subdivision and housing developments in the valley, the private land parcels containing healthy shrub-steppe habitat may be lost. Currently, the largest block of undeveloped shrub-steppe in private ownership is located north of Twisp, just south of WDFW land in the vicinity of the last known active sharp-tailed grouse lek in the Subbasin.

Dry forest

Historically in the Methow Subbasin, old-growth ponderosa pine forests occupied large areas between the shrub-steppe zone and moister forest types at higher elevations. Large, widely spaced, fire-resistant trees, and an understory of forbs, grasses, and shrubs characterized these forests. Periodic fires maintained this habitat type. With the settlement of the watershed, most of the old pines were harvested for timber, and frequent fires have been suppressed. As a result, much of the original forest has been replaced by dense second growth of Douglas fir and ponderosa pine with little understory. Only scattered pockets of old pines remain and many of these areas are suffering from the results of fire suppression.

Watershed Assessment

Watershed assessments are an important tool for identifying limiting factors and potential habitat restoration and protection projects. Following is a list of watershed assessments that either include the Methow Subbasin within a larger scope, or directly address conditions within the Subbasin.

Regional Assessments

- The Interior Columbia Basin Ecosystem Management Project (ICBEMP), was initiated by the Forest Service and Bureau of Land Management (2000). ICBEMP was designed to develop a scientifically sound, ecosystem-based strategy for management of eastside forests. The ICBEMP draft EIS focuses on critical needs at a broad scale: landscape health; aquatic habitat; terrestrial habitat; and human needs, products, and service.

- Federal Caucus All-H Paper (2000). This document provides a framework for basin-wide salmon recovery and identifies strategies for harvest management, hatchery reform, habitat restoration, and hydropower system operations.

- FCRPS Biological Opinion (BiOp) (2000). This is a biological opinion written by the National Marine Fishery Service (NMFS) and the U.S. Fish and Wildlife Service regarding the operation of the federal hydropower system on the Columbia River, and fulfills consultation requirements with the U.S. Army Corps of Engineers, the Bureau of Reclamation, and the Bonneville Power Administration under Section 7 of the ESA. The 2000 BiOp also concluded that off-site mitigation

in tributaries is necessary to continue to operate the hydropower system. In the Columbia River BiOp NMFS recognized that the establishment and protection of instream flows in the Upper Columbia is of paramount importance.

- The National Marine Fisheries Service conducted an assessment of aquatic species and habitat for the Wenatchee, Entiat, Methow, and Okanogan watersheds in 1998. This assessment summarized information on aquatic species and their habitats in these four major tributaries to the mid-Columbia River. The emphasis of this assessment was on anadromous salmonids.

- Washington State Department of Ecology Statewide Watershed Planning. The 1998 legislature passed HB 2514, codified into RCW 90.82, to set a framework for addressing the State's water resource, water quality issues as well as establishing instream flows and addressing salmon habitat needs. Statewide efforts to conduct Water Resource Inventory Assessments (WRIA) for all of the state's WRIA areas are currently underway.

- The Northwest Power Planning Council documented changes to watershed conditions within the Columbia Basin hydropower system in its Return to the River report (1996).

- The Inter-tribal *Wy-Kan-Ush Mi-Wa-Kish-Wit* (Spirit of the Salmon) restoration plan (CRITFC 1995) provides a foundation for meeting Tribal treaty and trust obligations in the Columbia River basin. The long-term plan also addresses the causes of anadromous fish declines, provides information on fish stock status and habitat, and makes recommendations to protect and restore declining fish populations.

- Washington Department of Fish and Wildlife, Yakama Nation, and the Confederated Tribes of the Colville Indian Reservation, developed the Methow and Okanogan Rivers Subbasin, Salmon and Steelhead Production Plan, Columbia Basin System Planning for the Northwest Power Planning Council (1990).

- *Strategy to Recover Salmon/Extinction is not an Option.* This statewide strategy is intended to be a guide and articulates the mission, goals and objectives for salmon recovery. The stated goal of the strategy is to: "Restore salmon, steelhead, and trout populations to healthy and harvestable levels and improve habitats on which fish rely."

Local Assessments

- The U.S. Geological Survey (USGS) has been collecting streamflow and other hydrologic data and investigating water-resources issues in the Methow River basin since the early 20th century. The USGS operates a network of 15 continuous streamflow gages in the Methow River basin including 8 "real-time" stations that transmit current stream flow information to the USGS's web-accessible database,

the National Water Information System. The gaging network extends from the main tributaries of the Methow River to a series of gages along the main stem. The stream gage at Andrews Creek serves as one of the Nation's hydrologic benchmark stations, which provide information on stream flow from basins with limited human influences.

- The USGS is currently involved in four water-resources investigations in the Methow River basin: 1) quantifying the effects of irrigation diversions on stream flow; 2) characterizing the unconsolidated aquifers of the basin; 3) analyzing the interaction of ground water and surface water; and 4) assessing the ambient ground- and surface-water quality in the basin.

- The USGS has developed a hydrologic simulation model to assess the effects of irrigation on stream flow in the Methow River and its tributaries. The first phase of this project was to reconstruct streamflow at various points in the basin as if there were no water diverted for irrigation. In the second phase of this project, the USGS will add irrigation diversions to the model, thus providing a publicly available water-resources management tool for the basin.

- The USGS has inventoried and monitored nearly 400 wells throughout the valley as the basis to characterize the unconsolidated deposits and confining layers in the basin. The USGS will be using lithologic information from the well driller's logs to characterize and map the thickness of hydrogeologic units. Periodic water-level measurements from the wells will be used to map the groundwater elevations in the basin. The hydrogeologic framework in combination with the groundwater elevations will improve the understanding of the unconsolidated aquifers throughout the basin.

- The USGS has been investigating the interaction of surface water and ground water. The focus of this project has been on the Twisp River where surface waters (including snowmelt from high elevation basins, high flows in streams, and irrigation canals) recharge ground water, which in turn sustains baseflow in the river. The results from this detailed investigation will be combined with information gained from the gaging network and the hydrogeologic framework to provide information on surface-water/groundwater interactions throughout the basin.

- The USGS has been collecting and analyzing ground- and surface-water samples to assess ambient water quality conditions in the basin. All of the samples will be analyzed for dissolved oxygen, conductivity, pH, chloride, and nitrate. A subset of the samples will be analyzed for common ions and selected metals. The data will provide a baseline for water quality conditions that can be referenced in future studies.

- The U.S. Department of Agriculture (USDA) Forest Service conducted an integrated weed management environmental assessment for the Okanogan National Forest (2000). This assessment documents the analysis and potential effects of implementing an integrated week management program in the Okanogan National Forest. Current conditions and environmental consequences of the proposed alternative action plans are described.

- U.S. Forest Service has completed watershed analysis or stream surveys for: Chewuch River (1994), Goat Creek (1995), Libby Creek (1995), Twisp River (1995), Early Winters Creek (1996), Gold Creek (1996), Middle Methow (1997), Early Winters (1998), Upper Methow (1998), Lower Methow (1999), Libby Creek Stream Survey (1999), Lost River and Robinson Creek (1999), Beaver Creek Stream Survey (2000), Black Canyon Creek Stream Survey (2000), Chewuch River Survey (2000), Early Winters Creek Stream Survey (2000), Goat Creek Stream Survey (2000), Gold Creek Stream Survey (2000), Libby Creek Stream Survey (2000), Lost River Stream Survey (2000), Methow River Stream Survey (2000), and Twisp River Stream Survey (2000).

- Okanogan Conservation District is currently conducting surveys of those streams in Okanogan County that have not been surveyed through prior activities.

- Washington State Conservation Commission prepared an assessment of salmon, steelhead, and bull trout habitat limiting factors within the Methow Subbasin (2000). This document assessed the habitat conditions in the Methow Basin as they affect the capacity of the habitat to sustain naturally producing salmonid populations.

- Washington Department of Ecology has ongoing streamflow and water quality monitoring and management in the Methow River sub-basin. Instream flows for the Methow River were first established in 1977 under the River Basin Program Series, No. 4, Water Resources Management Program, Methow River Basin (Chapter 173-548 WAC).

- Washington State Department of Ecology. *Recent Water Use in the Methow Valley* is part of a five-part report that estimates the amount of single domestic and stock watering uses from ground and surface waters since 1977. The report addresses 1) the relationship between ground water and surface water, and the impact single domestic wells may have on basin surface waters, 2) estimates the number of single domestic wells drilled in the basin between 1976 and 1990, 3) estimates the total amount of water pumped by single domestic water users developed since 1977, 4) the relationship of total high and low single domestic water use, and 5) information on current water allocations under "Priority IV" of the Basin management Plan for public water supply, irrigation, and other uses.

- Washington State Department of Ecology, Water Resources Program studied the relationship between fish habitat and stream flow in the Methow River basin using the Instream Flow Incremental Methodology (IFIM). The report, *Methow River Basin Fish Habitat Analysis using the Instream Flow Incremental Methodology*, was published in 1992. Measurement sites included four sites on the Methow River, involving 32 transects, to represent 60 miles of the Methow River. Three study sites, involving 20 transects, were chosen to represent the lower miles of the Twisp River, Chewuch River and Early Winters Creek.

- Washington State Department of Ecology. Water Resources Management Program (1976). Documented state management policies on water resources in the Methow Basin as part of effort to provide background for decisions on future water resource allocation and use.

- Pacific Northwest River Basins Commission guided a state and federal study team in development of the *Methow Level B Study Report* (1977). This report presents the results of a comprehensive reconnaissance study of water and related land resources in the Methow Basin. The study addresses existing and anticipated problems and needs related to irrigation, municipal and industrial water supplies, recreation fish and wildlife enhancement, power and flood damage reductions.

- Methow Basin Watershed Planning Unit contracted with Ken Williams to review the Washington State Conservation Commission's assessment of salmon, steelhead, and bull trout habitat limiting factors within the Methow Subbasin (2000).

- Methow Basin Watershed Planning Unit (MBPU) is working cooperatively with Okanogon County, USGS, the Confederated Tribes of the Colville Indian Reservation, and Golder Associates to develop a watershed plan for the Methow Basin (ongoing). The intent of this process is to allow stakeholders in the basin to examine the implications of water management scenarios on both human and ecological interests in the basin. The MBPU committee includes representatives from irrigation districts, cities, counties, environmental groups, state agencies and the Confederated Tribes of the Colville Indian Reservation.

- Golder Associates is currently conducting a baseline assessment of hydrologic conditions in the basin as a first step in developing a water management plan (Associated with MBPU activities). This includes assessment of variables such as precipitation, snowpack, run-off, evapotranspiration, groundwater and irrigation in the Methow Basin. This project is part of work being overseen by the Methow Basin Watershed Planning Unit.

- *Methow Basin Planning Unit Water Budget Report* (2000). Reviewed past research and assessments of water quantity in the Methow Basin. This work is part of the Methow Basin Watershed Plan coordinated by the MBPU. The report included recommendations for additional studies.

- Methow Valley Irrigation District (MVID) *Project Final Environmental Assessment and Finding of No Significant Impact*. Bonneville Power Administration (1997). This EA addressed proposed changed to the MVID's irrigation district which included conversion of the open ditches to a pressurized pipe system. The MVID later voted not to implement the plan addressed in this EA.

- Multi-objective river corridor plan for the Methow Basin. Office of planning and development, Okanogan County (1996).

- The Methow Valley Water Pilot Planning Project Committee conducted ongoing stakeholder meetings and collected watershed assessment information over the course of a two-year period to develop a Draft Methow Basin Plan. (1994). The goal of the project was to 1) create a plan for the Methow River Basin which would effectively resolve the regulatory and legal morass which complicates water use decisions in the Basin and which causes uncertainty and confusion to all who seek to use or preserve the water of the Basin; and 2) provide the Washington Department of Ecology with a document which identifies Basin-wide water management concerns, provides recommended management approaches which address instream and out of stream uses, and to suggest strategies which may aid in the implementation of the plan.

- Montgomery Watershed Group, Inc. *Methow Valley Irrigation District Water Supply Facility Plan* (1994). Studied existing irrigation district limitations and problems and developed alternative design plan to improve irrigation efficiencies.

- Pacific Watershed Institute (PWI) began working with the Methow Valley District of the Okanogan National Forest (MVD) in 1995 to complete a focused assessment of watershed processes and conditions in an effort to establish a short- and long-term strategy for the restoration of riparian and aquatic resources of the Chewuch Watershed on National Forest lands. The overall objective was to develop a strategy consistent with the objectives outlined in FEMAT and PACFISH for maintaining the health and integrity of aquatic and riparian ecosystems in key watersheds. The assessment resulted in the identification and mapping of more than 20 key areas of the watershed that were subsequently prioritized for restoration and conservation.

- Federal Emergency Management Agency flood insurance study for Okanogan County (1994).

- *Draft Report Upper Methow River Valley Hydrogeological Summary*, EMCON Northwest, Inc. (1993). This draft report assessed hydrogeological relationships in the Upper Methow River Valley.

Limiting Factors

Migratory fish and many wildlife species depend on intact, complex, and functioning habitat extending over broad geographic ranges to support healthy populations. Resident, non-migratory populations of fish and wildlife also indirectly depend on basin-wide habitat connectivity since migratory species make essential contributions to overall ecosystem balance, such as providing essential nutrients and maintaining predator/prey balances (NPPC 1996). Essential to any list of factors that limit self-sustaining populations of fish and wildlife in the Methow River drainage is acknowledgement of the overarching habitat destruction and disconnection brought about as a result of human settlement activities within the Columbia River Basin since the early 1800s. In particular, the development of hydropower facilities along the Columbia River has irrevocably altered both terrestrial and aquatic habitat throughout the entire Columbia River Basin.

A central limitation to building self-sustaining populations of anadromous fish in the Methow Subbasin is the high smolt and adult mortalities incurred at the nine hydropower facilities that lie downstream from the Methow's confluence with the Columbia River (Mullan et al. 1992b; Chapman et al. 1994-1995). These mortalities severely reduce the number of naturally produced adults that return to spawn and reseed available habitat within the Methow Subbasin. Salmon abundance is also heavily influenced by ocean conditions. Freshwater conditions reflect variability within a broader spectrum of population abundance that is largely controlled by ocean conditions (Mullan et al. 1992b; Nickelson 1986). An additional less tangible, but nevertheless important, limiting factor to maintaining prosperous self-sustaining fish and wildlife populations, is the lack of coordinated resources to monitor populations, evaluate environmental variables, and adequately coordinate regional restoration and research efforts.

Within the Methow Subbasin, habitat types, habitat conditions, and land uses vary primarily according to topography, climate, relative ease of access, and duration of human activity. Extreme winter temperatures, particularly in the watershed's upper reaches, play an important role in limiting potential salmonid productivity within the basin. The viability of habitat types including riparian zones and floodplains, shrubbe steppe and dry forest depends on protection of existing stands, linkage, and natural process. In addition, control of exotics and restoration of native grass and forb diversity is critical to maintaining habitat function for wildlife. The majority of the Methow watershed offers relatively intact, high quality fish and wildlife habitat due to inaccessibility and a related lack of human development, combined with extensive Wilderness and National Forest designations in the basin's upper reaches. This degree of habitat integrity and functionality in the majority of the watershed lends urgency to halting processes of habitat degradation in key areas within the lower and middle reaches of the basin and to restoring habitat functionality where it is feasible.

Over the course of the last century a number of human induced physical changes have redefined the quality and quantity of aquatic and terrestrial habitat found in the mid and lower reaches of the Methow Subbasin. Most significant among these changes is habitat fragmentation compounded by degradation in overall habitat quality; the result of historic and current agricultural practices, timber management, mismanaged grazing, mining, and commercial and residential development activities. Combinations of these

activities have contributed to 1) alteration, reduction, and elimination of riparian habitat; 2) alteration and elimination of floodplains; 3) degradation of instream habitat through sediment loading, elimination of large woody debris, and loss of stream bank integrity; 4) construction of artificial barriers to fish passage such as push up dams, diversions, and ill-functioning fish screens and culverts; 5) increased road densities and related erosion as well as loss of canopy cover; and 6) changes to overall vegetative composition and forage availability in both riparian and upland areas.

An additional crucial factor affecting overall habitat quality in the Methow Subbasin is water quantity. Numerous streams and creeks throughout the Methow watershed are prone to naturally occurring seasonal low flows and occasional dewatering. Those natural low flows and instances of dewatering have been compounded in some instances by irrigation withdrawals and by agricultural water use inefficiencies in some Methow tributaries. The relationship between stream flow and water use within the basin is not fully understood, however, and efforts are currently underway to assemble a better data from which to evaluate this relationship (see *Existing and Past Efforts, Fish and Wildlife Needs*). Harsh winter temperatures also contribute to seasonal limitations in water quantity. Water quality, primarily in terms of temperature is to a lesser degree, also a limiting factor in the Subbasin. In general, stream temperatures within the basin are conducive to fish health, although elevated temperatures have been noted in select reaches, and in winter, freezing creeks pose a limiting factor in some reaches.

As mentioned previously in the *Habitat Areas and Quality* section of this document, the analysis and prioritization of habitat factors which limit abundance of salmon, steelhead, and bull trout in the Methow Subbasin are not universally accepted by professional scientists or laymen connected with Methow Subbasin. In the Williams' review of the WSCC limiting factors report commissioned by the MBPU a paragraph-by-paragraph commentary of specific habitat conditions and dissenting views is presented (Williams 2000) (Appendix D). In that review of the WSCC report, Williams concludes that three habitat factors identified as limiting to salmon, steelhead, and bull trout in the WSCC analysis, require additional research. Those factors are 1) the extent to which irrigation diversion affects natural runoff patterns, water temperature, chemical enrichment, and fish production; 2) the role that large woody debris played historically within the Methow in producing fish; and 3) the affect of man's placement of 35 miles of riprap on fish production (Williams 2000).

Following is a summary of major limiting factors in the Methow Subbasin based primarily on the WSCC limiting factors analysis (WSCC 2000) (Appendix C) and the RTT draft report to the UCSRB (RTT 2001).

Habitat Fragmentation Compounded by Degradation in Overall Habitat Quality

- Alteration and reduction of riparian habitat (fish & wildlife)
- Habitat connectivity (fish & wildlife)
- Instream and floodplain habitat degradation (fish)
- Artificial and natural fish passage barriers (fish)
- Land management practices (fish & wildlife)

Water Quantity and Quality

- Low flows and dewatering (fish & wildlife)
- Temperatures (fish)
- Sediment load (fish)
- Freezing creeks and streams (fish & wildlife)

Additional Key Factors

- Severely reduced numbers of returning naturally produced adults (fish & wildlife)
- Decrease in nutrients i.e. salmon carcasses (fish & wildlife)
- Presence of brook trout in many Methow Subbasin streams and creeks (bull trout)
- Data and knowledge gaps (fish & wildlife)

Alteration and Reduction of Riparian Habitat

Riparian zones play many essential roles in maintaining ecosystem health and integrity. They provide connectivity between aquatic and upland habitats, moderate stream temperature through shading, maintain water quality by performing filtering and bank stabilizing functions, and supply in-stream nutrients through insect and vegetative contributions (Platts 1991; Johnson and Carothers 1982; Mitsch and Gosselink 1986; Lee et al. 1987). Additionally, riparian zones act to "meter" water delivery by holding water in plant root wads and soils and gradually releasing that moisture as humidity and groundwater (Knutson and Naef 1997). Riparian zones also assist in recruitment of large woody debris, the loss of which reduces in-stream pools and channel complexity. In addition to the role riparian zones play in moderating and improving overall habitat conditions, many species of fish and wildlife depend directly on riparian zones to provide cover and forage (Federal Caucus 2000). Loss of riparian areas affects streambanks, water quality, water quantity, impacts overall habitat complexity and leads to increased erosion, which in turn, increases sedimentation. Riparian habitat losses also contribute to higher water temperatures in summer months and lower temperature in winter months.

Instream and Floodplain Habitat Degradation

Loss of instream habitat complexity limit spawning and rearing habitat for fish, and in egregious cases limit passage. Large woody debris plays an important role in maintaining varied and functional instream habitat. For instance, woody debris sorts stream gravels, stores sediment and gravel, and stabilizes stream channels. Large instream woody debris also helps moderate stream velocities during high flow periods and creates pools. Logging and destruction of riparian habitat decrease available large woody debris recruitment materials. Reduced riparian cover, conversion of riparian zones to agricultural and residential uses, road construction, road failures, accelerated scour at culverts, and logging all contribute sediment materials to streams. Unmanaged grazing also degrades instream habitat by destabilizing banks thus encouraging erosion, or in some cases by hardening banks thus altering steam width to depth ratios and changing runoff patterns. Increased

sedimentation alters stream channel characteristics and reduces spawning gravels and egg/alevin survival.

Floodplains help to moderate river flows by dissipating flow velocity and providing storage capacity for excess flows. The sloughs, side channels and pools formed by lateral movement of the main channel and by sediment and large woody debris deposition, contribute to plant colonization and provide valuable cover, spawning and rearing habitat for fish (Bisson et al. 1987). Loss of floodplain wetland habitat further reduces the already limited over-wintering habitat for salmonids, eliminates forage and cover for wildlife, and reduces recharge potential of shallow groundwater in dry seasons. Loss of floodplain wetland also contributes to higher stream velocities with associated bank erosion and sediment delivery.

Artificial and Naturally Occurring Barriers

Dikes and dams constructed for irrigation purposes can reduce fish passage to spawning and rearing grounds, block passage to floodplain habitat, prevent development of stream side channels, limit spawning gravel recruitment, and can confine the stream channel which in turn concentrates stream flows and facilitates scouring of stream beds. Unscreened irrigation diversions can divert fish from the main river or creek flow thus leaving them stranded when the irrigation flow is cut off. Maintenance of irrigation diversions can damage streambeds and banks. Inadequate or inappropriate screens associated with diversion can entrap fish or simply not function properly, thus allowing fish to pass into irrigation diversions. Culverts can prevent access to spawning and rearing grounds by concentrating flow to the extent they become impassable and by concentrating debris. The high velocities of water moving through culverts also sometimes downcut the streambed to such an extent that upstream fish passage eventually becomes impossible. While all of these man made diversions play a role in reducing passage within the Methow Subbasin, even before human settlement, waterfalls and high gradient steams characterized by high velocity spring run-off prevented and reduced passage to many reaches of the Methow Subbasin.

Land Management Practices

Timber management activities, including extensive timber harvest in sections of the Methow Subbasin, and livestock grazing have negatively impacted both fish and wildlife habitat in mid and lower reaches of the watershed, particularly in the Chewuch River and Beaver Creek drainages. Both logging and grazing contribute to fragmentation of habitat, soil erosion, sediment delivery to creeks and streams, channel simplification from loss of LWD recruitment within the riparian zone, and changes to upland and riparian vegetative communities, including displacement of native plant communities with exotic species. Timber harvest changes upland vegetative cover and influences snow accumulation and melt rates. Road building associated with timber harvest further exacerbates erosion, habitat fragmentation, and contributes barriers to fish passage through construction of culverts. Uncontrolled livestock grazing compacts soil, contributes to stream bank destabilization, affects compositions of riparian plant communities, and slows recovery of damaged riparian habitat.

Conversion of forestland and riparian habitat to residential and agricultural uses also negatively affects habitat connectivity and composition. Human developments often constrain wildlife range and quality through construction of roads, dispersed residential developments, impediments to stream access, and changes to vegetative communities. Human activities have increased the number of fire starts but historic fire control policies have kept the size of fires small, resulting in a buildup of fuel in the forested uplands of the Subbasin. This absence of fire has resulted in changes to the composition of the forest and plant communities, and the related capacity to store and transport water. Areas of the Methow Subbasin burn periodically due to lightning and human causes and will continue to do so.

Low Flows, Temperature and Sediment Load

Seasonal naturally occurring and human influenced low stream flows and occasional dewatering can alter fish passage to upstream spawning and rearing habitat. Low flows also affect water quality by contributing to higher stream temperatures in summer months. Stream borne sediment also degrades overall water quality. In addition, low stream flows tend to concentrate any toxic materials or other contaminants entrained in the stream flow.

Additional Factors

A number of additional factors play important roles in limiting overall habitat quality for fish and wildlife. Many of those factors are naturally occurring and can have both positive and negative consequences for fish and wildlife habitat quality. Some tributaries within the Methow Subbasin experience naturally occurring seasonal low flows and occasional instances of dewatering. Landslides and avalanches in the upper reaches of the drainage periodically alter habitat conditions sometimes destroying and at other times creating, rearing and spawning habitat. Harsh winter temperatures in the Methow basin also play a role in limiting productive fish habitat. Additionally, fire events have altered habitat in many portions of the watershed.

The reduction in the number of beaver historically found within the watershed has also detracted from overall spawning and rearing habitat by eliminating pools, large woody debris recruitment, and decreasing water and nutrient storage capacity that was facilitated by beaver activity. The overall decrease in nutrients caused by lack of large numbers of salmon carcasses throughout the watershed has potentially contributed to reductions of both fish and wildlife abundance. Furthermore, brook trout in a number of Methow Subbasin tributaries present a threat to perpetuation of fluvial bull trout populations.

Finally, information gaps are a limiting factor to maintaining and restoring healthy self-sustaining populations of fish and wildlife species in the Methow Subbasin. Known gaps in data and knowledge are listed in the needs section of this document.

Artificial Production

History of hatchery production in the Methow Subbasin

The first salmon hatchery in the Methow Subbasin was built on the Methow River near the confluence of the Twisp and Methow Rivers in 1899. This hatchery was operated by the

State of Washington to provide coho salmon production until 1914. In 1916 a new facility was constructed on the mainstem Methow near the town of Pateros. This new hatchery operated from 1916 to 1931 and produced coho salmon, steelhead and minor numbers of chinook (Mullan et al. 1992b). During those years the hatchery used chinook eggs from out-of-basin locations, principally Quilcene and Little White hatcheries for its production.

In 1937 the Grand Coulee Fish Maintenance Project (GCFMP) was launched to mitigate for the loss of anadromous fish anticipated due to the impending completion of Grand Coulee Dam. Under the GCFMP, between 1939 and 1943 all adult salmon and steelhead were intercepted at Rock Island Dam for brood stock (Fish and Hanavan 1948; Chapman et al. 1995). Some adults were released in enclosed areas of each river to spawn naturally, while others were brought into the hatcheries for artificial production. The various tributary stocks of each species were mixed in the hatchery program with the resultant young released throughout the Wenatchee, Entiat, Methow and Okanogan River drainages. After 1943 the hatchery depended on eggs from previous hatchery stock, augmented with eggs from non-indigenous populations from other Columbia River Basin locations (BAMP 1998). The Winthrop NFH provided artificial production of anadromous fish to the Methow River Basin from 1939 to 1962, and from 1974 to the present.

The construction of the Mid-Columbia hydroelectric projects (Rocky Reach and Priest Rapids dams in 1961, Wanapum Dam in 1964 and Wells Dam in 1967) contributed to further declines in naturally occurring anadromous fish production in the Mid-Columbia River Basin. The hatchery programs developed to mitigate for losses associated with the Mid-Columbia hydroelectric projects relied historically (and at present) on locally returning populations of anadromous fish (spring chinook, summer chinook, summer steelhead and sockeye). Initially, Mid-Columbia anadromous fish production, like much hatchery production throughout the basin, was designed to replace lost productivity with little emphasis placed on recovery of locally adapted populations. Today's hatchery programs seek to address mitigation obligations in addition to preserving and enhancing indigenous fish populations.

Methow Subbasin Hatcheries

Artificial production of anadromous fish in the Methow Subbasin includes spring chinook, summer chinook, summer steelhead and reintroduction of coho salmon. Spring chinook and summer steelhead are currently ESA-listed as endangered through the Endangered Species Act of 1973. Summer chinook are considered a depressed population. Once extirpated from the Methow Subbasin, small numbers of coho salmon have been reintroduced, and plans are currently in the feasibility stage for larger scale reintroduction (see *Fish and Wildlife Status*).

Hatchery program goals and objectives in the Mid-Columbia Region are consistent with direction provided by the Joint Washington Department of Fish and Wildlife and Tribal Wild Salmonid Policy, Mid-Columbia Habitat Conservation Planning, Rocky Reach Dam Anadromous Fish Agreement, Rock Island Anadromous Fish Agreement, Wells Dam Settlement Agreement, Endangered Species Act, and the Northwest Power Planning Council Fish and Wildlife Program. In the Methow Subbasin Hatchery Genetic and

Management Plans (HGMP's) currently exist for summer and fall-run ESU chinook salmon (Appendix A) and coho salmon (Appendix B). The following discussion addresses artificial production in general within the Subbasin.

Table 21. Artificial anadromous fish production in the Methow Subbasin

Fish Species	Facility	Funding Source
Spring chinook	Methow Fish Hatchery (Operated by WDFW)	Douglas County PUD
	Winthrop NFH (Operated by USFWS)	Bureau of Reclamation
Steelhead	Wells Dam Hatchery Complex (Operated by WDFW)	Douglas County PUD
	Winthrop NFH (Operated by USFWS)	Bureau of Reclamation
Summer chinook	Wells Dam Hatchery Complex (Carlton acclimation pond) (Operated by WDFW)	Chelan County PUD
	Eastbank Hatchery (Operated by WDFW)	Chelan County PUD
Coho	Winthrop NFH (Operated by USFWS)	BPA (Fish & Wildlife Program)
	Acclimation sites at Eight Mile Creek and Biddle Pond on Wolf Creek (YN)	BPA (Fish & Wildlife Program)

Hatchery intervention in the Methow Subbasin is guided by a two-pronged approach that encourages local adaptation, preservation and enhancement of specific populations while simultaneously spreading the risk through selection of several artificial production alternatives.

Table 22. Discrete salmonid population segments within the Mid-Columbia Region, based on assessments in the SASSI (WDFW et. al 1993a, 1993b) and the WDFW Genetic Unit (GUD) classification (Busack and Shaklee 1995)

Analysis	Species	Race	Population Segment
SASSI	Chinook	Fall	Hanford Reach
		Summer	Wenatchee, Methow, Okanogan
		Spring	Chiwawa, Nason, Little Wenatchee, White, Entiat, Methow, Twisp, Chewuch and Lost
	Steelhead	Summer	Wenatchee, Entiat, Methow/Okanogan
	Sockeye	NA	Wenatchee, Okanogan
GUD	Chinook	Fall	Hanford Reach
		Summer	Upper Columbia
		Spring	Upper Columbia
	Steelhead	Summer	Upper Columbia
	Sockeye	NA	Wenatchee, Okanogan

Source: BAMP 1998

Anadromous Fish Production

Spring chinook

National Marine Fisheries Service (NMFS) listed upper Columbia River spring chinook (including the Methow Basin populations) as endangered on March 9, 1999 (NMFS 1999). Four (4) potentially distinct indigenous stocks of spring chinook, the Methow, Chewuch, Twisp and Lost River populations, exist in the Methow Subbasin as identified in the SASSI process (WDFW et al. 1993a; WDFW et al. 1993b), although the amount of genetic variability among these groups is low. In periodic allozyme-based genetic analyses done since 1992, the Twisp, Chewuch and Methow River populations have exhibited significant differences in allele frequencies (BAMP 1998). However, some of the genetic samples contained hatchery origin fish presumably originated from the non-indigenous stock production at the Winthrop NFH. The proportion of hatchery origin fish in the Twisp and Chewuch populations was minimal; however, in the Methow River above the confluence of the Chewuch River, they constituted the majority collected (BAMP 1998).

Genetic analysis of spring chinook in the Methow Subbasin indicates that the tributary stocks in the Chewuch and Twisp Rivers are in large part self-recruiting populations (WDFW et al. 1993; CRITFC 2001) that have maintained or developed within the past 60 years despite the influence of the GCFMP (WDFW et al. 1993). Population divergence within a relatively short period of time has been documented in chinook introduced in New Zealand (Quinn and Unwin 1993), and similar divergence is expected for the coho reintroduction program. Since 1992, variable broodstock collection and mating schemes of within-basin chinook stocks (as determined by adult demographics) may have influenced the appearance of stock relationships and stock composition in the Methow Subbasin.

Considerable controversy regarding the effects of the GCFMP actions, non-indigenous introductions, recent fishery management actions (variable broodstock collection and hatchery mating) on population structure, and regarding interpretation of available genetic data has prompted variable interpretations of spring chinook population structuring in the Methow Basin. In response to uncertainty about population structure, poor adult returns, and a desire to spread the risk of hatchery intervention strategies; the Hatchery Working Group (HWG) developed a conceptual approach, during the development of the Biological Assessment and Management Plan (BAMP) for mid-Columbia River Hatchery Programs. The approach consisted of enlarging the effective hatchery supplementation spawning population of Methow River and the Chewuch River populations during periods of low adult returns, by managing them as a single gene pool. During years of sufficient adult returns, tributary trapping locations would be utilized to obtain the broodstock components of each tributary population and within population mating would be a priority in an attempt to preserve and enhance discrete population attributes that exist in the Methow Basin.

Management decisions regarding the Twisp River population varied from those developed for the Methow and Chewuch populations. The Twisp River population was deemed the most divergent of the indigenous populations in the Subbasin and the least

tolerant of genetic introgression (Wells Project Coordinating Committee 1995). The Twisp River population is managed as a distinct population, using adult supplementation and captive broodstock programs. The Joint Fisheries Party (JFP) opted to phase out the Twisp Captive brood program beginning in 2000, leaving 1999 as the last brood year remaining in the program.

The benefits of maintaining distinct population attributes for the long-term survival of the spring chinook in the Methow Subbasin cannot be understated. However, the risk of extinction resulting from minimal effective spawning populations may surpass the risk of reduced within-population genetic integrity of spring chinook in the Methow Subbasin due to "composite" management of the Methow and Chewuch populations during poor adult return years (BAMP 1998). The multi-dimensional artificial production strategy (distinct population, composite population and captive broodstock management) may provide the highest probability of recovery for spring chinook salmon in the Methow Subbasin and reflects the variable population status and uncertain information about population structure within this Subbasin.

Summer Chinook

Artificial production of summer chinook for the Methow Subbasin is provided through the Rock Island Project Settlement Agreement, via the Eastbank Hatchery. The hatchery was constructed in 1989 and is located adjacent to Rocky Reach Dam on the Columbia River. The program is funded by Chelan County PUD and operated by WDFW. Summer chinook production at Eastbank Hatchery is intended to mitigate for summer chinook losses at Rock Island Dam. The production objective for the Methow River is a total of 400,000 yearling summer chinook at 10 fish/lb (BAMP 1998).

Summer chinook broodstock collected for the Methow River hatchery supplementation program are the descendants of the GCFMP which likely incorporated fall-run fish into summer chinook runs (Myers et al. 1998). The percentage of non-indigenous stocks incorporated into the hatchery program is low (about 3% of the over 200 million ocean-type chinook propagated since 1941), and does not appear to have had a significant impact on the genetic integrity of the ESU (Chapman et al. 1994a; Myers et al. 1998).

Broodstock (556 adults) are collected at the Wells Dam east ladder trapping facility and transported to the Eastbank Hatchery. These fish originate from Okanogan/Methow (Wells Dam traps) summer chinook populations of natural or hatchery-origin, and are indigenous to the Methow/Okanogan system. Returning salmon from the Carlton (Methow River) program also volunteer into Wells Fish Hatchery, yet they are identified by Code Wire Tags (CWT) and can be placed into their program of origin if desired (Eltrich et al. 1995; BAMP 1998). Incubation, spawning, and initial rearing take place at the Eastbank facility. The fish are then transferred to the Carlton Acclimation Pond towards the end of their second winter, where they are volitionally released at smolt size (10fish/lb.) into the Methow River in April-May. Broodstock collection protocols are developed annually and determined by annual escapement at Rocky Reach Dam, subject to in-season adjustments. Specific broodstock collection criteria are listed below (adapted from Petersen et al. 1999b and BAMP 1998). Facility operation description, biological attributes and aquaculture

practices and standards are detailed in the HGMP for summer chinook as developed for the Section 7 Draft Biological Opinion for ESA-section 10 Permit #901/902 (Incidental Take of Listed Salmon and Steelhead from Federal and Non-federal Hatchery Programs that Collect, Rear and Release Unlisted Fish Species; WDFW 2000) and as developed for the Rocky Reach and Rock Island Anadromous Fish Agreement and Habitat Conservation Plan (Appendix A).

a. Trap no more than 20% of the adult run, based on counts at Rocky Reach Dam;
b. If cumulative adult counts at Rocky Reach Dam are less than 40% of the ten-year average, cease trapping until the 40% escapement level has been reached;
c. Begin trapping after June 28 and end trapping on or before August 28;
d. Conduct trapping Sunday through Tuesday each week;
e. Do not use the west ladder on Wells Dam for broodstock collections unless difficulties are encountered with broodstock collections in the east ladder;
f. Mark all summer chinook trapped in the Wells Dam ladders to differentiate them from fish volunteering to the Wells Hatchery trap; and
g. Collect the run-at-large including the "Jack" component.

Recoveries of CWT from adults through the 1998 return year have occurred in fisheries, broodstock collections, and on spawning ground surveys. Since the initiation of the program in 1989, CWT recoveries have yielded highly variable estimates of smolt to adult survival rates. Analysis of data covering complete brood years shows smolt to adult return rates that range from a high of .653% for brood year 1989 to a low of .032% for brood year 1991.

The contribution of Methow summer chinook spawning escapement to the Methow River has also been variable since the inception of the program. Contributions to spawning escapements have ranged from a high of 45% in 1994 to a low of 9.2% in 1997.

The observed survival rates and hatchery contribution to natural spawning escapement may be influenced by decisions related to management of bacterial kidney disease (BKD) and duration of acclimation periods prior to release. The summer chinook comprising the Methow River component is derived from low as well as all the high/moderate BKD antigen level in adults collected from the Methow/Okanogan summer chinook population passing Wells Dam. The high/moderate BKD level fish are used in the Methow program because they are reared at the Eastbank hatchery where treatment is more conducive than at an acclimation facility (Similkameen Pond) where the remaining Methow/Okanogan summer chinook program fish are reared. Mortalities associated with BKD outbreaks during the juvenile migration may occur and adversely affect smolt to adult survival of this population. Studies are currently underway to assess the impacts of BKD segregation on this hatchery production.

The Methow River summer chinook supplementation program may also be adversely affected by the duration of acclimation at the Carlton Acclimation Pond. Acclimation typically last 4 to 6 weeks during late February and March. This acclimation period may be insufficient to develop a strong homing behavior in these fish possibly reducing the potential return to the Methow Subbasin.

Summer Steelhead

A 1996 NMFS status review of west coast steelhead populations (including the Methow Subbasin) concluded that the naturally produced steelhead population in the upper Columbia River ESU is not self-sustaining. The total abundance within the steelhead ESU is stable or has increased in recent years; however, this is attributed to hatchery supplementation programs with hatchery production comprising 81% of the spawning escapements to the Methow and Okanogan Rivers (NMFS 1996). NMFS concluded in their status review that this ESU might not exist today if it weren't for hatchery production based on indigenous stocks (NMFS 1996).

Steelhead in the Upper Columbia River ESU were listed as Endangered by NMFS on August 18, 1997. The Wells Hatchery population is considered a part of the Upper Columbia ESU because it was founded from a mixture of native populations (result of the GCFMP), retains genetic resources of steelhead populations above Grand Coulee Dam that are now extinct (NMFS Section 7 Biological Opinion for Section 10 Permit 1094, 1998), and was considered essential for recover in this ESU. Currently roughly 65% to 80% of the naturally producing population is hatchery derived. The incorporation of naturally produced origin adults into the hatchery broodstock, supports a close genetic resemblance between the natural and hatchery populations in the Methow Subbasin population (Busby et al. 1996).

Production from both Wells Hatchery and Winthrop NFH are derived from fish trapped at Wells Dam west fish ladder and are consistent with objectives and strategies contained in the ESA-Section 10 Permit 1094 (NMFS 1998), Wells Settlement Agreement (FERC 1990), Biological Assessment and Management Plan for Mid-Columbia River Hatchery Program (NMFS et al. 1998), Final Joint WDFW Tribal Wild Salmonid Policy (WDFW et al. 1997), Upper Columbia steelhead management Conservation Plan (WDFW 2001) and goals outlined in development of the Mid-Columbia Mainstem Conservation Plan.

Coho

Coho were once the most abundant anadromous salmonid in the Methow Subbasin and were the most cultured species in the Methow during the early 1900s (Mullan et al. 1992). Coho were extirpated from the Methow River between 1915 and 1923. Extensive stocking (46 million juveniles) occurred between 1942 and 1975 utilizing short-run coastal populations. However, the stocking efforts failed to re-establish coho in the Methow River. Since the 1990s various entities in the Pacific Northwest have renewed the region's focus on reintroduction of coho in these rivers. In 1996, the NPPC recommended the mid-Columbia coho reintroduction project for funding by the Bonneville Power Administration. This project was identified as one of fifteen highest-priority projects for the Columbia River basin and was incorporated in the NPPC's Fish and Wildlife Program. Currently feasibility research is being conducted before a full-scale reintroduction program is implemented. Resource managers believe that for reintroduction to be successful under the current NPPC program during feasibility and beyond, a broodstock development program be established to take advantage of natural selection and promote development of a local broodstock. Besides the BPA, project participants include co-managers the Yakama Nation

and Washington Department of Fish and Wildlife, as well as the Confederated Tribes of the Colville Indian Reservation, National Marine Fisheries Service, U.S. Fish and Wildlife Service, and U.S. Forest Service.

The Mid-Columbia Coho Reintroduction Program encompasses long-term as well as short-term goals. The long-term vision for the program is to reestablish naturally reproducing coho salmon populations in mid-Columbia river basins, with numbers at or near carrying capacity that provide opportunities for significant tribal and non-tribal harvest. Mid-Columbia coho reintroduction is identified as a priority in the *Wy-Kan-Ush-Mi-Wa-Kish-Wit* document developed by the four Columbia River Treaty Tribes.

Hatcheries

Winthrop National Fish Hatchery

The Winthrop NFH was established by the GCFMP in 1937 to help mitigate for anticipated anadromous fish losses above Grand Coulee Dam (Grand Coulee Dam was completed in 1942). The hatchery is funded by the Bureau of Reclamation and operated by the U.S. Fish and Wildlife Service and is a sub-station of the Leavenworth NFH Complex. The Columbia River Fisheries Management Plan under the U.S. v Oregon decision of 1969 set production goals. Winthrop NFH is located near Winthrop, Washington on the Methow River.

Prior to the mid-1970s, cutthroat, rainbow, and brook trout, sockeye, summer steelhead, coho, and spring and summer chinook salmon were propagated at Winthrop NFH. Current production consists of two stocks of spring chinook salmon (ESA listed and unlisted), with a total release goal of 600,000 smolts annually.

Table 23. Yearling spring chinook salmon released from Winthrop NFH, 1990 to 1999

Year	Number Released	Year	Number Released
1990	1,121,395	1995	770,847
1991	1,055,056	1996	112,395
1992	624,771	1997	14,620
1993	950,624	1998	324,851
1994	556,313	1999	545,062

The hatchery also propagates listed summer steelhead and unlisted coho salmon. From 1990 to 1999, an average of 197 spring chinook adults have returned to the facility (Carie and Hamstreet 2000). Return percent by brood year has varied considerably, ranging from a high of .165% in 1980 to a low of .001% in 1990. Non-indigenous Carson origin stock are being phased out and replaced with Methow Basin Composite Stock (Carie and Hamstreet 1999). At present no sport or tribal harvest occurs in the Methow Subbasin. There is no HGMP for Winthrop NFH, however the USFWS is currently developing one.

Table 24.Yearling spring chinook releases, total returns and % returns to Winthrop NFH 1979-1993

Brood Year	Releases	Total Returns	% Return
1979	966,300	402	0.042
1980	712700	1175	0.165
1981	953508	1028	0.108
1982	985081	877	0.089
1983	1167625	1031	0.088
1984	1062794	736	0.069
1985	1069293	163	0.015
1986	1090200	90	0.008
1987	865734	117	0.014
1988	1121395	703	0.063
1989	1055056	263	0.025
1990	624771	3	0.001
1991	950624	21	0.002
1992	556,313	202	0.036
1993	770,847	370	0.048

Source: Carie and Hamstreet 1999

Table 25. Winthrop NFH adults returning to the Methow Basin, 1990 to 1999

Year	Number of Returning Adults	Year	Number of Returning Adults
1990	121	1995	14
1991	92	1996	205
1992	332	1997	231
1993	646	1998	178
1994	29	1999	118*

Source: Carie and Hamstreet. 2000.
*Adult Salmonid returns to Leavenworth, Entiat, and Winthrop National Fish Hatcheries in 1999, USFWS.

Coho salmon are cultured at the Winthrop NFH as part of the of coho reintroduction feasibility study. The Yakama Nation acclimated and released between 69,000 and 341,000 yearling coho smolts in the Methow Subbasin between 1995 and 1998 from the Winthrop NFH and acclimation sites on the Chewuch River and Wolf Creek. Subsequent releases from the Winthrop NFH occurred in 2000 and 2001 and totaled 199,763 and 260,319 smolts respectively (K. Murdoch, YIN, personal communication). Estimates of hatchery coho smolt-to-adult survival in the Methow for releases made in 1995-1997 averaged 0.001%. This survival rate was based on the number of coho adults and jacks passing Wells Dam as enumerated via video monitoring (Dunnigan 2000). In 1998 the reintroduction program shifted emphasis to the development of a localized broodstock. As the program transitions from the exclusive use of lower Columbia River hatchery coho towards the exclusive use of in-basin returning broodstock, it is expected that positive trends in smolt-to-adult survival will be observed. Returns in 1999 calculated from the total number of coho collected for broodstock at Wells Dam and the Wells Dam passage counts, were an order of magnitude higher than previous smolt-to-adult estimates. Based on

trapping and video counts, 246 adult coho returned to the Methow Basin resulting in a smolt-to-adult survival rate of 0.07%.

Table 26. Release years, numbers, locations, and smolt-to-adult survival estimates for all coho smolt releases in the Methow sub-basins 1995-2001

Year	Release Location	Release Number	Adult Returns	Smolt-to Adult Survival (%)	Counting Location
1995	Winthrop NFH	70,000	1	0.001%	Wells Dam
1996	Winthrop NFH	235,300			
	Chewuch R.	100,000			
		335,300	3	0.001%	Wells Dam
1997	Winthrop NFH	69,200			
	Chewuch R.	5,000			
		74,200	1	0.001%	Wells Dam
1998*	Winthrop NFH	169,200			
	Chewuch R.	95,099			
	Wolf Creek	76,847			
		341,146	246	0.072%	Wells Dam Trapping and Video
1999				Wenatchee River releases only	
2000	Winthrop NFH	199,763	N/A	N/A	N/A
2001	Winthrop NFH	260,319	N/A	N/A	N/A

*Note: In 1998 program emphasis shifted to local broodstock development.

Methow Fish Hatchery

The Methow Fish Hatchery was constructed in 1992 to compensate for passage mortality of spring chinook salmon at Wells and Rock Island dams. Douglas County PUD funded the construction and is responsible for funding operations and maintenance (Wells Dam Settlement Agreement 1990), while WDFW operates the facility. The Methow Fish Hatchery is located on the Methow River.

The central facility consists of 24 start tanks, 15 raceways and an acclimation pond. In addition 3 of the existing raceways function as adult holding ponds. The facility also has two satellite facilities located on the Chewuch and Twisp rivers. The satellite facilities provide adult trapping and juvenile acclimation capabilities. Details of the hatchery facility and acclimation ponds are included in a 1995 Washington Department of Fish and Wildlife summary report on the Methow Subbasin spring chinook salmon hatchery program (Bartlett 1997).

The Methow Fish Hatchery operates as an adult-based supplementation program using multiple adult broodstock collection locations including the Chewuch, Twisp, and upper Methow rivers. Additional supplementation includes volunteer returns to Methow Fish Hatchery, Winthrop NFH and Wells Hatchery on the Columbia Mainstem. The hatchery also operates as a captive broodstock program in the Twisp River. The long-term production objective for the Methow Fish Hatchery was set at 738,000 yearling spring chinook smolts in the Wells Dam Settlement Agreement (1990). However, that production objective was modified during the development of the Mid-Columbia Habitat Conservation

Plan (MCHCP) to 550,000 yearlings at 15 fish/lb. (BAMP 1998). In years with adequate adult returns, production is limited by an insufficient number of start tanks and raceways. In low water years, production is limited by insufficient water volume because the Methow Fish Hatchery's water supply depends on a combination of ground water and surface water from the Methow River. The long-term production objective and the interim production objective are both consistent with the Draft Biological Opinion for Section 10 Permit 1196 (ESA-Section 7 Biological Opinion for Section 10 Permit 1196, NMFS, 1999).

The location and extent of the trapping for the adult based supplementation program is determined by the expected adult return to Wells Dam (based on lower river dam counts). Broodstock collection in 1994 and 1995 maximized escapement for natural production and created a "bottleneck" in the supplementation program by limiting effective population size. Effective population size for all artificial production in the Subbasin consisted of 63 fish (32% extraction rate) in 1994 and 20 fish (20% extraction rate) in 1995.

Poor returns and related limited broodstock collection compounded with by historically poor spring chinook replacement rate of .669 recruits per spawner (1985-1990; LaVoy unpublished) prompted the development of a 3-tiered broodstock collection protocol for the spring chinook supplementation program in the Methow Subbasin.

Under a revised approach adopted in 1996, the location and extent of broodstock collections is based on projected escapement at Wells Dam. Broodstock collection protocols are now developed annually and are determined by adult escapement above Wells Dam, expected escapement to tributary and hatchery locations, estimated wild/hatchery proportion, and production objectives and stock origin (endemic/non-endemic).

Table 27. Number and location of spring chinook broodstock collected and retained as part of the Methow River Basin spring chinook adult based supplementation program, 1992-1999

	Brood Cycle							
Trapping Location	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Wells Dam	0	0	0	6	461	192	409	309
Tributaries	54	152	17	0	0	0	0	0
Winthrop NFH	332	646	29	7	0	231	0	12
Methow FH	0	99	17	7	0	131	0	56
Total Escapement to Wells Dam	1573	2626	258	113	461	1163	439	649

Source: Brown 2000. Unpublished data, WDFW.

The Captive Broodstock Program promotes the unique population-specific attributes of the Twisp River population and constitutes an alternative to the spread the risk hatchery production strategy. Beginning with brood year 1997, approximately 1,000 to 1,500 eyed-eggs of pre-emergent fry were hydraulically removed from redds on the Twisp River (Bartlett, WDFW personal communication). The eggs/pre-emergent fry were then transferred to the Methow Fish Hatchery where they reared to a yearling stage, and later

transferred to AquaSeed Inc. in Rochester, Washington, to mature to adult stage. However, due to funding allocation difficulties, the Twisp River captive broodstock program has not obtained brood year components since 2000.

Table 28. Broodstock collection guidelines of the Methow Basin spring chinook supplementation plan (ESA Section 7 Draft Biological Opinion, Section 10 Permit 1196)

Wells Escapement Projection	Broodstock Collection Objective
< 668	100% collection of Wells Dam escapement; place all fish into the adult-based supplementation program.
>668 <964	Pass a minimum of 296 adults upstream of Wells Dam for natural spawning.
> 964	Collection at levels to meet interim production level of 550,000 and 600,000 smolts at Methow Fish Hatchery and Winthrop NFH, respectively.

The hatchery and acclimation ponds are operated in a manner that is consistent with accepted aquaculture standards and those identified in the Wells Dam Settlement Agreement. Broodstock handling, spawning, fertilization, incubation, rearing, fish transport, and release activities are detailed in annual summary reports of specific brood years for the Methow Basin Spring Chinook Salmon Hatchery Program (Bartlett et al. 1994; Bartlett 1996; Bartlett 1997; Bartlett 1998; Bartlett 1999; and Jateff 2001).

Production at the Methow Fish Hatchery has varied considerably since the program began with brood year 1992. The variability in production is entirely a function of poor adult returns and different broodstock collection strategies stemming from adaptive management strategies for this tenuous population. Smolt production from the Methow Fish Hatchery has averaged 288,442 smolts annually, representing 52.4% of the interim production level identified in the BAMP (1998).

Table 29. Methow Fish Hatchery complex spring chinook production, 1994-2001 (PSMFC Coded-Wire Tag Data Base)

Brood Year	Migration Year	Stock	Rearing site	Release site	Number released	ESA Status
1992	1994	Twisp	Methow FH	Twisp R.	35,881	No
1992	1994	Chewuch	Methow FH	Chewuch R.	40,882	No
1993	1995	Twisp	Methow FH	Twisp R.	116,749	No
1993	1995	Chewuch	Methow FH	Chewuch R.	284,165	No
1993	1995	Methow	Methow FH	Methow R.	210,849	No
1994	1996	Twisp	Methow FH	Twisp R.	19,835	No
1994	1996	Chewuch	Methow FH	Chewuch R.	11,854	No
1994	1996	Methow	Methow FH	Methow R.	4,477	No
1995	1997	Methow	Methow FH	Methow R.	14,258	No
1996	1998	Methow	Methow FH	Methow R.	202,947	No

Brood Year	Migration Year	Stock	Rearing site	Release site	Number released	ESA Status
1996	1998	Twisp	Methow FH	Twisp R.	76,689	No
1996	1998	Chewuch	Methow FH	Chewuch R.	91,672	No
1997	1999	Methow	Methow FH	Methow R.	332,484	Yes*
1997	1999	Twisp	Methow FH	Twisp R.	26,714	Yes*
1997	1999	Chewuch	Methow FH	Chewuch R.	132,759	Yes*
1998	2000	Methow	Methow FH	Chewuch R.	217,171	Yes*
1998	2000	Methow	Methow FH	Methow R.	218,499	Yes*
1998	2000	Twisp	Methow FH	Twisp R.	15,470	Yes*
1999	2001	Methow Comp.	Methow FH	Methow R.	186,775	Yes*
1999	2001	Twisp	Methow FH	Twisp R.	67,408	Yes*
Total					**2,307,538**	
Average					**288,442**	

* Formal ESA Endangered-listing March 24, 1999

Smolt to adult return rates are currently available for brood years 1992-1995. The brood year 1995 Methow origin production component resulted in the greatest smolt to adult return rate at .7% through age 4. It is likely that the brood year 1995 smolt to adult survival rate will be greater once the entire brood year has returned (age 4-6). The remaining brood years smolt-adult survival rates ranged between .10% and .01%. Production of Methow, Chewuch and Twisp origin fish were segregated into low and high ELISA designations and differentially marked to assess BKD impacts to smolt-adult survival rates. Survival rates between high and low ELISA groups within a specific production group generally favored the low ELISA groups.

Table 30. Smolt to adult survival rates for spring chinook propagated at the Methow Fish Hatchery, Brood Year 1992-1995

	Brood year			
Stock	1992	1993	1994	1995
Methow	NA	Low ELISA -.09%	.02%	.7% *
		High ELISA -.08%		
Chewuch	0.10%	Low ELISA - .05%	.02%	NA
		High ELISA - .02%		
Twisp	0.06%	Low ELISA - 0.04%	.03%	NA
		High ELISA - .01%		

*Survival rate through age 4
Source: BY 1992-1993, Bartlett 1997; BY 1994-1995, B. Jateff, WDFW, personal communication

Wells Dam Hatchery

Wells Dam Hatchery currently provides the majority of the steelhead production for the Methow Subbasin as part of the Wells Dam Settlement Agreement in 1990. The hatchery's production objective is 350,000 steelhead smolts destined for the Methow Subbasin (NMFS 1998). The Winthrop NFH also contributes 100,000 steelhead smolts to artificial

production in the Methow Basin as part of the GCFMP. The entire Methow Subbasin steelhead production is derived from broodstock collections on the west ladder at Wells Dam.

The current broodstock objective is to collect a maximum of 420 adult steelhead from the run-at-large. Adults are held at Wells Hatchery until maturity. Spawning, incubation and rearing all take place at Wells Hatchery. Stocking is conducted primarily as scatter plantings throughout the upper Methow Basin, including upper Methow River, Gold Creek, Eight Mile Creek, Early Winters Creek, Chewuch River, Lost River and Twisp River. Throughout the 1980s smolt production was very high, peaking with brood years 1981 and 1987. Since 1994 production has generally been consistent with the 350,000 smolt objective. Hatchery return rates were variable for brood years 1986/87 through 1993/94 with a return rate average of 1.0% (Bartlett 1999).

Naturally produced steelhead in the Methow Subbasin persist at threshold population levels making it difficult to provide a substantial infusion of naturally produced steelhead to complement the hatchery broodstock. Nevertheless, at this time the hatchery program plays an important role in sustaining the steelhead population in the Methow Subbasin.

Table 31. Summer steelhead production from the Wells Hatchery stocked into the Methow Subbasin, Brood Year 1981-1999

Brood year	Number released	Stock	Release location
1981	38,728	Wells Dam/Chief Joseph dam	Chewuch R.
	784,531	Wells Dam/Chief Joseph dam	Methow R.
	35,745	Wells Dam/Chief Joseph dam	Twisp R.
1982	35,842	Wells Dam/Chief Joseph dam	Chewuch R.
	1,554	Wells Dam/Chief Joseph dam	Gold Cr.
	2,817	Wells Dam/Chief Joseph dam	Lost R.
	143,046	Wells Dam/Chief Joseph dam	Methow R.
	46,143	Wells Dam/Chief Joseph dam	Twisp R.
1983	35,842	Wells Dam/Chief Joseph dam	Chewuch R.
	373,798	Wells Dam/Chief Joseph dam	Methow R.
	24,218	Wells Dam/Chief Joseph dam	Twisp R.
1984	12,600	Wells Dam/Chief Joseph dam	Chewuch R.
	353,862	Wells Dam/Chief Joseph dam	Methow R.
	14,033	Wells Dam/Chief Joseph dam	Twisp R.
1985	32,212	Wells Dam/Chief Joseph dam	Chewuch R.
	1,400	Wells Dam/Chief Joseph dam	Eight Mile Cr.
	3,275	Wells Dam/Chief Joseph dam	Lost R.
	351,537	Wells Dam/Chief Joseph dam	Methow R.
	34,485	Wells Dam/Chief Joseph dam	Twisp R.
1986	37,584	Wells Dam/Chief Joseph dam	Chewuch R.
	1,470	Wells Dam/Chief Joseph dam	Eight Mile Cr.
	60,160	Wells Dam/Chief Joseph dam	Gold Cr.
	339,859	Wells Dam/Chief Joseph dam	Methow R.
	43,980	Wells Dam/Chief Joseph dam	Twisp R.
1987	50,275	Wells Dam/Chief Joseph dam	Chewuch R.
	1,700	Wells Dam/Chief Joseph dam	Eight Mile Cr.

Brood year	Number released	Stock	Release location
	3,870	Wells Dam/Chief Joseph dam	Lost R.
	593,060	Wells Dam/Chief Joseph dam	Methow R.
	50,835	Wells Dam/Chief Joseph dam	Twisp R.
1988	38,600	Wells Dam/Chief Joseph dam	Chewuch R.
	2,650	Wells Dam/Chief Joseph dam	Eight Mile Cr.
	2,650	Wells Dam/Chief Joseph dam	Lost R.
	389,079	Wells Dam/Chief Joseph dam	Methow R.
	48,390	Wells Dam/Chief Joseph dam	Twisp R.
1989	33,300	Wells Dam/Chief Joseph dam	Chewuch R.
	1,500	Wells Dam/Chief Joseph dam	Eight Mile Cr.
	3,075	Wells Dam/Chief Joseph dam	Lost R.
	487,239	Wells Dam/Chief Joseph dam	Methow R.
	35,500	Wells Dam/Chief Joseph dam	Twisp R.
1990	8,000	Wells Dam/Chief Joseph dam	Chewuch R.
	1,680	Wells Dam/Chief Joseph dam	Eight Mile Cr.
	487,567	Wells Dam/Chief Joseph dam	Methow R.
	5,200	Wells Dam/Chief Joseph dam	Twisp R.
1991	4,300	Wells Dam/Chief Joseph dam	Chewuch R.
	1,290	Wells Dam/Chief Joseph dam	Eight Mile Cr.
	1,935	Wells Dam/Chief Joseph dam	Lost R.
	395,350	Wells Dam/Chief Joseph dam	Methow R.
	5,805	Wells Dam/Chief Joseph dam	Twisp R.
1992	5,400	Wells Dam/Chief Joseph dam	Chewuch R.
	2,250	Wells Dam/Chief Joseph dam	Lost R.
	392,815	Wells Dam/Chief Joseph dam	Methow R.
	7,752	Wells Dam/Chief Joseph dam	Twisp R.
1993	4,070	Wells Dam/Chief Joseph dam	Chewuch R.
	324,200	Wells Dam/Chief Joseph dam	Methow R.
	5,920	Wells Dam/Chief Joseph dam	Twisp R.
1994	359,170	Wells Hatchery	Methow R.
1995	255,000	Wells Hatchery	Methow R.
1996	310,480	Wells Hatchery	Methow R.
1997	125,300	Wells Hatchery	Chewuch R.
	127,020	Wells Hatchery	Methow R.
	126,000	Wells Hatchery	Twisp R.
1998	96,225	Wells Hatchery	Chewuch R.
	350,431	Wells Hatchery	Methow R.
	127,515	Wells Hatchery	Twisp R.
1999	138,300	Wells Hatchery	Chewuch R.
	39,172	Wells Hatchery	Early Winters Cr.
	126,728	Wells Hatchery	Methow R.
	136,680	Wells Hatchery	Twisp R.
TOTAL	**8,521,999**		
AVERAGE	**448,526**		

Carlton Acclimation Pond/Eastbank Hatchery

Artificial production of summer chinook in the Methow Subbasin takes place at the Carlton Acclimation Pond as part of the Rock Island Project Settlement Agreement. The production objective for the Methow Subbasin is 400,000 yearling spring chinook. Since

its inception in 1992, the program's average annual smolt production total is 347,508 fish. Stock originated from the Wells Hatchery between 1992 to1995 and from the Methow/Okanogan between 1996 to 1998.

Table 32. Summer chinook production from the Carlton Acclimation Ponds located on the Methow River

Brood year	Release year	Number released	Stock
1989	1991	420,000	Wells
1990	1992	391,650	Wells
1991	1993	540,900	Wells
1992	1994	402,641	Wells
1993	1995	431,149	Wells
1994	1996	394,042	Methow/Okanogan
1995	1997	346,806	Methow/Okanogan
1996	1998	275,573	Methow/Okanogan
1997	1999	377,211	Methow/Okanogan
1998	2000	205,133	Methow/Okanogan
Total		**3,785,105**	
Average		**378,511**	

Table 33. Brood year smolt-adult survival rates for hatchery origin Methow River yearling summer chinook (Murdoch and Petersen 2000)

Brood year	Release year	Adults produced	Smolt-adult survival (%)[1]
1989	1991	2,743	0.653%
1990	1992	415	0.106%
1991	1993	174	0.032%
1992	1994	138	0.034%
1993	1995	126	0.029%
1994	1996	195	0.048%

[1] The Methow River summer chinook population adult returns are typically dominated by 4 and 5 year old age classes. The modal age for return years 1993-1998 was five years, with the exception of 1993 and 1998 (Murdoch and Petersen 2000).

Table 34. Methow River adult escapement contribution of Methow/Okanogan summer chinook released from the Carlton Acclimation Pond (Murdoch and Petersen 2000)

Return year	Hatchery contribution	Tributary escapement	Percent contribution
1991	0	530[a]	0
1992	0	364[a]	0
1993	126	524[a]	24
1994	474	1054[a]	45
1995	447	1213[a]	36.9
1996	97	615[a]	15.8
1997	64	697[a]	9.2
1998	150	675[b]	22.2

[a] Based on total redd count multiplied by 3.4 fish/redd (Meekin 1967; LaVoy, WDFW, personal communication)

[b] Based on total redd count multiplied by 3.0 fish/redd (calculated from broodstock male to female ratio of 2.0:1.0).

Existing and Past Efforts

Summary of Existing and Past Efforts

Existing and past efforts in the Methow Subbasin span a broad range of activities. In many cases the habitat restoration work, educational activities, improvements to irrigation systems, etc., undertaken within the Methow Subbasin represent cooperative efforts of various combinations of local government, private organizations, private citizens, tribes and state agencies. The following list is an attempt to provide an overview of the majority of activities that have taken place in the Methow Subbasin during the last six to ten years. This list does not represent a comprehensive recitation of every activity by every entity doing habitat related work in the Subbasin.

BPA Funded Activities

- *Eastern Washington Landowners Adopt-Stream Training (*Project #9208200) Conducted 6 watershed-training meetings for various groups in eastern Washington. Groups were targeted for training in stream and watershed management to enhance habitat for anadromous fish. Six watershed-training meetings were held for target groups of Native Americans, ranchers, and foresters in eastern Washington.
- *Methow Valley Irrigation District, Reorganization to wells, 1999 to 2000* (Funding WDOE and BPA). Lower ditch was shut off and individuals served by the lower ditch were converted to wells.
- *Methow River Valley Irrigation District* (Project # 199603401, sponsored by Yakama Nation, ongoing project). Examine the feasibility of alternatives and recommend a project to address water conservation, benefit fish and continue to provide water for irrigation.
- *Early Winters Creek Habitat Restoration* (Project #199802500). Restored historic fish, riparian and floodplain habitat, identified methods to augment instream flow to increase spawner success and juvenile survival. Project was completed the summer of 2000 with some follow-up monitoring in 2001.
- *Mid-Columbia Coho Feasibility Reintroduction Study, Yakama Nation* (Project #9604000). This project was initiated in 1996. The project is designed to gather data and develop and implement plans for coho restoration in the Methow, Entiat, and Wenatchee river basins in concert with various state and federal agencies. The project is centered on the development of a localized broodstock while minimizing potential negative interactions among coho and listed and sensitive species. Juvenile coho from appropriate lower river hatcheries are acclimated in ponds or hatcheries prior to release. As the program transitions from the exclusive use of lower Columbia River hatchery coho to ultimately the exclusive use of in-basin returning broodstock during the development of a locally adapted broodstock, it is expected that positive trends in smolt-to-adult survival will be observed. The progeny of adult returns will initially be released into areas of low risk to listed species and will be allowed to return as adults to spawn naturally. Monitoring and

evaluation activities in the Methow Subbasin have focused on evaluating the success of broodstock development, associated survival rates, and examining interactions between coho and listed species, particularly spring chinook salmon, steelhead, sockeye salmon and bull trout. The mid-Columbia coho reintroduction feasibility study relies on the transfer of non-basin specific information from the Wenatchee and Yakima River basins where concurrent releases of coho and associated studies are occurring. Studies designed to examine the impact of direct predation by hatchery coho on salmonid fry have been conducted in the Wenatchee and Yakima River basins. Snorkel surveys to determine the abundance of residual hatchery coho have been conducted annually in the Methow, Wenatchee, and Yakima Subbasins following volitional releases. Studies to examine chinook redd superimposition by later spawning coho salmon, microhabitat use and overlap by naturally spawned coho salmon, and carrying capacity are currently ongoing or planned for 2002.

- *Hancock Springs Passage and Habitat Restoration Improvements, Yakama Nation* (Project #23024). This project was awarded in 2001, with on-the-ground implementation scheduled to begin in 2002. The project is designed to increase juvenile salmonid access to, and enhance the habitat of Hancock Springs, a spring fed off-channel to the upper Methow River. Project objectives are to 1) increase the number of juvenile spring chinook and steelhead utilizing Hancock Springs, and 2) increase the over-winter survival of juvenile spring chinook and steelhead in the Methow River.
- *Goat Creek Instream Habitat Restoration* (Project #199802900). Instream habitat restoration work and instream rehabilitation. Project is ongoing.
- *Arrowleaf/Methow River Conservation Easement* (Project #200103700). Purchase prime riparian habitat in the form of a conservation easement.
- *Methow Basin Screening* (Project #200106300). Provide fish screen facilities and new fish screen construction at Methow Subbasin irrigation diversions including Foghoorn, Rockview, McKinney Mountain, Kum Holloway. Some equipment upgrades are also included under the project. Project is ongoing.
- *Methow Watershed Project II* (Implemented by WDFW). An ongoing $12 million effort to identify and secure more than 5,000 acres of critical riparian/floodplain habitat and linkages to protected upland through fee title acquisition and conservation easements. BPA contributed over $2 million to purchase conservation easements on portions of over 1000 acres of habitat.
- *Respect the River* (Project #9026, USFS). Respect the River is an ongoing interpretive and public contact program that started out with informational/educational signs along the Methow River and its tributaries. The program has been repeatedly expanded to include both media and one-on-one contacts with river users and to include numerous additional drainages within the Methow Subbasin.
- *Measure Mine Drainage Effects of Alder Creek* (Project #199803500). The project involved analyzing the leachable metals in the Methow River and Alder Creek drainages resulting from the abandoned Alder Mine. The Alder Creek Mine is on the western slope of McClure Mountain at 3600 feet on private land surrounded by

National Forest. It produced gold, silver, copper and zinc from before 1937 until 1953. Preliminary results indicated that water at sites below Alder Mine exceed Washington's freshwater criteria for heavy metals. Sediment metal concentrations and calcite precipitation were also high. The impact on riparian vegetation was also determined. The benthic index of biotic integrity was less below the mine than above. While it is clear that Alder Creek has been impaired, the extent of impact has not been determined.

- *Methow River Valley NEPA Study (Project #199603450).* NEPA archaeological and historical studies of the Methow Irrigation District. This contract provided for public involvement, communication and coordination support for the NEPA process.

Non-BPA Funding Sources

American Bird Conservancy

- *Conservations Strategy for Landbirds*, *1997.* Program identified important habitats and desired habitat conditions, and provided interim management targets and recommended management actions for land birds and their habitats.

Methow Conservancy

- *Methow Conservancy Riparian Habitat Project, 1997-2001* (Funded by State of Washington Interagency Committee for Outdoor Recreation). In March of 1997, the Methow Conservancy was awarded a $500,000 grant (later amended to $550,000) from the State of Washington Interagency Committee for Outdoor Recreation (IAC) to be used for the facilitation or purchase of conservation easements that would protect riparian habitat in the Methow Watershed for perpetuity. By the summer of 2001, nine property owners, representing 526 acres and over $930,000 of donated easement value had completed these voluntary conservation restrictions on their properties. The areas include riparian/agricultural lands on the mainstem Methow River and the Little Cub Creek (Rendezvous) complex, an important, upland watershed of the Chewuch River, a tributary of the Methow. Landowners have created protective buffer zones along the critical riparian areas near the river and creeks, have agreed to forest management and land use plans to promote values of watershed and wildlife enhancement, and have agreed that this is to be done for perpetuity. The Methow Conservancy as 'holder' of these easements has a contractual duty to annually monitor these properties for compliance with the terms of the easements and support landowner stewardship where possible.
- *Methow Watershed Riparian Acquisition, 2001* (Funded by State of Washington Salmon Recovery Funding Board). The Methow Conservancy was awarded a $1,290,000 grant by the State of Washington Salmon Recovery Funding Board to help protect spring Chinook salmon, bull trout and steelhead trout habitat in the Methow Subbasin in 2001. The award to the Conservancy provides financial assistance to landowners who want to assure that their lands along the Twisp, Chewuch and Methow Rivers remain as relatively pristine habitat for fish and wildlife. The funds are earmarked specifically for new conservation easements on

private properties that border the Methow River north of the town of Winthrop, and for the Twisp, and Chewuch rivers. As of September of 2001, seventeen property owners, representing 870 plus acres and over four miles of riverfront in the areas identified by the Upper Columbia Regional Technical team and Washington State Conservation Commission's Limiting Factors Analysis as of the utmost importance to salmon recovery have signed Letters of Understanding to begin the easement process with the Methow Conservancy.

- *Partners in Flight Habitat Prioritization, November 2000 to October 2001*. This Songbird Conservation Project brought a land trust (the Methow Conservancy) and several conservation biologists (from the U.S. Forest Service, American Bird Conservatory, and the Washington Department of Fish and Wildlife) together to survey and recommend ways to protect the best privately owned riparian areas in the Methow Valley. The Project allowed for detailed landscape-level mapping and analysis of Methow Valley songbird habitat, along with extensive one-to-one habitat conservation education and many hours of on-the-ground surveys, which formed an important foundation for future conservation easements, research and planning.

Methow Valley Irrigation District

- *Reorganization to wells, 1999 to 2000.* (Funding WDOE and BPA, project is also listed under BPA funded projects). Lower ditch was shut off and individuals served by the lower ditch were converted to wells.
- *Remeshing of MVID screens, 2001.* (Funding WDFW). Screens along both the Methow and Twisp rivers were remeshed to NMFS standard in the spring of 2001.

Okanogan County

Funding for the following restoration projects undertaken by Okanogan County was provided through the Salmon Recovery Funding Board. The Salmon Recovery Act (RCW 77.85) also known as HB2496, directs the Lead Entity Citizen's Committee to develop strategies for prioritizing and implementing salmon restoration activities in a logical sequential manner that produces habitat capable of sustaining healthy populations of salmon. The Confederated Tribes of the Colville Indians Reservation and Okanogan County are Co-Lead Entity for Okanogan County, which includes all areas within the Methow Subbasin.

- *Wolf Creek Channel Restoration*. Enhanced fish passage and created additional instream habitat during summer low flow for steelhead and chinook and bull trout in Wolf Creek.
- *Skyline Ditch Pipe Installation*. Assisted in piping part of the 6.2 mile Skyline Ditch in high water loss areas. This irrigation diversion is located on the Methow River.
- *Airey/Risley Ditch Removal*. Removed an irrigation diversion structure and reduced the length of conveyance on an irrigation canal on the Twisp River.

- *Buttermilk Creek Ditch Fish Screen*. Installed a fish screen on the Buttermilk Creek irrigation ditch on the Twisp River.
- *Skyline Ditch*. Repaired the headgate at the Skyline Ditch diversion on the Chewuch River and replaced the delivery ditch with pipe in a high water loss area.
- *Aspen Meadows Ditch Piping*. Replaced a portion of the Aspen Meadows irrigation ditch with pipe to prevent water loss on Little Bridge Creek, a tributary to the Twisp River.
- *Fulton Ditch Lining Project*. Lined a portion of the Fulton irrigation canal to prevent seepage/water loss. The Fulton diversion is located on the Chewuch River.
- *Eagle Creek Ditch Fish Screen*. Removed an irrigation ditch and installed a well on Eagle Creek, a tributary to the Twisp River.
- *Tourangeau Ditch*. Abandoned the Tourangeau irrigation canal and installed a well on Little Bridge Creek, a tributary to the Twisp River.
- *Early Winters Ditch Diversion Structure*. Constructed a fish friendly diversion structure that ensures flow to the Early Winters irrigation canal.
- *Little Bridge Creek Culvert*. Provided engineering & design work to determine alternatives and costs associated with solving a culvert blockage problem on Little Bridge Creek.

Okanogan Conservation District

The Okanogan Conservation District implemented a number of riparian rehabilitation projects within the Methow Subbasin. Funding for these projects came from the Department of Natural Resources (DNR) or a combination of DNR and private funds through DNR's *Jobs For the Environment* program. DNR and the USDA Natural Resources Conservation Service provided technical assistance.

- *Pete's Creek, 1997.* Seeded 65 acres with grass and planted 880 cottonwood and dogwood whips. Also installed 7,745 feet of cross fence to control grazing and protect riparian areas in the upper watershed.
- *French Creek, 1997.* Installed 6,792 feet of fence to protect riparian zone.
- *Pete's Creek, 1998.* Project to control access road erosion control. Planted 2,000 cottonwoods, 100 pines, and 100 aspen. Developed spring for stock water outside the riparian zone.
- *French Creek, 1998.* Installed 6,864 feet fence to protect riparian zone. Installed two miles of pipeline and two troughs for livestock water outside the riparian zone. Planted 6,000 cottonwoods and dogwood whips.
- *Cow Creek, 1998.* Instituted measures to control road erosion on an access road. Planted 2,000 cottonwoods, 6,000 dogwoods, 200 pine and stabilized headcut.
- *Texas Creek, 1998*. Planted 6000 dogwoods and 2,000 cottonwoods. Created livestock barriers in creek channel by felling trees.
- *Methow River, Wolf Creek Area, 1998*. Built 1.7 miles of fence to exclude livestock from the river. Drilled wells and installed 2,000 feet of pipe and two troughs for stock water outside of riparian zone.

U.S. Fish and Wildlife provided funding for the following projects. The Okanogan Conservation District and the Pacific Watershed Institute completed these projects jointly.

- *Methow River, Lehman Site, 2000.* Drilled a well and installed 500 feet of pipe and one trough for fall stock water outside the riparian zone. Installed 2,640 feet exclusion fence creating a 175-foot riparian buffer. Installed 2,000 feet of pipeline and two troughs for winter stock water outside the riparian zone. Removed corrals from riverbank and rebuild 350 feet away from the river. Replanted the old corral site with native trees and shrubs.
- *Methow River, Konrad site, 2000.* Fenced .75 miles of river bank and planted .25 miles of streambank and irrigate riparian plantings. Developed solar stock water system for trough and storage.

Funding for the following two projects has been awarded through the Salmon Recovery Funding Board, but work has not yet been completed.

- *Beaver Creek Fish Passage Barrier Amelioration*. This project will provide fish passage that is compatible with irrigation needs on Beaver Creek in addition to eliminating one diversion dam and replacing it with a well.
- *Okanogan County Fish Passage Barrier Survey.* This project will inventory and access all potential fish passage barriers including unscreened diversions in Okanogan County. Identified barriers will be prioritized for correction based on quality and quantity of habitat.

Pacific Watershed Institute

In 1996, the Pacific Watershed Institute worked cooperatively with the Methow Valley Reclamation District (MVRD) of the Okanogan National Forest to identify and design restoration activities for several high priority areas in the Chewuch and to develop and implement a monitoring protocol to evaluate restoration activities and long-term conditions of the watershed. The partnership formed between PWI and the MVRD in 1995, enabled PWI to receive a grant from the Washington State *Jobs for the Environment Program* (JFE) to implement activities in four watershed areas within a 12 mile long reach of the Chewuch mainstem. Two of the projects areas are entirely situated on USFS land. One project area lies on both Washington State Department of Fish and Wildlife and USFS land and the fourth area is on private land. The first JFE grant was received in 1996 with matching funds from USFS, USFWS, WDFW and PWI. Additional funding extended that grant to new projects in 1997 with the majority of new funding coming from the USFS. The following projects were completed in 1996 and 1997. An additional JFE grant and challenge cost share grant with the U.S. Forest service in 1998 provided funds for monitoring and continued maintenance.

- *Restored riparian vegetation in a mile long dispersed recreation area near the Chewuch River*. Activities included road obliteration, fencing, seeding in meadow areas, stream bank re-grading and re-vegetation with associated large woody debris (LWD) placement in key locations. Construction of a bar apex jam to retain and

encourage development of off-channel habitat areas. Placement of non-anchored log complexes within the off-channel area for cover.

- *Enhanced and added road slope protection in a large side channel of Chewuch.* Activities included: 1) development of a smaller pilot-channel across and island to deflect flow away from the road slope and provide future side channel development opportunities; 2) construction of lateral bar jams to deflect flow into the new side channel; and 3) construction of a large chaotic crib structure to protect the road slope while providing instream habitat and cover.
- *Opened .5 mile side channel to increase year-round flow for juvenile rearing and flood refugia habitat*. Enhanced the stream channel with 6 LWD complexes to provide summer and winter cover. Investigated ground water relationships to alluvial fan geomorphology as it relates to side channel development and winter habitat availability.
- *Restored access to flood channels on a channelized alluvial fan.* Activities included the excavation of portions of constructed boulder berms to bankfill level and reshaping connections to the main flow to prevent sub-surface flow during summer.
- *Addition of 6 LWD structures to a depositional area of the Chewuch in order to maintain an off–channel area, provide hiding cover and shading.* Also, restoration of riparian area in a dispersed campsite.
- *Established a native plant collection and propagation program for re-vegetation projects in the Methow.* Propagation methods include transplants, shrub, tree and forb rooted cuttings, and seed collection and propagation to container stock. Project includes work with local and regional nurseries to propagate plants.
- *Monitoring of 6 restoration projects completed in 1996 & 1997.* Monitoring includes re-vegetation success, large woody debris structures, channel geometry, sediment, habitat condition, hydrology and fish presence.

Upper Columbia Regional Fisheries Enhancement Group

The Upper Columbia Regional Fisheries Enhancement Group (UCRFEG) is a non-profit group that works with willing landowners to protect good quality habitat, facilitate and implement fish restoration projects. UCRGEG informs the public through education, training, and public information to improve the health of our region's environment, increase fish populations, promote a more sustainable and environmentally sound regional economy, and minimize community conflicts over natural resource management.

- *Fraser Creek Riparian Fence*. Installed 1.25 miles of fencing to prevent livestock access to the stream and riparian zone.
- *Black Pine Basin Riparian Fence*. Installed 1.1 miles of fencing to prevent livestock access to the stream and riparian zone.
- *South Fork Beaver Creek Riparian Fence*. Installed .1 miles of fencing to prevent livestock access to the stream and riparian zone.
- *Okanogan Fish Passage Inventory*. Assisted Okanogan Conservation District with their assessment of barriers to fish migration.

- *Methow Corridors Project, Methow Corridors II Project, Methow Corridors Project III, Methow Watershed Project.* Over $20 million of Washington Wildlife Recreation Program (WWRP) funding used to secure several thousand acres of critical lower elevation fish and wildlife habitats.
- *Spring chinook artificial supplementation and captive broodstock program*. Funded by Douglas County Public Utility District as part of the Wells Dam Settlement Agreement.
- Operation and Management of the Methow Fish Hatchery for the production of ESA-listed upper Columbia River spring chinook salmon. The program is responsible for broodstock collection spawning, rearing and releasing up to 550,000 spring chinook smolts into the Methow River Basin annually.
- *Summer chinook artificial supplementation program*. Operation and management of the Carlton Acclimation Pond and Eastbank Hatchery Facility for production of summer chinook (400,000 smolts) as a component of the summer chinook supplementation program associated with mitigation for the construction and operation of Rock Island Dam. The program collects broodstock and spawns, incubates, and releases 400,000 yearling summer chinook into the Methow Subbasin annually.
- *Summer chinook supplementation program evaluation*. The program is funded by Chelan County Public Utility District as part of the Rock Island Project Settlement Agreement. Implementation of the summer chinook supplementation hatchery evaluation program. The program monitors and evaluates the efficacy of supplementation efforts in the enhancement of summer the chinook population in the Methow Subbasin.
- *Summer steelhead hatchery supplementation program*. Funded by Douglas County Public Utility District as part of the Wells Dam Settlement Agreement. Operation and management of the Wells Dam Hatchery for the production of ESA-listed upper Columbia River steelhead in the Methow Subbasin. The program collects broodstock and spawns, incubates and releases approximately 350,000 steelhead smolts in to the Methow Basin annually. It also provides the egg source for the 100,000- steelhead smolts stocked annually in to Methow Subbasin from the Winthrop NFH.
- *Adult steelhead migration and spawning disposition*. Funded by Chelan, Douglas and Grant County PUDs. WDFW participated in a steelhead radio telemetry study in the mid-Columbia Region to assess the upstream migration and eventual spawning disposition of Upper Columbia River ESA-listed summer steelhead. The radio tags are applied at Priest Rapids Dam and monitored throughout migration and spawning, and includes the monitoring in Methow Subbasin.
- *Upper Columbia River steelhead stock assessment.* Funded by WDFW. The stock assessment project occurs at Priest Rapids Dam and collects biological data related to enumeration, origin (hatchery/wild), age (fork-length and scale), and record of marked/tagged steelhead migrating above Priest Rapids Dam, including those destined for the Methow basin.

- *Species abundance and distribution.* WDFW fisheries personnel conduct annual and periodic species distribution abundance surveys in the Methow Basin.
- *Creel Census Survey Information*. Creel census information is gathered annually during the Methow River trout fishery season to assess angler success, angler effort, species assemblage, and population characteristics.
- *Methow Wildlife Area Management Plan.* Plan developed for WDFW lands in the Methow Subbasin to conserve fish and wildlife resources and maximize wildlife-based recreation. Includes removing fish passage barriers and installing fish friendly irrigation components.
- *Wildlife species management or recovery plans.* Developed Sharp-tailed Grouse Recovery Plan, Lynx Recovery Plan, Elk Management Plan, Black Bear Management Plan, Bald Eagle Recovery Plan.
- *Lynx research*. Completed ongoing research projects in the 1980s documenting lynx ecology and potential management conflicts.
- *North Cascades Rare Carnivore Camera Survey*. An ongoing volunteer partnership with Northwest Ecosystem Alliance to survey North Cascades backcountry areas with self-activated cameras for rare carnivores. Multiple occurrences of lynx and wolverine documented to date.

Washington Department of Fish and Wildlife and U.S. Forest Service

- *Townsend's Big-eared Bat Project* (Funding, $20,000 grant from Trust for Public Lands). Project involved construction of a "bat house" to replace a currently occupied structure (Rattlesnake House) slated for demolition or relocation and site preparation in anticipation of new funds to move an existing structure.
- *Mule Deer Research*. Research projects in the 1970s and 1980s collected data on mule deer ecology and habitat needs for the West Okanogan herd.
- *Grizzly Bear/Gray Wolf Investigations Project.* Project evaluated the status of grizzly bears and gray wolves in the North Cascades, and the ability of the North Cascades Ecosystem to support a viable grizzly population. USFWS and National Park Service (NPS) also contributed information and financing for the project.
- *Forest Carnivore Survey*. Challenge cost-share project with National Fish and Wildlife Foundation to survey Okanogan National Forest lands for lynx, wolverine, fisher, and marten.
- *Wolverine Investigations*. Cost-share project with additional Skagit Environmental Endowment Commission and USFWS funds to document wolverine distribution and reproductive status.

WDFW Cooperative Efforts

The Washington Department of Fish and Wildlife has worked with many of the irrigation districts, the U.S. Forest Service, the U.S. Fish and Wildlife Service and other agencies to improve fish passage conditions related to irrigation systems within the Methow Subbasin.

Table 35. Cooperative efforts to correct fish screens in the Methow Subbasin, 1998-2001

Year	Location	Activity
1998	Barkley (Methow River)	Fish screen completed summer 1998. On line 1999 irrigation season, tuneup complete spring 2001.
1998	Chewuch (Chewuch River)	Completed fall 1998. Tuneup completed. Contributed 10 cfs to river.
1999	Larson Ditch (Libby Creek)	Completed spring 99, Cap funded, owner cost-share.
1999	WCRD (Wolf Creek)	Completed sprint 1999, did not divert until spring 2000, tuneup complete 5/31/00. Low flow season 10 cfs contributed to river due to Patterson Lake storage. Owner cost share SRFB. EI 75k, NMFS 25k.
1999	Buttermilk (Buttermilk Creek)	Completed summer 1999, tuneup complete 5/31/00, (*) GSRO 17.5K, NMFS 11.5K, owner cost-share, (IAC not used)
1999	Eightmile (USFS, Eightmile Creek)	Completed spring 1999, USFS funded 18K. Point of diversion change contributed 8cfs to Chewuch.
2000	Twisp Power (Twisp River)	Completed spring 00, tuneup complete by 5/31/00, SRFB EI 80 K, NMFS 40K. WDFW negotiations returned 3 cfs to river.
2000	Beaver Creek Basin (Beaver, Frazer, Storer)	IAC contract extension to 10/31/00, SRFB EI 100K, Proviso 50K. Will be completed Spring of 1991.
2000	Fulton (Chewuch River)	Completed spring 00, tuneup complete fall 2000, SRFB EI 100K, NMFS 50K, SRFB early 2000 33.5K, NMFS 16.5K. Saved 6 cfs with WDFW negotiations.
2000	Twisp Airey (Twisp River)	Conversion to pump completed spring 2000,GSRO 30K, [Cap Sup 25K, tuneup not yet completed, County has lead] 4 cfs returned to river, change of point of diversion.
2000	Skyline (Chewuch River)	Completed summer 00, SRFB early 2000 100K, NMFS 40K, Proviso 25K. Lined ditch. Saved 8 cfs.
2001	Early Winters (Early Winters Creek)	Pre-design, scheduled construction spring 01, funded SRFB early 2000 100K, NMFS 36.5K, Proviso 14.5K. Creek rebuilt by USFW. Point of diversion changes negotiated and completed. Low flow trigger returned to creek. 6cfs.
2001	McKinney Mtn. (Methow River)	Re-screened with 3/32 perforated plate 1999. Meets current criteria, scoping stage, flows an issue, scheduled spring 2001. Cap funded 25K.
2001	Fog Horn (Methow River)	USFWS responsibility, scoping stage, construction scheduled fall 2001. Cap support 65K, USFWS 100K.
2001	Rockview (Methow River)	Agency screen, re-screened with 3/32 mesh 2000 meeting criteria, pre-design 2001, Proviso 120K
2001	Kumn Holloway (Methow River)	Re-screened with 3/32 perforated plate 99. meets current criteria, scoping stage, construction scheduled spring 2001, Proviso 20K.

* SRFB EI = Salmon Recovery Funding Board, Early Implementation (5595)
GSRO = Governors Salmon Recovery Office

Wolf Creek Reclamation District

Wolf Creek Reclamation District has undertaken a number of projects to improve habitat including channel modifications, activities to improve fish passage, and to eliminate erosion and sedimentation from bank failure along the District's ditches. The District is also beginning work on development of a Habitat Conservation Plan (HCP). Most of the

activities listed below were funded through a combination of Salmon Recovery Funding Board and National Wildlife Foundation Funds.

Table 36. Wolf Creek Reclamation District restoration activities

Year	Location	Activity
2000	Patterson Lake	Modified spillway to allow additional 450 acre-feet of water storage.
2000	Lower Wolf Creek	Modified creek channel to improve passage opportunities for migrating fish.
2000	WCRD Distribution System	Installed 1,100 feet of new 21" PVC piping. Estimated saving of 500 to 800 acre-feet per year.
2001	WCRD Distribution System	Installed 5,500 feet of new 18" PVC pipe in WCRD distribution system.
2001	WCRD Distribution System	Reconstructed existing WCRD structure.

U.S. Forest Service

The U.S. Forest Service completed many riparian habitat improvement projects on Forest Service land during the last six years. A table outlining completed projects within the Methow Subbasin follows.

Table 37. U.S. Forest Service riparian habitat improvement projects in Methow Subbasin 1994-1999

Year	Location	Activity
1994	Doe Creek	Completed road cut and fill stabilization. Project shifted road further into the hill, seeded, matted, planted, created a drainage ditch and kept sediment laden water from reaching the stream.
1994	Chewuch Road	21 miles of non-system roads retired.
1994	Chewuch	Survey done to identify the dispersed sites along the Chewuch. Modifying sites to reduce their impact on riparian and aquatic resources prioritized.
1994	Chewuch	Installed two miles of electric fence, two miles of barbed wire fencing (E. Chewuch). Cattle guard installed to protect main Chewuch River from migrating cattle.
1994	Poorman Creek	Completed variety of road obliteration, planting seeding, riparian rehabilitation projects.
1994	Eightmile Ranch	Pulled the fence line back from the river and planted ponderosa pine.
1994	Lake Creek Trail	Rerouted short segments of trail and rehabilitated part that could deliver sediment into the river.
1994	Chewuch Trail	Rerouted short segments of trail and rehabilitated part that could deliver sediment into the river.
1994	East Chewuch	Completed riparian surveys.
1995	Chewuch	Pre-work for large woody debris material for Chewuch, includes low elevation flights, channel cross-sections and design.
1995	Chewuch Campsites	Dispersed sites. Rehab work in 15-20 sites. Minor maintenance on work done previous year.
1995	Chewuch	Contracted with Watershed Restoration Program at Wenatchee Valley College for road/culvert inventory in uplands.

Year	Location	Activity
1995	Bromas	Completed road stabilization project.
1995	Chewuch	Replaced culverts off East Chewuch.
1995	Poorman Creek	Replanted riparian units and obliterated some road.
1995	Falls Creek	Completed seeding and cut/fill of slopes. Tested various approaches to see what worked best. Results were variable depending on slope orientation.
1995	Chewuch	Installed 2 miles fencing.
1995	Chewuch?	Began Proper Functioning Condition survey for riparian areas and instituted appropriate responses.
1996	Chewuch	Implemented large woody material project, two sites included large wood jams in streams and re-vegetation of area.
1996	Chewuch	Rehabilitation work on developed sites includes defining river access and moving use further away from shore.
1996	Chewuch and others	Many small road fixes, some obliteration of roads, closure, culvert work. Includes Chewuch, Eightmile, Falls, Ortell, Island Mountain, Sherwood, Sweetgrass, War Creek, Little Bridge and Buttermilk.
1996	Long Creek	Moved water troughs in Long Creek and Cub Pass.
1996	Reynolds Landing	Rehabilitation work completed.
1996	Rogers Lake	Research Natural Areas designation in process, results in compilation of biological and physical information about Rogers's lake and Chewuch above Andrews Creek.
1997	Chewuch River	Site 9 on Chewuch River, added large wood.
1997	Vanderpool Crossing	Removed culvert, made passage fish friendly and re-vegitated area.
1997	Eightmile	Dispersed and developed site rehabilitation.
1997	Blackpine Lake	Beaver Creek fence.
1997	Chewuch	Rehabilitation and maintenance of Chewuch sites.
1998	Cub Creek	Road package prepared to determine which roads could be closed in preparation for implementation in 2000.
1998	Twentymile Creek	Road rehabilitation.
1999	Throughout	Modifications in campsites and campgrounds are revisited and maintained.
1999	Chewuch	Closed or obliterated USFS roads in Chewuch area.
1999	Barney creek (Falls Creek)	Road obliteration halfway completed.
2000	Throughout	Dispersed campsite maintenance

Yakama Nation

- *Methow Basin spring chinook spawner surveys* (Funded by Douglas County PUD). Since 1987 basin wide spawner surveys have been conducted. This information is summarized each year in an annual report submitted to Douglas County PUD. The data set consists of redd counts by stream reach for each major tributary in which spring chinook spawn, estimated spawner escapement, plus bio-sample data (i.e. scale samples, recovery of CWTs, notation of external marks, sex, body length and extent of gamete retention).
- *Methow Basin Spring Chinook Salmon Supplementation Program (MBSCSP)* (Funded by Douglas County PUD). The Yakama Nation contracted with Douglas County PUD in 1993 to conduct monitoring and evaluation activities as part of the MBSCSP. The Methow Basin Spring Chinook Supplementation Plan dictates specific monitoring and evaluation tasks associated with the Program. Since 1993

the spawner surveys have been incorporated into the MBSCSP. Field activities not related to spawner surveys have focused mainly on the Chewuch spring chinook population. Data collected includes juvenile outmigrant information (timing, size, condition) on an annual basis, and late summer juvenile standing crop estimates and distribution. Limited fall monitoring of juvenile outmigrants has been done twice in the middle Methow River (near Carlton). Limited habitat data pertaining to side channel habitat has been collected in the Chewuch, Twisp and Methow rivers.

- The Yakama Nation has been involved with the Methow Valley Irrigation District for the past several years in negotiations to resolve the issue of inadequate instream flows in the lower Twisp River.

Present Subbasin Management

Existing Management

Many agencies and entities share responsibility for management and protection of fish and wildlife populations and habitats in the Methow Subbasin. Roughly 80% of land within the Subbasin is owned and managed by the federal government. In addition to federal management, state, county, and tribal regulations and policies guide management activities within the Subbasin. Regional coordination efforts and management goals also play vital roles in guiding local management response to specific fish, wildlife and habitat issues. Throughout the Columbia River Basin, implementation of the Endangered Species Act and the Clean Water Act, Shoreline Management Act, etc., have profoundly affected how resource management strategies are implemented at a local level. Following is a brief outline of the various management entities and their legal and regulatory responsibilities regarding resource management, protection and recovery.

Federal Government

Bonneville Power Administration

The Bonneville Power Administration has mitigation responsibility for fish and wildlife restoration under the Fish and Wildlife Program of the Northwest Power Planning Council as it relates to hydropower development. It is also accountable and responsible for mitigation related to federal Biological Opinion and Assessments for recovery of threatened, endangered, and sensitive species. The recently released Federal Columbia River Power System Biological Opinion calls for the BPA to expand habitat protection measures on non-federal lands.

Environmental Protection Agency

The Environmental Protection Agency is responsible for implementing and administering the Clean Water Act. The Clean Water Initiative of 1998, established the Clean Water Action Plan, a federal partnership to promote and enhance locally based watershed improvements. A key piece of this action plan was the development of Unified Watershed Assessments, which identified watersheds not meeting CWA 303(d) standards and other restoration goals. As part of the Unified Watershed Assessment process, Total Maximum

Daily Loads (TMDL) are currently being developed for the Columbia River mainstem and tributaries. EPA is developing TMDL's for the mainstem Columbia River, while the state and tribes are working to develop TMDL's for tributaries.

National Marine Fisheries Service

The National Marine Fisheries Service (NMFS) administers the Endangered Species Act (ESA) for anadromous fish. NMFS reviews and comments on activities that affect fishery resources and develop recovery plans for listed species in the Subbasin. Under the ESA's 4(d)rule, "take" of listed species is prohibited and permits are required for handling. Biological Opinions, recovery plans, and habitat conservation plans for federally listed fish and aquatic species help target and identify appropriate watershed protection and restoration measures.

U.S. Bureau of Land Management

The Bureau of Land Management (BLM) manages approximately 1% of the land in the Methow Subbasin. The BLM, in accordance with the Federal Land Policy and Management Act of 1976, is required to manage public lands to protect the quality of scientific, historical, ecological, environmental, air and atmospheric, water resource and archeological values. Both the BLM and USFS must ensure that activities on lands they administer comply with requirements of the Clean Water Act and the Endangered Species Act.

U.S. Bureau of Reclamation

The Bureau is responsible for a number of hydropower facilities and irrigation projects in the Columbia River Basin. Within the Methow Subbasin the Bureau of Reclamation provides funding for the Winthrop National Fish Hatchery.

U.S. Department of Agriculture

Within the U.S. Department of Agriculture (USDA), the Natural Resource Conservation Service (NCRS) oversees the implementation of conservation programs to help resolve natural resource issues. The Environmental Quality Incentives Program (EQIP), established in the 1996 Farm Bill, provides a voluntary conservation program for farmers and ranchers who face serious threats to soil, water and related natural resources. The Conservation Reserve Enhancement Program (CREP) helps to establish forested riparian buffers. The NRCS assists landowners to develop farm conservation plans and provides engineering and other support for habitat protection and restoration.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) administers the Endangered Species Act (ESA) for resident fish and wildlife. USFWS reviews and comments on activities that affect fishery and wildlife resources and develops recovery plans for listed species in the Subbasin.

U.S. Forest Service

The U.S. Forest Service (USFS) is required to manage habitat to maintain viable populations of anadromous fish and other native and desirable non-native vertebrate species. USFS manages approximately 80% of the Methow Subbasin. In its management of lands within the Methow Subbasin, the USFS follow guidelines laid out in the Northwest Forest Management Plan Standards and Guidelines for Management of Habitat for Late Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (1994 Forest Plan). In the Columbia River Basin, the Forest Service and the Bureau of Land Management manage salmonid habitat under the direction of PACFISH (USDA and USDI 1994) and INFISH (Inland Native Fish Strategy; USDA 1995). These interim management strategies aim to protect areas that contribute to salmonid recovery and improve riparian habitat and water quality throughout the Basin, including the Methow Subbasin. PACFISH guidelines are used in areas east of the Cascade Crest for anadromous fish INFISH is for the protection of habitat and populations of resident fishes outside anadromous fish habitat. The Northwest Forest Plan, PACFISH and INFISH all include components dealing with riparian reserves, key watersheds, watershed analysis, and watershed restoration.

Tribes

Confederated Tribes of the Colville Indian Reservation

The Confederated Tribes of the Colville Indian Reservation (CTCR) is a confederation of 11 aboriginal tribes and bands. Six tribes (Wenatchi, Entiat, Chelan, Columbia, Palus, and Chief Joseph Band of Nez Perce) signed treaties in 1855 with the United States that contained language reserving the right to continue to fish off reservation. The Wenatchi, Entiat, Chelan, and Columbia tribes were provided a separate executive order reservation that was originally adjacent and west of the Colville reservation and included the lands within the Methow Subbasin. The Columbia Reserve was eliminated and the four tribes were removed to the Colville Reservation. The other tribes of the confederation, not party to any treaty, were residents of the original Colville Reservation. The original boundaries of the reservation extended up to the Canadian border. When the northern half of the reservation was released, all tribes and bands within the confederation retained fishing and hunting rights. Some tribal allotment lands still lie within the Methow Subbasin. The CTCR play an active role in many cooperative planning and management activities throughout the Subbasin including the activities of the Upper Columbia Salmon Recovery Board and the Methow Basin Planning Unit. The CTCR is also involved in the Habitat Conservation Plans being developed by individual irrigation districts and in ongoing efforts to improve instream flows. The CTCR maintains a strong interest in plants, fish and animal species of their traditional lands and strive to maintain viable populations of native and desired non-native species of wildlife, and their supporting habitat, while providing wildlife in sufficient numbers to meet the cultural, spiritual, and subsistence needs of tribal members.

Yakama Nation

As guaranteed by the Yakama Treaty of 1855, the Yakima Nation reserved the right to continue to hunt and fish outside of the established reservation without interference from

states or federal government, absent express acts of Congress. These reserved rights provide part of the basis for a wide range of rights and interests regarding the protection, enhancement, management, and harvest of fish and wildlife. The Yakama Nation has been involved in numerous habitat restoration projects within the Methow Subbasin as well as in efforts to improve instream flow within the basin. The Yakama Nation conducts ongoing monitoring and evaluation studies as part of the Methow Basin Spring Chinook Salmon Supplementation Plan. In addition, the Yakama Nation is working towards restoring naturally spawning coho in the Methow Subbasin.

State

Washington Department of Ecology

Washington State Department of Ecology (WDOE) is Washington's principal environmental management agency. WDOE's mission is to protect, preserve and enhance Washington's environment, and promote the wise management of air, land and water for the benefit of current and future generations. The WDOE manages and administers many specific programs including the Air Quality Program, Environmental Assessment Program, Nuclear Waste Program, Shorelands and Environmental Assistance Program, Solid Waste and Financial Assistance Program, Spill Prevention, Preparedness, and Response Program, Toxics Cleanup Program, Water Quality Program, and the Water Resources Program.

WDOE has ongoing streamflow and water quality monitoring and management in the Methow River Subbasin. Instream flows for the Methow River were first established in 1977 under the River Basin Program Series, No. 4, Water Resources Management Program, Methow River Basin (Chapter 173-548 WAC). From 1977 to present, any surface water rights issued were made subject to interruption should Methow River instream flows not be met.

The National Marine Fisheries Service (NMFS) in the Columbia River Biological Opinion (BiOp) and the Upper Columbia Regional Technical Team (RTT) in it's July 2000 report and draft Regional Recovery Strategy recognize that the establishment and protection of instream flows in the Upper Columbia is of paramount importance. WDOE agrees that instream flows must be established and protected to facilitate restoration of salmonids and other instream values. However, there are not adequate state resources to address instream flows throughout the province. Therefore, WDOE is concentrating its efforts on updating the mainstem Columbia River management program, and is assisting groups organized under the Watershed Planning Act with development of instream flow analyses and plans as part of their watershed plans.

WDOE has provided ongoing technical and policy assistance to the Methow River Basin Planning Unit (MBPU). The MBPU received grant funding to complete an assessment and of water quantity, water quality, habitat, and instream flow resources in the Methow Subbasin. The MBPU has until December 1, 2001 to decide whether or not instream flows will be revised through the watershed planning process in order to qualify for limited supplemental state funding. The MBPU has the opportunity to update the 1976 flows using instream flow analyses conducted by the WDOE using the Physical Habitat Simulation System (PHABSIM) portion of the Instream Flow Incremental Methodology

(IFIM) or another technically defensible method of their choosing. Brad Caldwell and Dave Catterson completed the IFIM analyses in 1992. Until additional analyses are completed and a viable watershed plan proposes revisions to the water resource management program, the WDOE will continue to monitor stream flow and manage water resources based upon the 1977 instream flow management plan.

Washington Department of Fish & Wildlife

The Washington Department of Fish and Wildlife (WDFW) is a significant landowner in the Methow Subbasin with five scattered management units totaling over 26,400 acres. The agency's responsibility, not only on these public lands, but throughout the Subbasin, is to preserve protect and perpetuate the diverse wildlife resource and their habitats, and to maximize the recreational and aesthetic benefits of wildlife for all citizens of Washington.

Policies that WDFW uses to carry out its responsibilities include the *Revised Code of Washington* (RCW) and *Washington Administrative Code* (WAC). These codes set the framework for developing administrative rulings to protect fish and wildlife and their habitats through regulatory actions. The *Hydraulic Code* requires that any person, organization, or government agency that conducts any construction activity in or near state waters (all marine and fresh waters in the state) must comply with the terms of a Hydraulic Project Approval permit issued by WDFW.

WDFW actions are also guided by a variety of statewide and regional habitat and species management plans including the *Wild Salmonid Policy for Washington*. This policy includes proposed changes in hatchery management, fish management, habitat management, and regulation/enforcement actions that WDFW will use to protect and enhance salmonid species. The *Draft Steelhead Management Plan*, is still under development/review, however, this plan describes goals, policies and guidance for management of steelhead on a statewide level. The *Upper Columbia Steelhead Management Conservation Plan*, is a first step in delisting of hatchery steelhead. This plan also addresses various fish management actions for the use of hatchery fish in recovery of the Upper Columbia River Basin ESU. The *Bull Trout and Dolly Varden Management Plan*, describes goals, objectives and strategies to restore and maintain the health and diversity of self-sustaining bull trout and Dolly Varden stocks and their habitats in Washington.

WDFW is a party to Upper Columbia Regional Technical Team which developed a document titled, *A Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region*. The strategies outlined in this document offer guidance to the Upper Columbia Salmon Recovery Board and the Washington State Salmon Recovery Funding Board in identifying projects for funding that will best contribute to the recovery of salmonids listed under the Endangered Species Act.

WDFW also provides funding to develop and implement projects to benefit salmon through the *Regional Fisheries Enhancement Program*. Created by the Washington Legislature in 1990, the program is aimed at including citizens in salmon enhancement efforts. Regional Fisheries Enhancement Groups have been established throughout the state.

Washington State Conservation Commission

The Washington State Conservation Commission (WSCC) facilitates and coordinates resource conservation programs and activities of conservation districts as they relate to other special purpose districts, counties, and other public agencies. WSCC encourages the cooperation and collaboration of state, federal, regional, interstate and local public and private agencies with the conservation districts, and facilitates arrangements under which the conservation districts may serve county governing bodies and other agencies as their local operating agencies in the administration of any activity concerned with the conservation of renewable natural resources. The WSCC recently completed development of the *Salmon, Steelhead and Bull Trout Habitat Limiting Factors, Water Resource Inventory Area 48*, Final Report which documents habitat conditions in the Methow Subbasin.

Upper Columbia Salmon Recovery Board

The UCSRB is a partnership among Chelan, Douglas, and Okanogan counties, the Confederated Tribes of the Colville Indian Reservation, the Yakama Nation, in cooperation with local, state, and federal partners. The mission of the UCSRB is *to restore viable and sustainable populations of salmon, steelhead, and other at-risk species through the collaborative efforts, combined resources, and wise resource management of the Upper Columbia Region.* To better meet its mission, the UCSRB seeks to ensure that actions taken to protect and restore salmonid habitat in the region are based on sound scientific principles.

Department of Natural Resources

The Washington State Department of Natural Resources (DNR) manages more than 5 million acres of forest, range, agricultural, and aquatic lands. These lands produce income to support state services and to provide other public benefits. Nearly 3 million acres are state trust lands, most of which were given to Washington at statehood by the federal government. DNR protects 12 million private and state-owned forested acres from wildfire. DNR administers Forest Practices Board rules on 12 million forested acres. The DNR manages approximately 5% of the lands within the Methow Subbasin.

Local Government & Other Entities

Okanogan County

Okanogan County is responsible for planning and land use within county boundaries. The county also issues planning permits. Representative of Okanogan County play an active role within the Methow Basin Planning Unit and on the Upper Columbia Salmon Recovery Board.

Okanogan Conservation District

The Okanogan Conservation District is a sub-division of Washington State Government formed by the authority of RCW 89.08. Conservation Districts in Washington are governed by a board of five supervisors (three locally elected, two appointed by the Washington

State Conservation Commission). Conservation Districts are responsible for identifying natural resource concerns and developing programs that bring voluntary technical and financial assistance to landowners and land occupiers in the District.

Methow Basin Planning Unit

The Methow Basin Planning Unit (MBPU) includes local citizens representing a diverse range of interests. MBPU members include representative from Okanogan County, the Confederated Tribes of the Colville Indian Reservation, and Methow Valley Irrigation Districts, the towns of Twisp and Winthrop, business interests, agricultural interests, environmental groups, DOE, and WDFW among others. The MBPU is coordinating watershed-planning efforts in the Methow Subbasin as part of the state's HB2514 watershed planning process.

Existing Goals, Objectives, and Strategies

The fish and wildlife populations of the Methow Subbasin are of economic and cultural significance to the people of the State of Washington, the Northwest, and the Nation, and to members of the Confederated Tribes of the Colville Indian Reservation and the Yakama Nation. The overall goal for the Methow Subbasin is to restore and protect the abundance, productivity, and diversity of biological communities and habitats within the Subbasin.

Additional goals guiding fish, wildlife and habitat activities in the Methow Subbasin are 1) protection and restoration of anadromous and resident fish species and wildlife species within the Methow Subbasin, 2) use of strategies that rely on natural production and healthy habitat to achieve restoration and protection goals, 3) recognition of tribal sovereignty and treaty rights, 4) passing on to future generations a functioning ecosystem capable of supporting self-sustaining populations of anadromous and resident fish and wildlife species with intact populations of those species, 5) and balancing economic viability of local communities with fish and wildlife needs through development of cooperative processes that promote adaptive and creative problem solving.

The following presentation of goals, objectives and strategies begins with habitat since restoring and maintaining functional habitat throughout the Columbia River Basin is essential to successfully restoring and maintaining self-sustaining populations of fish and wildlife.

Habitat Goals, Objectives and Strategies

The habitat goal in the Methow Subbasin is to restore and maintain normative biological and physical processes such that healthy indigenous populations of aquatic and terrestrial species can sustain themselves over the long-term.

Objective 1 **Protect intact healthy habitat and restore habitat connectivity and overall habitat quality in degraded areas.**

Strategy 1. Continue to develop and support efforts like those underway through the Methow Basin Planning Unit (MBPU) to integrate local community values and needs in developing solutions for fish and wildlife habitat maintenance and restoration.

Strategy 2. Restrict residential development within the floodplain. Enforce existing regulations under NEPA, SEPA and the Shoreline Management Act.

Washington Department of Fish and Wildlife

Lost River Subwatershed

Strategy 1. Develop an alternative to maintaining the dike on Lost River (built on National Forest land). Reestablish the habitat forming processes themselves by including structural components that complement the restoration of the watercourse's access to the stream meander zone and riparian growth and instream woody debris maintenance.

Strategy 2. Allow no further development on the alluvial fan and immediately upstream to the bridge, that would constrict or constrain the channel, degrade riparian areas, negatively impact ground water and surface water interactions, or in any other way degrade stream channel functions.

Strategy 3. Develop an MOU with agencies and private citizens to manage LWD being transported into the alluvial fan so that both biological/hydrological function and property/safety concerns are balanced.

Upper Methow Subwatershed

Goat Creek

Strategy 1. The Methow River between Winthrop and the Lost River confluence is the most productive spring chinook salmon spawning habitat in the entire Methow Subbasin. Protecting functioning floodplain, riparian habitat and side channels within the channel migration zone of the Methow River in this subwatershed is critical to sustaining naturally producing spring chinook in the Methow watershed.

Strategy 2. Stream restoration is needed in some areas of the channel from just below Vanderpool Crossing (RM 6.5) upstream to about RM 9.5. The total length of channel needing restoration is about 1 to 1.5 miles.

Strategy 3. Fish are being entrained in the Foster ditch during high spring flows. There may also be problems with entrainment during the winter. Alternatives to address this problem should be investigated.

Strategy 4. Address the affects of roading, logging, stream crossings, grazing, and the water diversions on the hydrology of Goat Creek. Habitat projects in this drainage should address restoring channel function by reducing road density/proximity, eliminating grazing impacts, reducing water crossing structure impacts, and

reestablishing mature riparian vegetation along degraded stream reaches.

Strategy 5. Restore fish passage at the USFS Rd. 52 crossing on Whiteface Creek.

Strategy 6. Restore channel function within the floodplain in the lower 1.5 mile channelized section of Goat Creek.

Strategy 7. Roads above Vanderpool Crossing should be obliterated and replanted, as identified in watershed analysis (USFS 2000c).

Little Boulder & Hancock Springs

Strategy 1. Replace the fish-blocking culvert on Hwy. 20 at Little Boulder Creek with a bridge or bottomless arch.

Strategy 2. Address low flow concerns in lower Little Boulder Creek to improve fish passage.

Strategy 3. Replace the fish-blocking culvert on Hancock Creek upstream to Wolf Creek Road with a bridge or bottomless arch.

Strategy 4. Reduce sediment delivery to Gate Creek from roads by reducing road densities.

Strategy 5. Restore riparian buffers in Fawn Creek. Improve LWD levels in Fawn Creek.

Wolf Creek

Strategy 1. Address the impacts of channelization on the lower 1.5 miles of Wolf Creek, restoring natural functions to the extent practical and rehabilitating habitat where restoration is not practical.

Strategy 2. Eliminate unstable bank sections along the Wolf Creek irrigation ditch that contribute sediment to Wolf Creek.

Strategy 3. Improve stream channel conditions and investigate water savings options to address low stream flows downstream of RM 4.6 and dewatering downstream of RM 0.5.

Strategy 4. Develop a channel condition assessment and restoration needs assessment for Little Wolf Creek. The assessment should evaluate the current channel condition and its effects on Wolf Creek.

Early Winters Subwatershed

Strategy 1. Restore natural functions within the alluvial fan.

Strategy 2. Improve riparian conditions in the lower reach.

Strategy 3. To the extent Early Winters Creek can be rehabilitated to support more beaver, they should be encouraged to repopulate.

Chewuch River Subwatershed

Chewuch Mainstem

Strategy 1. Restore the habitat-forming processes to sustain natural levels of channel complexity as a long-term approach to the degraded condition of the lower 28 miles of the Chewuch subwatershed.

Strategy 2. Review and revise land use regulations (federal, state and local) for the lower 8 miles of the Chewuch River.

Strategy 3. Habitat projects in the lower 8 miles of the Chewuch River should seek to increase habitat complexity by allowing LWD accumulation and recruitment and restricting development.

Strategy 4. Reduce road densities, particularly in highly erosive areas (such as mid-slope areas) and riparian areas.

Strategy 5. Manage recreation activities in riparian areas, including development of an educational component.

Chewuch Tributaries

Strategy 1. Implement habitat projects to restore floodplain function and increase the LWD in the alluvial fans of Twentymile and Farewell creeks.

Strategy 2. Reduce sediment delivery to Boulder Creek.

Strategy 3. Habitat projects aimed at decreasing road densities in Cub, Boulder, Eightmile and Falls Creek drainages, through road abandonment and road stabilization, should be pursued to reduce sediment delivery and improve surface hydrology impacts, two factors contributing to habitat degradation in this portion of the Chewuch subwatershed.

Strategy 4. Determine if Eightmile road is creating a barrier and if so, repair.

Strategy 5. Eliminate impacts caused by dispersed campgrounds on Lake Creek, to riparian areas where bull trout are spawning.

Strategy 6. Develop habitat projects that seek to improve beaver populations in the subwatershed.

Middle Methow Subwatershed

General Strategies

Strategy 1. Protect the channel migration zone of the Methow River from activities that will further constrict or constrain the channel, degrade riparian areas, negatively impact ground water and surface water interactions, or in any other way degrade stream channel functions.

Strategy 2. Restore access to floodplain areas that have been disconnected by dikes.

Strategy 3. Restore access by the mainstem channel to side channels disconnected by dikes.

Strategy 4. Incorporate design elements to reduce velocities (i.e. j-hook veins and riparian vegetation) in unavoidable bank hardening projects (riprap).

Strategy 5. Increase LWD levels in the mainstem. This should be done by: restoring the river's access to its floodplain to allow habitat-forming processes to occur (i.e., LWD recruitment, stream energy dissipation, riparian plant community development, bedload transport and deposition); and improving riparian habitat conditions to allow for the development of a mature stand component.

Beaver Creek

Strategy 1. Manage riparian habitat in the WDFW campground on Beaver Creek to exclude livestock and control camping impacts in order to allow recovery of riparian habitat.

Strategy 2. Identify and re-vegetate slopes destabilized by past timber harvest management throughout the drainage. Identify riparian buffer zones degraded by past harvests, stabilize and re-vegetate as needed. Stabilize or abandon road densities in proximity to streams to reduce sediment delivery. Increases in LWD and beaver activity, where appropriate, would also provide for improved sediment management.

Strategy 3. Institute habitat projects in the South Fork of Beaver Creek to reduce sediment delivery from roads. LWD levels should be increased concurrently to manage sediment transport.

Strategy 4. To the extent possible, reintroduce beaver into the drainages of Beaver Creek. The ponds in upper Lightning Creek are prime candidates for beaver reintroduction.

Strategy 5. Purchase property to provide for channel migration.

Strategy 6. Eliminate Brook trout.

Twisp River Subwatershed

Twisp Mainstem

Strategy 1. Increase LWD levels, recruitment and retention in the lower sections of the Twisp River.

Strategy 2. Reduce road densities and their effects on hydrology and instream sediment conditions.

Strategy 3. Protect floodplains through acquisition and conservation easements.

Strategy 4. Restore access to the floodplain and reconnect side channels in the lower 15 miles of the Twisp River.

Strategy 5. Evaluate critical areas ordinances and floodplain ordinances for inclusion of floodplains not presently mapped (Okanogan County 1996). Floodplains are defined as "lowland areas that are

periodically inundated by the lateral overflow of streams or rivers".

Twisp Tributaries

Strategy 1. Address the irrigation diversion structures acting as fish passage barriers on Little Bridge Creek.

Strategy 2. Do not remove the culvert acting as a barrier on Reynolds Creek. Brook trout are found below the culvert and bull trout above it. Replacing the fish-blocking culvert with a passable structure would expose the bull trout population in upper Reynolds Creek to brook trout competition.

Strategy 3. Address road densities and their effects on hydrology and instream sediment conditions in the subwatershed.

Strategy 4. Monitor the implementation and success of the USFS plan to reduce sediment delivery rates from Little Bridge Creek and Buttermilk Creek by reducing road densities in these drainages.

Objective 2 Improve instream water quantity and quality within Subbasin.

Upper Methow Subwatershed

Strategy 1. Protection of stream channel sections where ground water recharge occurs and which sustain flow through the winter during dry years, should be given the highest priority.

Early Winters Subwatershed

Strategy 1. Address improving low flow conditions in the lower reach and determine biologically based instream flows below the two diversions.

Chewuch River Subwatershed

Strategy 1. Pursue water conservation measures.

Twisp River Subwatershed

Twisp Mainstem

Strategy 1. Investigate alternatives to improve low flow conditions in the subwatershed.

Strategy 2. Gather baseline temperature data.

Strategy 3. Initiate a joint study with MVID's participation to conduct baseline monitoring to determine the relationship of changes to MVID's irritation system to winter baseflow and groundwater recharge.

Yakama Nation

Objective 1 Protect intact healthy habitat and restore habitat connectivity and overall habitat quality in degraded areas.

Strategy 1.	Habitat projects that support improved instream base flows (i.e., restoring drained wetlands), restore cut off side channels, rehabilitate riparian areas, and remove constrictions and constraints within the channel migration zone (i.e. dikes, roads and inadequately sized stream crossing structures) should receive priority.
Strategy 2.	The McKinney dike should be considered for removal. The side channel blocked-off by this dike is located in the reach of the upper Methow River that usually maintains surface flows even during dry years when the main channel both upstream and downstream dewaters. To restore access to the year-round juvenile rearing habitat blocked by the McKinney dike and to restore the functionality of this reach, the dike will need to be removed.
Strategy 3.	Existing LWD needs to be protected and overall LWD levels need to be increased to "acceptable levels" within the mainstem Methow River. Options for facilitating further recruitment and establishment of LWD need to be investigated.
Strategy 4.	From Goat Creek to Mazama, where accelerated erosion is occurring along banks that have been impacted by agricultural and residential development, attempts should be made to reestablish mature vegetated buffers. An evaluation of the location of these eroding sites relative to the channel migration zone and an evaluation of the impact of the stabilization to bed and banks in the vicinity should be included. Conservation easements to secure riparian buffers should be pursued.
Strategy 5.	Prevent further development within the channel migration zone that will constrict or constrain the channel, degrade riparian areas, negatively impact ground water and surface water interactions, or in any other way degrade stream channel functions.
Strategy 6.	The People Mover should not be protected.

Fish Goals, Objectives and Strategies

Washington Department of Fish and Wildlife

The fish goal in the Methow Subbasin is protection and restoration of anadromous and resident fish species. The following objectives and strategies for fish target spring and summer chinook, summer steelhead, and bulltrout, however, maintaining healthy populations of non-listed indigenous fish species is also an important goal within the Subbasin.

Spring chinook and summer steelhead

Objective 1 **Recover ESA listed upper Columbia spring chinook salmon and summer steelhead trout in the Methow Subbasin to a level that supports a harvestable surplus.**

Strategy 1. Determine adult to adult and smolt to adult return rate for naturally and hatchery produced fish.

Strategy 2. Eliminate exogenous spring chinook stocks from the artificial production programs.

Strategy 3. Enlarge existing hatchery facilities and construct additional facilities to increase effectiveness, not through quantity but through quality, of the hatchery programs to supplement natural production.

Strategy 4. Reduce predatory consumption in mainstem migration corridor.

Strategy 5. Manage consumptive fisheries consistent with adult escapement objectives.

Strategy 6. Increase and require spring flow augmentation on the Columbia mainstem.

Strategy 7. Improve smolt bypass systems at mainstem hydropower facilities.

Strategy 8. Use only locally adapted brood fish for artificial production.

Strategy 9. Reduce to the extent possible the number of consecutive brood years in the hatchery.

Strategy 10. Design and implement shared monitoring and evaluation goals and objectives specific to the upper Columbia River steelhead artificial production program.

Strategy 11. Develop new and modify existing acclimation facilities to improve distribution of spawners at return and reduce point source impact of direct plants (Upper Methow, Early Winters, upper Chewuch, upper Twisp and Lost rivers).

Strategy 12. Develop or improve tributary trapping facilities to improve local stock adaptation.

Strategy 13. Maintain supplementation programs for spring chinook and summer steelhead.

Strategy 14. Radio tag adult steelhead migrants in upper Columbia River to monitor location of winter holding and spawning

Objective 2 **Determine natural smolt production capabilities within the Methow Subbasin.**

Strategy 1. Determine adult to adult and smolt to adult return rates and quantify spawner success rates for naturally produced and hatchery produced fish.

Strategy 2. Operate a smolt trap in the lower Methow River and at least one tributary to the Methow River to monitor migration pattern, timing, as well as determine smolt production.

Strategy 3. Design and implement an over-winter ecology study to examine use and survival of stream type fish through the winter.

Strategy 4. Locate or create a genetic mark on fish within the hatchery that can be located in progeny after adult return and spawning to quantify productivity.

Objective 3 Determine and quantify natural and artificial limitations to natural production.

Strategy 1. Design and implement a study to quantify use and survival of stream type fish through the summer and winter months of their first year.

Strategy 2. Conduct annual spawning ground surveys.

Strategy 3. Determine fry production, parr production and spring smolt production and correlate to spawner abundance, human and natural changes over time.

Strategy 4. Find fish in summer, early fall, and winter and characterize the habitat they utilize. Follow this protocol through a series of years and abundance trends.

Strategy 5. Radio tag adult steelhead migrants in upper Columbia River to monitor location of winter holding and spawning.

Objective 4 Achieve a natural cohort replacement rate of 1.0% or greater for at least five consecutive years.

Strategy 1. Maintain artificial production programs.

Strategy 2. Use locally adapted stocks.

Strategy 3. Eliminate exogenous stocks from the artificial production programs.

Strategy 4. Manage consumptive fisheries consistent with adult escapement objectives.

Strategy 5. Increase and require spring flow augmentation.

Strategy 6. Reduce predatory consumption of smolts during seaward migration.

Strategy 7. Enlarge existing hatchery facilities and construct additional facilities to increase effectiveness, not through quantity but through quality of the hatchery programs to supplement the natural production.

Objective 5 Provide adult spawning escapement of 2,212 steelhead to the Methow Subbasin (this value from Mullan et al. 1992b was determined to achieve MSY).

Strategy 1. Maintain artificial production programs.

Strategy 2. Use locally adapted stocks.

Strategy 3. Eliminate exogenous stocks from the artificial production programs.

Strategy 4. Manage consumptive fisheries consistent with adult escapement objectives.
Strategy 5. Increase and require spring flow augmentation.
Strategy 6. Reduce predatory consumption of smolts during seaward migration.
Strategy 7. Enlarge existing hatchery facilities and construct additional faculties to increase effectiveness, not through quantity but through quality of the hatchery programs to supplement the natural production.
Strategy 8. Radio tag adult steelhead migrants in upper Columbia River to monitor location of winter holding and spawning.

Objective 6 Maintain artificial production programs using locally adapted brood fish to meet recovery, conservation and harvest needs, while mitigating for fish losses from the Columbia River hydropower system.

Strategy 1. Use locally adapted stocks only.
Strategy 2. Determine egg to smolt survival.
Strategy 3. Use natural rear to determine if a better smolt (smolt to adult survival) can be produced from competition, predator avoidance, temperature, flow, and cover than a traditional production facility.
Strategy 4. Radio tag adult steelhead migrants in upper Columbia River to monitor location of winter holding and spawning.
Strategy 5. Quantify naturally produced spawners with CWT marked spawners.
Strategy 6. Maintain distinct population attributes of the Methow Subbasin summer steelhead.
Strategy 7. Develop or improve tributary adult collection facilities so all brood stock requirements are met from these locations.
Strategy 8. Eliminate exogenous stocks from Methow Subbasin.
Strategy 9. Increase and require spring flow augmentation.
Strategy 10. Reduce predatory consumption of migrating smolts in the mainstem hydropower system.
Strategy 11. Manage and monitor consumptive fisheries consistent with adult escapement objectives.
Strategy 12. Perform annual spawning ground surveys.
Strategy 13. Collect DNA or genetic tissue from adult spawners within the hatchery and on the spawning ground to ensure artificial production is not altering the genetic composition of the populations.
Strategy 14. Design and implement hatchery evaluation program for summer steelhead.

Objective 7 Assess the applicability of a captive brood program.

Strategy 1. Increase water volume (surface and ground water) at the Methow Hatchery.
Strategy 2. Increase Methow Hatchery capacity to rear captive brood fish and study best life history strategy (years fresh – years salt or spawn cycle).
Strategy 3. Create natural parr collection facility to provide source for captive brood.

Objective 8 Maintain the genetic diversity and integrity of the locally adapted stocks that are artificially propagated.

Strategy 1. Eliminate exogenous stocks.
Strategy 2. Improve existing or create adult collection facilities on the tributary streams to promote local stock production.
Strategy 3. Collect DNA or genetic tissue to monitor and evaluate artificial production programs.
Strategy 4. Quantify naturally produced and hatchery spawners on the spawning grounds to determine success adult to adult for both.

Objective 9 Minimize impacts of artificial propagation on resident and naturally produced anadromous fish through genetic and fish health monitoring, juvenile rearing and release strategies, and brood collection.

Strategy 1. Modify current acclimation ponds on the Chewuch and Twisp rivers to allow over-wintering of juveniles on natal water.
Strategy 2. Improve existing or create adult collection facilities on the tributary streams to promote local stock production.
Strategy 3. Eliminate exogenous stocks.
Strategy 4. Collect DNA or genetic tissue to monitor and evaluate artificial production programs.
Strategy 5. Monitor smolt migration development using external visual observation within the hatchery and coincide release to peak smoltification.

Objective 10 Determine natural life history characteristics and quantify polymorphism to the extent possible.

Strategy 1. Identify and mark portion of resident rainbow trout population and monitor recruitment downstream.
Strategy 2. Determine residualism rate and two-year hatchery migrant rate from artificial production.
Strategy 3. Collect scale information from smolt migrants at Methow River smolt trap.
Strategy 4. Collect scale and age information from hatchery spawners and use as guide to age structure of broods.

Objective 11 Improve smolt to adult survival in the mainstem migration corridor.

Strategy 1. Increase and require spring flow augmentation.
Strategy 2. Reduce predatory consumption of migrating smolts in the mainstem hydropower system.
Strategy 3. Manage and monitor consumptive fisheries consistent with adult escapement objectives.

Objective 12 **Provide species status report every five years to evaluate effectiveness of vision, with adoption of changes as necessary every ten years.**

Strategy 1. Document life history strategy.
Strategy 2. Operate smolt trap to determine migration pattern and timing.
Strategy 3. Correlate abundance with human and natural environmental changes.
Strategy 4. Create Methow Technical Working Group that is tasked with specific responsibility of collecting life history information data, producing spawner-recruit analysis, monitoring trends in abundance and correlating them with external influences.

Summer Chinook

Objective 1 **Increase the natural spawning escapement to pre-1980 numbers in the Methow Subbasin, consistent with 3,500 adults run past Wells Dam.**

Strategy 1. Identify and evaluate most successful rearing strategy for artificial production to ensure demographic success of the natural production.
Strategy 2. Expand the number of acclimation facilities to better distribute releases of artificial production.
Strategy 3. Increase and require spring/summer flow augmentation.
Strategy 4. Reduce predatory consumption of summer chinook subyearlings and yearling migrants.
Strategy 5. Manage consumptive fisheries consistent with adult escapement objectives.

Objective 2 **Maintain sport and tribal fisheries, consistent with the protection of endemic naturally produced stocks.**

Strategy 1. Improve juvenile bypass facilities at Columbia River hydropower facilities.
Strategy 2. Identify and evaluate most successful rearing strategy for artificial production to ensure demographic success of the natural production.
Strategy 3. Increase and require spring/summer flow augmentation.
Strategy 4. Reduce predatory consumption of summer chinook subyearlings and yearling migrants.
Strategy 5. Identify, conserve and monitor natural production demographics.

Strategy 6. Manage consumptive fisheries consistent with adult escapement objectives.

Objective 3 Maintain artificial production programs that supplement natural production using locally adapted stocks.

Strategy 1. Identify and evaluate most successful rearing strategy for artificial production to ensure demographic success of the natural production.

Strategy 2. Quantify naturally produced spawners with CWT marked spawners.

Objective 4 Determine natural production smolt capabilities within the Methow Subbasin.

Strategy 1. Determine egg to smolt survival.

Strategy 2. Operate a smolt trap in the lower Methow River to monitor migration pattern and timing as well as determine natural production capabilities.

Strategy 3. Identify, conserve and monitor natural production demographics.

Strategy 4. Conduct annual spawning ground surveys.

Objective 5 Determine and quantify natural and artificial limitations to natural production.

Strategy 1. Design and implement microhabitat study.

Strategy 2. Evaluate long-term trends with human and natural events.

Objective 6 Minimize impacts of artificial propagation on resident and naturally produced anadromous fish through juvenile rearing and release strategies, brood collection and genetic monitoring.

Strategy 1. Rear and release high quality smolts determined through size, fish health, smoltification and imprinting.

Strategy 2. Collect only adults attempting to pass Wells Dam, or create tributary traps to collect only locally adapted fish.

Strategy 3. Collect DNA or genetic tissue from natural spawners and hatchery spawners every three years to ensure consistency between the two and with baseline.

Strategy 4. Determine early life history strategy most successful to adult return for natural production and hatchery production. Ensure artificial production does not change demographics.

Strategy 5. Monitor fish health monthly, and ensure disease occurrence mirrors natural production.

Objective 7 Improve smolt to adult survival in the mainstem migration corridor.

Strategy 1. Increase and require spring/summer flow augmentation.

Strategy 2. Improve juvenile bypass facilities at Columbia River hydropower facilities.

Strategy 3. Reduce predatory consumption of summer chinook subyearlings and yearling migrants.
Strategy 4. Identify, conserve and monitor natural production demographics.

Objective 8 Provide species status report every five years to evaluate effectiveness of vision, with adoption of changes as necessary every ten years.

Strategy 1. Document natural production demographics.
Strategy 2. Correlate historical and current abundance with human and natural occurrences.
Strategy 3. Provide spawner recruit analysis.
Strategy 4. Determine natural production carrying capacity.
Strategy 5. Determine what proportion of the annual return is naturally and artificially produced. How well is artificial production meeting goals and objectives.

Objective 9 Identify, conserve and monitor life history characteristics of summer chinook salmon, as they relate to juvenile migration pattern and timing.

Strategy 1. Operate smolt trap in the lower Methow River.
Strategy 2. PIT tag naturally produced and artificially produced smolts to determine if migration patterns are similar.

Objective 10 Maintain and expand evaluation of the artificial production program.

Strategy 1. Operate a smolt trap in the lower Methow River to assess naturally production and smolt migration timing and pattern.
Strategy 2. Design complete life history study to monitoring survival through Columbia River hydropower system, estuary and marine environment.
Strategy 3. Provide query of PSMFC database for CWT recoveries to determine escapement, fishery contributions and general marine survival.

Bull Trout

Objective 1 Identify, monitor and evaluate resident bull trout populations.

Strategy 1. Conduct annual spawning ground surveys.
Strategy 2. Operate smolt trap in lower Methow River to collect fluvial migrants and determine migration timing, size and pattern.

Objective 2 Quantify resident recruit to fluvial and adfluvial populations.

Strategy 1. Collect resident bull trout, measure habitat components at collection site, mark fish for later identification, and then monitor for level of fluvial/adfluvial recruitment.

Strategy 2. Operate smolt trap in lower Methow River to collect fluvial migrants and determine migration timing, size and pattern.

Objective 3 Quantify and measure available spawning habitat.

Strategy 1. Design and implement habitat accounting survey tied to number of fish present and characteristics of habitat components.

Objective 4 Eliminate brook trout populations, and reintroduce bull trout populations in historical reaches where extirpation has occurred (Eightmile and Beaver creeks).

Strategy 1. Design and implement hatchery program to reestablish bull trout in extirpated locations.

Strategy 2. Create and implement recovery plan that incorporates a status report every five years, with option for revision every ten years.

Yakama Nation

The Wy-Kan-Ush-Mi Wa-Kish-Wit, Spirit of the Salmon, Volume I (1995) document presents four Columbia River Basin goals, which represents the four common goals of the four Columbia River Tribes; while the revised version of Volume II (2000) states the specific objectives and strategies for the Methow Basin. Those goals are to 1) restore anadromous fishes to the rivers and streams that support the historical, cultural and economic practices of the tribes; 2) emphasize strategies that rely on natural production and healthy river systems to achieve this goal; 3) protect tribal sovereignty and treaty rights; and 4) reclaim the anadromous fish resource and environment on which it depends for future generations. Following are specific production goals:

- Produce the following numbers of spring chinook – 738K, Wells Settlement Program; 800K Grand Coulee Mitigation Program.
- Produce the following numbers of summer chinook – 400K, Methow/Okanogan (Eastbank).
- Produce the following numbers of steelhead – 380K from Wells Hatchery Program and 100,000 from the Winthrop NFH (BAMP 1998).
- Coho production – 400,000 at Winthrop NFH (Winthrop NFH capacity limited to 250,000 at present) or a facility yet-to-be-determined.

To date the Tribe has not established a desired natural escapement goal for each species/stock. The following numbers represent adult harvest goals.

- Spring chinook – 2,000
- Summer chinook – 3,000
- Summer steelhead – 10,000
- Coho – not established
- Lamprey – not established

Coho

There are two primary goals for the Mid-Columbia Coho Reintroduction Program feasibility stage 1) to continue existing studies and to initiate new ones (adapting to changing needs, new information, and concerns of project participants) to determine whether a localized brood stock can be developed from Lower Columbia River coho stocks, whose progeny can survive in increasing numbers to return as adults to the mid-Columbia region; and 2) to initiate natural reproduction in areas of low risk to sensitive species.

Objective 1 **Determine whether hatchery adults from lower Columbia River brood stock return in increasing numbers to the Wenatchee and Methow basins so that their progeny may be expected to reach replacement, thus significantly limiting the infusion of the lower river hatchery stock, with the long-term goal of eliminating use of the lower river stock altogether.**

Strategy 1. Acclimate and release up to 1,000,000 and 400,000 coho smolts in the Wenatchee and Methow River Basin respectively. Within these released, a sample of coho smolts will be PIT tagged to provide and estimate of smolt survival and run timing through McNary Dam.

Strategy 2. Collect returning broodstock at Wells Dam and Winthrop NFH for the Methow River, Leavenworth NFH, Tumwater or Dryden Dam for Wenatchee returns.

Strategy 2. Estimate smolt-to-adult survival rates for hatchery coho released in the Wenatchee and Methow Subbasin.

Strategy 3. All coho produced from coho returning to the Methow and Wenatchee sub-basin and lower Columbia River hatchery transfers will be coded wire tagged. Smolt-to-adult survival rates for each brood source will be distinguished.

Strategy 4. Specific numerical broodstock development goals are described in the HGMP (1999) attached in Appendix B.

Objective 2 **Begin to develop a locally adapted brood stock, starting with adult returns to Winthrop NFH and Wells Dam in 1999.**

Strategy 1. Adult coho returns to the Methow River Basin in 1999 were trapped at Wells Dam and spawned at the WNFH.

Strategy 2. Progeny from coho trapped and spawned in the Methow River in 1999 were acclimated and released into Nason Creek (Wenatchee River Basin) in 2001.

Strategy 3. Continue to trap and spawn adult returns to the Wenatchee and Methow River Basins. Progeny will be released into both the Wenatchee and Methow river basins to replace lower river transfers of juvenile coho to the eventual exclusive use of in-basin stock.

Objective 3 **Begin coho releases in areas of low risk to listed species that will be allowed to return as adults to spawn naturally. These areas currently are located in the Wenatchee basin at sites at Chumstick and Brender creeks.**

Strategy 1. Progeny of adult returns to the Wenatchee and Methow Subbasin will be acclimated in areas of low risk to listed species (current identified sites at Chumstick and Brender Creeks but to include yet unidentified sites). Escapement goals are shown in the HGMP (Appendix B).

Strategy 2. Progeny of naturally spawning coho from releases in Nason Creek will provide the opportunity to evaluate interactions between naturally produced coho salmon and listed species and species of concern.

Objective 4 **Study interactions among coho and listed and sensitive species, particularly spring chinook , steelhead, and bull trout.**

Strategy 1. Evaluate the potential for direct predation of hatchery coho smolts on salmonid fry in the Wenatchee River Basin.

Strategy 2. Assess the potential for hatchery coho juvenile residuals to interact with other species of concern by identifying distribution and abundance of residual coho.

Strategy 3. Estimate the proportion of the adult coho return that was not collected and potentially spawned in the natural habit through coho spawning ground surveys.

Strategy 4. Evaluate the potential for spring chinook redd superimposition by later spawning coho salmon in Nason Creek.

Strategy 5. Examine microhabitat use by naturally spawned coho salmon, spring chinook salmon, and steelhead in Nason Creek.

Objective 5 **Minimize potential negative interactions among coho and listed and sensitive species.**

Strategy 1. Initiate releases of coho in areas of low risk to listed species.

Strategy 2. Study interactions among coho and listed and sensitive species.

Objective 6 **Annually evaluate project performance and expand or adapt studies as data indicate is necessary or appropriate.**

Strategy 1. Meet with the Mid-Columbia Coho Technical Workgroup 2 to 4 times/year to coordinate activities with management entities and to ensure consensus on project goals and activities.

Strategy 2. Write and submit an annual report to Bonneville Power Administration to summarize, evaluate, and analyze information gathered during project activities.

The primary Methow Subbasin wildlife goals are to protect, enhance, restore, maintain and/or increase wildlife populations and associated habitats to viable or management objective levels, for ecological, social, recreational, subsistence, and aesthetic purposes within the Subbasin. Emphasis is placed on PHS listed species and habitats. Special effort is directed at securing critical habitat components that are in limited supply, under imminent threat of development, and underrepresented in the pubic land base.

Riparian/floodplain

Objective 1 **Maintain the ecological function and associated biodiversity of deciduous riparian forest within the Subbasin**

- Strategy 1. Halt or reverse loss of riparian/floodplain forest to development.
- Strategy 2. Protect existing riparian/floodplain habitat through acquisition and conservation easements.
- Strategy 3. Restore native riparian vegetation on suitable sites.
- Strategy 4. Survey and monitor existing/restored habitats for obligate species.

Shrub-steppe

Objective 1 **Halt or reverse loss of shrub-steppe to development and weed invasion**

- Strategy 1. Protect existing shrub-steppe habitat through acquisition and conservation easements.
- Strategy 2. Control noxious weeds.
- Strategy 3. Reintroduce periodic controlled fires into this habitat type.

Objective 2 **Evaluate shrub-steppe condition for proper ecological function**

- Strategy 1. Survey and monitor existing/restored habitats for obligate species.

Dry forest

Objective 1 **Restore ponderosa pine stands to historical conditions.**

- Strategy 1. Protect old pine from harvest.
- Strategy 2. Thin over-stocked stands.
- Strategy 3. Reintroduce periodic controlled fires into this habitat type.

Objective 2 **Evaluate forest condition for proper ecological function**

- Strategy 1. Survey and monitor existing/restored stands for obligate species.

Mule deer

Objective 1 **Maintain adequate winter range and unobstructed migration corridors**

- Strategy 1. Protect identified winter range through acquisition and conservation easements.

Strategy 2. Construct wildlife-friendly highway passage structures at important crossing points.

Objective 2 Maintain/improve range condition

Strategy 1. Protect identified winter range through acquisition and conservation easements.

Strategy 2. Conduct low intensity prescribed burns on publicly owned winter range.

Strategy 3. Reduce herd size through antlerless harvest if range over utilization documented.

Objective 3 Maintain healthy herd population parameters

Strategy 1. Structure harvest to maintain a minimum of 15 bucks per 100 does post-season.

Strategy 2. Determine population regulation mechanisms through ongoing research.

Sharp-tail grouse

Objective 1 Provide suitable habitat in three or more blocks of 10,000 or more acres.

Strategy 1. Inventory suitable/potential habitat adjacent to existing public land within a six-month evaluation period.

Strategy 2. Protect identified additions through acquisitions and conservation easements.

Strategy 3. Improve habitat quality of secured habitat through weed control and reestablishment of native plants, with emphasis on water birch propagation.

Objective 2 Re-establish a viable sharptail grouse population within the Subbasin.

Strategy 1. Reintroduce sharp-tailed grouse to suitable habitat.

Strategy 2. Establish six viable leks (100-150 birds) within the Subbasin over five years.

Strategy 3. Use artificial leks to establish breeding sites.

Wide-ranging carnivores

Objective 1 Identify movement patterns of wide-ranging carnivores to locate preferred travel routes and blockages at the landscape level

Strategy 1. Conduct radio telemetry of wide ranging carnivores using GPS/satellite collars for fine scale movement data.

Objective 2 Prevent habitat fragmentation/isolation.

Strategy 1. Protect riparian/floodplain habitat and cross-valley movement corridors in the Subbasin with acquisition and conservation easements.

Strategy 2. Construct wildlife-friendly highway passage structures at important crossing points.

Objective 3 Recover viable grizzly bear population in the North Cascades Grizzly Bear Ecosystem (NCE).

Strategy 1. Produce an EIS for grizzly bear recovery in the NCE.
Strategy 2. Implement recommended alternative from the EIS.

Objective 4 Maintain viable, well-distributed lynx population within the Subbasin.

Strategy 1. Implement federal Lynx Conservation Strategy on state lands.
Strategy 2. Expand ongoing research to investigate effects of winter recreation and snow compaction on lynx viability.
Strategy 3. Manage recreation to minimize identified impacts.
Strategy 4. Research the effects of growing cougar population on lynx viability.

Objective 5 Maintain and enhance viability of wolverine population with the Subbasin.

Strategy 1. Initiate local wolverine ecology study
Strategy 2. Model predicted wolverine denning habitat.
Strategy 3. Locate maternal dens and protect from disturbance.

Objective 6 Reestablish viable fisher populations in the Subbasin.

Strategy 1. Maintain/expand low-elevation riparian habitats.
Strategy 2. Inventory suitable habitat and fisher release sites.
Strategy 3. Reintroduce fishers in suitable habitat

Research, Monitoring and Evaluation

Fisheries

Hatchery evaluation activities specific to hatchery production and efficacy in recovery of ESA-listed spring chinook and summer steelhead, and in meeting the mitigation/compensation objectives outlined in the Wells Settlement Agreement and Rock Island Project Settlement Agreement have been ongoing since 1990. Additional general research and monitoring activities in the Methow Subbasin include:

- Creel and aerial effort survey for Methow River trout fishery
- Research comparing the egg to adult survival for hatchery x hatchery crosses and hatchery x wild crossed progeny. Study began with the 1997 brood year, and continued through two subsequent brood years.

Following is a general list of research, monitoring and evaluation activities by species.

Spring chinook

The evaluation program for spring chinook has two parts 1) adult supplementation programs ,and 2) captive broodstock programs. These two parts are intended to

complement one other and provide information useful to guiding adaptive management of spring chinook in the Methow Subbasin. The Methow Spring Chinook Supplementation Program's goal is to increase the number of naturally reproducing adults in Methow Subbasin spawning grounds. The evaluation program addresses the efficacy of the hatchery program in the recovery of ESA-listed spring chinook in the Methow Subbasin and is funded by Douglas County Public Utility District as part of the Wells Dam Settlement Agreement.

The evaluation plan for the adult supplementation component address three fundamental objectives:

- Determine if the spring chinook facilities in the Methow Subbasin are capable of meeting their production objectives.
- Determine that actions taken as part of the hatchery programs conserve the genetic integrity and long-term fitness of naturally spawning populations.
- Determine if the spring chinook salmon released in to the Methow Subbasin interact adversely with natural production in the streams.

Spring chinook (captive broodstock)

The initial captive rearing evaluation plan targeted the issues of genetic maintenance and the viability of captive brood progeny. The captive broodstock program was phased out by the JFP in 2000, however, many feel that the protective option provided through the program shouldn't be discounted. In addition, the captive fish that remain during the phase out should be used to the fullest extent possible. Specific objectives addressed in the monitoring and evaluation program for the captive broodstock include:

- Determine if the facilities are capable of meeting the production objectives.
- Determine if the program is meeting specific performance criteria.
- Determine the effects of egg/alevin extraction on the survival of the remaining eggs in redds that were sampled.
- Compare the family survival rates within and among fish held in captivity.
- Compare morphometric and meristic characteristics of fish held in captivity versus those in the natural environment.
- Determine the reproductive success of captive reared fish in the natural environment.

Steelhead

The recovery and enhancement activities for summer steelhead in the Methow Subbasin involve adult supplementation using a single broodstock source derived from steelhead stock endemic to the Methow and Okanogan rivers. Adult supplementation programs, like most hatchery programs require evaluation to help minimize impacts to natural populations and to assess the efficacy of the production activities toward recovery and enhancement. Evaluation, research and monitoring efforts will include:

- Implementing a database management system at the Wells Hatchery facility to facilitate broodstock management, incubation and rearing strategies, fish health monitoring, smolt release information, adult returns, and tag/mark programs.

- Evaluating the fish culture operations at the Wells Hatchery Facility and determine if culture techniques are consistent with the production and management objectives.
- Estimating the reproductive potential of hatchery and wild steelhead in the natural environment.
- Evaluating the migration preparedness of smolts released into the Methow River and providing an assessment of volitional releases versus scatter planting.
- Assessing the need and the feasibility of developing a broodstock collection location on the Methow River in an effort to maintain and enhance local tributary stock attributes
- Determining the natural cohort replacement rate for steelhead in the Methow Subbasin.
- Determining if the natural steelhead and hatchery steelhead are genetically divergent over time.

Summer Chinook

The summer chinook hatchery program in the Methow Subbasin is a supplementation program that incorporates both hatchery and naturally produced fish in an effort to enhance the natural population in a manner consistent with maintaining and enhancing locally adapted tributary stocks. Evaluating the program is important in order to assess the efficacy of actions taken and to provide information necessary to facilitate informed adaptive management of the program. Evaluation objectives for the summer chinook supplementation program include:

- Determining if the Eastbank facility and the Carlton Acclimation Pond is capable of meeting the production objective identified for the Methow Subbasin in a manner consistent with current disease policies.
- Determining if smolt to adult survival rates of fish from the Methow River are sufficient to satisfy mitigation compensation requirements of the Rock Island Project Settlement Agreement.
- Determining if the supplementation actions preserve the reproductive success, genetic integrity, and long-term fitness of the natural spawning population in the Methow Subbasin and throughout the mid-Columbia Region.
- Determining if smolts released from the Carlton acclimation facility migrate downstream without impacting natural production population in the Subbasin.
- Determining if ELISA segregation in the summer chinook program above Wells Dam, as it currently exists (high and moderate antigen levels at Carlton), adversely affects the efficacy of the Methow Subbasin summer chinook supplementation program.

Specific tasks and actions included in the evaluation program for adult supplementation and captive broodstock plans are detailed in the Biological Assessment and Management Plan (BAMP 1998) for the Mid-Columbia River Hatchery Program, the Methow Basin Spring Chinook Salmon Supplementation Plan, the Wells Dam Settlement Agreement, the Rock Island Project Settlement Agreement.

Coho

The long-term goal of the coho reintroduction program is to reestablish naturally reproducing coho salmon populations in the mid-Columbia River Basin. That population will would achieve numbers at, or near, carrying capacity and would provide opportunities for significant tribal and non-tribal harvest. Although it is unlikely that the historic populations of coho that once existed can be achieved due to varying degrees of habitat degradation in each of the Subbasins, it nevertheless remains a long-term goal. Specific strategies, tasks and timelines for coho reintroduction are detailed in the HGMP for the Mid-Columbia Coho Reintroduction Program (Appendix A).

Yakama Nation

- Determine whether numbers of hatchery adults returning to the Wenachtee and Methow Subbasins, from lower Columbia River brood stock are increasing. Determine whether the number of their progeny are adequate to support replacement so that the infusion of the lower river hatchery stock can be decreased, with the long-term goal of eliminating the use of lower river stock altogether.
- Initiate natural reproduction in areas of low risk to sensitive species.
- The specific smolt outplant objective for the Methow Basin is 400,000 smolts annually although it is currently limited by capacity at Winthrop NFH (HGMP, mid-Columbia coho reintroduction program). During the initial 5-year period, smolts released in to the Methow River will be from stocks derived from stock transfers from the lower Columbia River coho hatcheries unless there is enough adult escapment to utilize first year returns. The 2001 returns should provide enough abundance to use local adult returns for the entire program. All smolts will be released from the Winthrop NFH.
- Study interactions among coho and listed and sensitive species, particularly spring chinook and sockeye salmon, steelhead, and bull trout.
- Evaluate tools to minimize potential negative interactions among coho and listed and sensitive species.
- Annually evaluate project performance and expand or adapt studies as data indicate is necessary or appropriate.

Wildlife

Both WDFW and the USFS are engaged in many ongoing wildlife research, monitoring, and evaluation activities. These activities are designed to help the agencies serve their mandates and meet objectives described earlier. Typically these mandates and objectives encompass the entire watershed or larger areas.

Research

On going research projects help fill data gaps and answer specific management driven questions.

WDFW

- Study lynx habitat selection study. This study addresses the relative occurrence of lynx, their prey, and potential competitor carnivores within different snow and habitat conditions. It is also investigating lynx behavioral patterns and fine scale resource selection. Results will be used to help implement the state and federal lynx recovery plans and help guide lynx habitat management and lynx population management both locally and statewide.
- Study lynx distribution and movement. This is a cooperative effort with the USFS and DOT to determine where and how often lynx cross a major highway (State Hwy. 20).

USFS

- Chelan Ridge Raptor Migration Study. This cooperative study with Hawkwatch International is deploying satellite transmitters on a variety of raptor species to help identify migration routes and breeding and wintering areas of raptor migration in the Methow Subbasin. Results will help refine habitat management at breeding and wintering areas, and help monitor population trends.
- Townsend's Bat Habitat Selection Study. This cooperative study with Bat Conservation International is using data recorders to determine maternal roosting site microclimate parameters selected for by Townsend's Big Eared Bats. Results will further the understanding of the habitat selection and general ecology of this species.

Monitoring

Many species are surveyed annually or every few years to monitor population parameters.

WDFW

- Mule deer pre-season, post-season, and post-winter composition surveys
- Deer season check station harvest surveys
- Mountain goat composition
- Mourning dove population surveys
- Waterfowl breeding and production surveys
- Harlequin duck distribution and abundance surveys
- Forest grouse population surveys
- Sharp-tailed grouse lek counts
- Burrowing owl population surveys
- Loon production surveys
- Bald eagle production and winter roost surveys
- Golden eagle production surveys
- Riparian neotropical migrant diversity and abundance surveys
- Lynx LAU occupation and productivity surveys
- Forest Carnivore distribution surveys

In addition, WDFW is conducting surveys specific to particular cost-share programs including:

- Wolverine distribution and den location surveys
- Rare Carnivore distribution surveys

All WDFW conservation easements are monitored at least annually for compliance with the documented conservation easement elements. In addition, upon easement establishment, a baseline inventory of existing resources/condition is conducted. These activities are integral components of the Methow Corridors and Methow Watershed acquisition projects. The Methow Conservancy conduct similar monitoring on their conservation easements.

USFS

The USFS also conducts regular surveys on certain species or guilds.

- Chelan Ridge migrating raptor counts.
- Northern goshawk productivity surveys.
- Amphibian diversity and distribution surveys.
- Spotted owl distribution and productivity surveys.
- Dry forest neotropical migrant diversity and abundance surveys.
- Bat diversity and abundance surveys.

Statement of Fish and Wildlife Needs

There are many unanswered questions regarding the restoration, function and preservation of habitat, fish and wildlife in the Methow Subbasin. As stated previously, the fish and wildlife populations of the Methow Subbasin are of great economic and cultural significance to the people of the State of Washington, the Northwest, and the Nation, and to members of the Confederated Tribes of the Colville Indian Reservation and the Yakama Indian Nation. Identifying the tools and priorities to most effectively protect and preserve those resources, while taking into account the necessity of maintaining healthy rural economies and communities is a challenge requiring that decisions and planning be based on the best available data and research.

Specific needs for restoring, enhancing, protecting, managing, monitoring and understanding habitat, fish and wildlife within the Methow Subbasin are listed below.

Habitat Needs

- Water resources are important to the residents and ecosystems of the Methow Subbasin. People depend on reliable, high-quality water supplies for their domestic and agricultural uses, and aquatic organisms depend on streamflow from snowmelt and groundwater discharge to survive in an otherwise arid environment. To improve the understanding of the quantity and quality of water resources of the Methow Subbasin both spatially and temporally, it is important that hydrologic data are collected throughout the basin over periods spanning a range of climatic conditions. Long-term hydrologic data have been collected at some points in the

basin, but generally, the information is limited. Hydrologic data of interest include long-term records of streamflow discharge, temperature, and sediment loading, irrigation diversions and application rates, and groundwater levels in the unconsolidated sediments of the basin. Currently, an extensive network of 27 streamflow gages is operated in the Methow River Basin. Except for seven USGS gages that have been in operation for more than a decade, most of these gages have been in operation for about one year. Once continuous records of hydrologic conditions have been measured throughout the basin over a period spanning wet and dry years, the records can be evaluated to determine whether some stations indicate broader conditions and thus provide the core physical information for a water-resources management system.

- The "natural-flow" watershed model in the Methow Subbasin needs to be updated by including the effects of diversions. Currently no watershed-management tool exists for the Methow River Subbasin to estimate the cumulative effects of natural variability in streamflow and irrigation diversions and returns. The USGS recently completed a watershed model that can be used to estimate natural streamflows, but it needs to be improved by incorporating newly collected data and by simulating irrigation diversions and returns.
- Leaking irrigation canals are expected to return some of the diverted river water to the groundwater system. The valley-fill groundwater system is connected to streams and contributes groundwater discharge to streamflow along selected stream reaches. Increased groundwater levels that may result from leaking irrigation canals may increase groundwater contributions to streamflow. To date, the timing and amount of the possible increase in groundwater contributions to streamflow are not known. In a current study, the USGS has instrumented part of the Twisp subwatershed to investigate the groundwater/surface-water interactions. Data have been collected since the beginning of the 2001 irrigation season and will be analyzed later in 2001 and 2002. Continued data collection in the existing study area and, potentially, other areas of the basin would improve estimates of irrigation canal leakage and groundwater discharge to streams, particularly during non-drought years.
- Forest management, including tree harvesting, road building, and fires, alter the density and type of vegetation in parts of the Methow River Basin. Cumulative effects of these land-use changes may affect the accumulation and melting of the snowpack, snowmelt and rainfall runoff patterns, and soil erosion. If it were known what the effects of different forest management practices were on the timing and amounts of water and sediment yields in streams prior to their implementation, forest practices could be planned to minimize potential adverse impacts and increase potential benefits to salmonid habitat in the basin.
- Changing land use may affect streamflow temperatures by changing the quantity and timing of streamflow and by changing the degree of shading from vegetation. If streamflow temperatures are changed significantly from natural conditions, habitat may be less favorable for salmonids. Currently, no management tools exist for the Methow River Basin to predict the effect of land-use practices on streamflow temperatures.

- Bank protection and flood-control projects in the Methow River Basin have modified the development and maintenance of floodplain and off-channel habitat for salmonids. Determining the extent of structural changes to stream channels and floodplains in the Methow Subbasin and assessing the effect of these changes on geomorphic processes (channel migration) and aquatic habitats would be very useful in future restoration and planning activities.
- Prior to converting the Methow Subbasin open ditch irrigation systems to closed systems it would be useful to design and implement a test case to determine if conversion to a closed irrigation system would provide the benefits linked with such a system e.g. increasing instream flows without deleterious effects at another time of year.
- There is a great deal of conflicting information about actual water use in the Methow Subbasin. An assessment of agricultural use including all water rights, claim and certificates and actual acreage of irrigated land is needed. In addition an assessment of municipal, industrial and domestic water use is needed.

Fish Needs

Washington Department of Fish and Wildlife

- Little information exists about the current or historical anadromous carrying capacity of the Methow Subbasin. An analysis of anadromous carrying capacity for the Methow Subbasin in its current state correlated with historical carrying capacity drawn from review of historic literature, reports, and archived documents would provide valuable data for current fish and wildlife managers.
- Conduct and Ecosystem Diagnostic and Treatment (EDT) analysis for spring chinook and steelhead to better understand the linkages and magnitude of various limiting factors on current and historic abundance, productivity and life history diversity.
- Insufficient data exists regarding the relationship between fish abundance and ground water discharge. Research correlating high ground water discharge areas to fish abundance throughout the year would be helpful in Methow Subbasin planning.
- Recent ocean conditions have provided some of the highest adult returns and potentially spawner escapements in 20 years. Drought conditions in 2001 left smolt migrants to navigate the Columbia River without flow augmentation. An assessment of spawner success, smolt production and adult return, undertaken immediately, would provide important information about these relationships.
- Document a chronology of human activities and environmental factors like drought with fish abundance to establish a cause and effect continuum.
- Insufficient information exists in the Methow Subbasin regarding which life history stages of which fish species use various habitat components at different times of the year. Design and implement a study that evaluates which life history stages of fish species utilize which habitat components at various times of the year.
- Insufficient information exists about the habitat preferences, spawn location, recruitment and abundance trends for Mountain Whitefish in the Methow Subbasin. Design and implement a study that documents the life history characteristics and

strategies of the Mountain Whitefish. Include growth and survival estimates to all life stages, as well as estimate of fishery impact.

- Insufficient information exists in the Methow Subbasin regarding over-winter ecology and fish abundance. Design and implement an over-winter ecology and fish abundance study.
- Locate a pink salmon or another coastal salmon population with a short unaltered freshwater migration corridor and correlate with Methow Subbasin anadromous species population abundance, to act as a predictor and modifier/qualifier to freshwater habitat improvements and subsequent abundance trends or evaluations.

Spring Chinook

- Provide annual spawning ground and carcass recovery surveys complete with genetic tissue collection and analysis.
- Monitor smolt outmigration from all major tributaries and upper Methow River, complete with early life history and genetic tissue collection and analysis.
- Provide genetic analysis of hatchery adult returns and subsequent progeny (monitor potential genetic divergence as a result of long-term adult supplementation programs).
- External "mark" program to identify specific origin of returning hatchery produced fish (upper Methow, Chewuch, Twisp, Carson). Knowing the specific origin of adult returns would be particularly useful during broodstock collection and spawning activities.
- Locate or create a genetic mark on fish from within the hatchery that can be located in progeny after adult return and spawning to quantify productivity.
- Determine carrying capacity of existing habitat and identify limiting factors to increased productivity in distinct watersheds within the Methow Basin.
- Examine nutrient availability in the basin and its affect on spring chinook smolt production capacity (carry capacity).
- Design and implement study to quantify use and survival of stream type fish through summer and winter of their first year and then correlate this information with abundance trends and human and natural changes (summer and winter bio-energetics study).
- Increase the number, distribution and function of acclimation facilities in the basin, including satellite facilities associated with the acclimation sites to increase the distribution of fish throughout the basin.
- Provide for ground water and/or other improvements as necessary at the acclimation facilities to promote long-term rearing at the acclimation sites.
- Design and implement an experimental "natures rearing" at a minimum of one acclimation and one satellite facility.
- Maintain existing hatchery evaluation program associated with the Methow Spring Chinook Supplementation Program.
- Provide healthy rearing environment for current Twisp Captive brood fish to maintain and enhance the attributes of the Twisp River spring chinook population through phase out of program.

- Eliminate exogenous stocks from artificial production.
- Develop and implement a Network Hatchery Data Base for all State, Tribal and Federal hatchery facilities in the mid-Columbia Region.
- Implement a comprehensive surface-ground water continuity study in critical rearing and migration river sections within the Methow River Basin.
- Increase water and number of start tanks at the Methow Hatchery to improve quality of smolts produced.
- Increase the complex in-stream habitat in the Methow River and its tributaries.
- Provide stock status reports every 5-years and re-assess management direction and strategies every 10-years to assist in implementing a management plan consistent with current data analysis and population response.
- Implement and require mainstem Columbia River spring flow augmentation.
- Improve or provide smolt bypass systems at all mainstem Columbia River hydropower facilities.
- Develop parr collection facility to provide captive source for captive brood stock.

Summer Steelhead

- Design and implement a summer steelhead artificial production evaluation program complete with goals, objectives and strategies.
- Conduct annual spawning ground surveys.
- Radiotelemetry study to assess over-wintering habitat and spawning locations.
- Conduct annual smolt outmigration surveys from all major tributaries and Methow River.
- Determine carrying capacity of existing habitat and identify limiting factors to increased productivity of distinct watersheds within the Methow Subbasin.
- Examine nutrient availability in the Subbasin and its affect on smolt production capacity (carry capacity).
- Design and implement study to quantify use and survival of stream type fish through summer and winter of their first year and then correlate this information with abundance trends and human and natural changes. (summer and winter bioenergetics study).
- Examine and determine natural life history characteristics and quantify polymorphism to the extent possible.
- Increase the complex in-stream habitat in the Methow River and its tributaries.
- Purchase optimal habitat to protect and sustain current conditions, while reconnecting side channels, improving floodplain habitat and re-establishing riparian vegetation.
- Develop and implement comprehensive creel census surveys during any authorized fishery in the basin.
- Develop acclimation and satellite facilities throughout the basin. Design and implement an experimental “natures rearing” at a minimum of one acclimation and one satellite facility.
- Provide for ground water supply at the acclimation facilities to promote long-term rearing at the acclimation sites.

- Develop adult trapping facilities on the mainstem Methow River to provide broodstock source consistent with enhancing tributary stock attributes.
- Maintain existing artificial production program for the Methow Basin.
- Develop and implement a genetics evaluation program for naturally produced and hatchery origin steelhead to assess genetic divergence over time.
- Develop and implement a network hatchery database for all state, tribal and federal hatchery facilities in the mid-Columbia region.
- Implement a comprehensive surface-ground water continuity study in critical rearing and migration river section within the Methow Subbasin.
- Implement the Washington Department of Fish and Wildlife upper Columbia steelhead management and conservation plan and the Biological Assessment and Management Plan (BAMP 1998).
- Provide stock status reports every 5-years and re-assess management direction and strategies every 10-years to assist in implementing a management plan consistent with current data analysis and population response.
- Examine inter and intra-specific species interactions involving natural production coho cohorts and determine potential impacts to summer chinook in the Methow Subbasin and the mainstem Columbia River.
- Implement and require mainstem Columbia River flow spring flow augmentation.
- Improved smolt bypass systems at all mainstem Columbia River hydropower facilities.

Summer Chinook

- Provide annual spawning ground and carcass recovery surveys complete with genetic tissue collection and analysis.
- Conduct annual out-migration surveys in Methow River, complete with life history and genetic tissue collection and analysis.
- Provide genetic analysis of hatchery adult returns and subsequent progeny (monitor potential genetic divergence as a result of long-term adult supplementation programs).
- Provide an external "mark" program to identify specific origin of returning hatchery-produced fish (Methow or Okanogan/Similkameen). Knowing the specific origin of adult returns would be particularly useful during broodstock collection and spawning activities to promote tributary stock attributes.
- Develop adult trapping facilities on the Methow River to trap summer chinook in the tributary rather than at Wells Dam. Tributary trapping locations may maintain/enhance local tributary stock attributes.
- Provide sustained flows in migration, spawning and rearing locations throughout the Methow River mainstem.
- Provide comprehensive creel surveys for authorized fisheries.
- Provide additional rearing space at the Carlton Acclimation site to reduce the loading densities. This is particularly important if the current ELISA segregation activities continue or if high/moderate ELISA egg lots are to be reared in this program. Water, or more accurately the discharge pipe requires improvement.

Currently when water gets high it backs up into the pond making release almost impossible.

- Develop and implement a genetics evaluation program for naturally produced and hatchery origin summer chinook to assess genetic divergence over time.
- Determine that yearling hatchery program does not change the demographics for the summer chinook.
- Examine inter and intra-specific species interactions involving natural production coho cohorts and determine potential impacts to summer chinook in the Methow River Basin and the mainstem Columbia River.
- Provide stock status reports every 5-years and re-assess management direction and strategies every 10-years to assist in implementing a management plan consistent with current data analysis and population response.
- Develop and implement a network hatchery database for all state, tribal and federal hatchery facilities in the mid-Columbia region.

Coho

- Conduct annual spawning ground surveys.
- Conduct annual smolt outmigration surveys from all major tributaries and the Methow River.
- Determine carrying capacity of existing habitat and identify limiting factors to increased productivity of distinct watersheds within the Methow Subbasin.
- Examine nutrient availability in the basin and its affect on coho smolt production capacity (carry capacity).
- Examine inter and intra-specific species interactions involving natural production coho cohorts and determine potential impacts to existing fish assemblage in the Methow Subbasin and the mainstem Columbia River.
- Document and monitor abundance trends of coho as they relate to other stream type species to ensure one does not increase at the expense of the other. Historical literature suggests coho were once the most abundant species but when they were extirpated chinook abundance increased. We do not want chinook abundance to decline (ESA listed) at expense of a re-introduction program.
- Pending positive outcome of the species interaction investigations, develop adult trapping facilities on the Methow River to trap coho in the Methow River and associated tributaries rather than at Wells Dam. Tributary trapping locations may enhance the development of local tributary stock attributes.
- Develop acclimation and satellite facilities throughout the basin in a quantity and location consistent with species interaction study results.
- Provide sustained flows in migration, spawning and rearing locations throughout the Methow River mainstem.
- Provide functional side-channel habitat and increase complexity of stream habitat.
- Provide stock status reports every 5-years and re-assess management direction and strategies every 10-years to assist in implementing a management plan consistent with current data analysis and population response.

Bull Trout

- Provide monitoring of fluvial/adfluvial emigration from the Methow River and associated tributaries.
- Quantify the proportion of resident, fluvial and adfluvial life histories that comprise the overall population in the Methow Subbasin.
- Provide genetic analysis of the existing bull trout population to determine the Subbasin linkages.
- Quantify the distribution of bull trout in the Methow Subbasin.
- Determine carrying capacity of existing habitat and identify limiting factors to increased productivity of distinct watersheds within the Methow Subbasin.
- Examine the feasibility of re-introducing bull trout to locations where they are currently extirpated (e.g. Beaver Creek and Eightmile Creek).
- Examine the feasibility of developing and utilizing artificial production as a strategy to re-introduce bull trout into locations where they are currently extirpated.
- Provide comprehensive creel census surveys during any authorized fishery in the Methow Subbasin.
- Provide stock status reports every 5-years and re-assess management direction and strategies to assist in consistent with current data analysis and population response.
- Examine inter and intra-specific species interactions involving bull trout and determine potential impacts to existing fish assemblage in the Methow River Basin and the mainstem Columbia River.
- Radio tag fluvial migrants to monitor holding, spawning and downstream movement.
- Mark portion of resident populations to quantify recruitment to fluvial populations.

Wildlife Needs

- Develop projects to restore native species in shrub-steppe habitat.
- Develop a project to reintroduce fire to shrub-steppe and dry conifer forest habitat types.
- Develop programs to control and reduce the spread of noxious weeds within the Subbasin.
- Programs are needed to maintain cross-valley migration movement corridors for wide-ranging species. This should include construction of wildlife-friendly highway passage structures at important crossing points.
- Reduce stocking density of young trees in Ponderosa dominated stands.
- Reduce ORV use on National Forest lands.
- Protect and enhance the last active historical sharp-tailed lek site and surrounding habitat.
- Develop programs to reduce upland erosion through noxious weed control and proper grazing management.
- Develop survey programs to locate wolverine den sites so that den sites can be protected from disturbance.
- Minimize potential for forage competition between livestock and mule deer on critical seasonal ranges.

- Move Rattlesnake House to new location suitable for Townsend's big-eared bats.
- Population Management programs are needed to re-introduce sharptail grouse into the Subbasin, establish population goals for mule deer in the district, reestablish a viable fisher population in the basin and implement grizzly bear recovery plan.
- Monitor shrub-steppe obligate songbird diversity and abundance.
- Inventory potential sharptail grouse habitat.
- Survey WDFW land for amphibian abundance and diversity.
- Conduct new mule deer quadrant surveys to estimate population size.
- Inventory extent and quality of remaining shrub-steppe.
- Identify movement corridors for wide-ranging carnivores.

Methow Subbasin Recommendations

Projects and Budgets

The following subbasin proposals were reviewed by the Columbia Cascade Province team and Province Budget Work Group and are recommended for Bonneville Power Administration (BPA) project funding for the next three years.

It is important to note that the historically, the Methow Subbasin and the Columbia Cascade Province as a whole, have received relatively low BPA mitigation and restoration funding through the auspices of the Northwest Power Planning Council's (Council) Fish and Wildlife Program. The Columbia Cascade Province team and Province Budget Work Group are recommending a suite of projects, the funding of which will require long-overdue increases in the base level of funding for the Province as a whole and for the Methow Subbasin in particular.

The need and urgency of increased mitigation and restoration activity and related funding was recognized in the designation of the Methow Subbasin as one of three priority subbasins in the Basinwide Recovery Strategy. In addition, the urgency of recovery work in this region was recognized at the Washington State level, as well. The Upper Columbia Region was recently awarded $3.26 million from the Washington State Salmon Recovery Funding Board, the second highest total of any region in the state, in order to implement 12 of 28 projects proposed for the region.

Table 1 provides a summary of how each project relates to resource needs, management goals, objectives, and strategies, and other activities in the subbasin.

New Projects

Project: 29002 - Conjunctive Use and River Enhancement (CURE) for Habitat Improvement in the Upper Methow River

Sponsor: Chewuch Basin Council

Short Description:

Enhance late summer streamflows in the Upper Methow River through direct streamflow augmentation using groundwater from the prolific Methow Aquifer. Groundwater pumping rates of up to 25 cfs for periods of up to 90 days (4,600 AF storage equivalent).

Abbreviated Abstract

Conjunctive Use and River Enhancement, or CURE, involves pumping ground water into streams for enhancement of in-stream values and later withdrawal for consumptive use. Low flows during late summer and early fall are often cited as key factors limiting fish production. CURE simply uses groundwater naturally stored in a nearby aquifer to augment stream flows during late summer and early fall low-flow periods. The

groundwater can be withdrawn downstream for consumptive use. This increases supply for both fish and people.

A consortium of three irrigation companies is preparing a habitat conservation plan (HCP) for the Chewuch River sub-basin in the Methow Valley. One of the storage projects identified in the HCP is a CURE project. The project would pump the Upper Methow Aquifer during August-October and discharge it directly into the Methow River. This groundwater would flow downstream through critical salmon habitat to a downstream location where it will be withdrawn and put into two existing irrigation canals that are currently supplied by surface diversions from the Chewuch River. This will allow significant reductions in irrigation diversions from the Chewuch River. In addition, the conveyance reach of the Methow River is the most productive spring chinook salmon spawning habitat in the entire watershed. Thus, two reaches on two rivers will experience increased flows during critical periods for fish before any CURE water is withdrawn for irrigation.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
199603401	Methow River Valley Irrigation District	Similar concept: Addresses approach that benefits fish and continues to provide water for irrigation.
199802500	Early Winters Creek Habitat Restoration	Similar objectives: Restore historic fish, riparian and floodplain habitat; identify methods to augment instream flow to increase spawner success and juvenile survival.
199802900	Goat Creek Instream Habitat Restoration	Similar location: Goat Creek is closest tributary to CURE. Mainstem flow improvements will complement restoration activities on this tributary.
200106300	Methow Basin Screening	Similar location: Fish screen facilities and new fish screen construction funded by BPA for Foghorn, Rockview, McKinney Mountain, and Kum Holloway diversions are within the enhancement reach for CURE. Flow improvements will complement screening work.

Relationship to Existing Goals, Objectives and Strategies

The need for the CURE project is presented in:

1) NMFS Biological Opinion, which includes actions related to basic habitat needs of listed species. In tributary habitat, two objectives are relevant to this project: Increase tributary water flow to improve fish spawning, rearing, and migration; and comply with water quality standards, first in spawning and rearing areas, then in migratory corridors. Biological Opinion Section 9.6.2.1. Action 151 states that:

- "BPA shall, in coordination with NMFS, experiment with innovative ways to increase tributary flows." The discussion of this action notes that while tributary flow problems are widespread, it is unclear whether and how solutions can be implemented through existing laws and processes. New approaches must be tested, especially where there are significant non-federal diversions and ancillary water

quality benefits. This action will also develop a competitive process to increase flows and water quality at the lowest cost.

2) The Methow Subbasin Summary, which identifies that:

- The Methow River between Winthrop and Lost River is "the most productive spring Chinook spawning habitat in the entire Methow Subbasin." Protecting functioning floodplain, riparian and side-channels is "critical to sustaining naturally producing spring Chinook in the Methow watershed"; and sustaining flows in this reach throughout the year (including the winter) during dry years should be "given the highest priority."

3) The strategies and objectives of the Confederated Tribes of the Colville Reservation (CTCR) Integrated Resource Management Plan. The CTCR Integrated Resource Management Plan includes a goal of maintaining and protecting instream and riparian habitat and supporting ecological function in these habitats. This goal is to be achieved through several objectives including:

- Objective 2: maintain adequate stream flow to support salmonids at all life stages;
- Objective 3: reduce summer temperatures in the watershed to meet the needs of salmonids in all life stages.

4) The goals and objectives of the Upper Columbia Salmon Recovery Funding Board (UCSRB) as outlined in USCRB (2001) and the 2000 Columbia River Fish and Wildlife Program (FWP). Specifically:

- Strategy 6: Provide alternative sources of irrigation and domestic water to mitigate impacts of problematic surface water diversions.

5) 2000 Columbia River Basin Fish and Wildlife Program. The 2000 Columbia River Basin Fish and Wildlife Program ("FWP") focuses on protecting and restoring natural ecological functions to watersheds. Stream flow restoration will benefit anadromous and resident fish, including:

- Restoration of anadromous fish to areas that contain good habitat but are limited by reduced flows from dewatering.

Funding the CURE Pilot Project will enable some of the key benefits of these recommended actions to be realized in a way that can be replicated in other subbasins. The development of the CURE Project will also allow for the development of water strategies that can be used in other areas of Eastern and Western Washington and the infrastructure needed to demonstrate transactional strategies for securing flows and improving water quality both from large irrigation projects and individual landowners. Stream flow restoration will address both streamflow problems and water quality problems.

Review Comments

Lacks universal public acceptance. May be foregoing less expensive alternatives. NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$500,000 Category: Recommended Action	$ Category:	$220,000 Category: Recommended Action

Project: 29006 – Supplement Spring Chinook in Early Winters Creek

Sponsor: Methow Salmon Recovery Foundation

Short Description:

Develop a "natural" acclimation/rearing site on Early Winters Creek to supplement native fish stocks.

Abbreviated Abstract

The project includes the design and development of an acclimation/supplementation pond with an outfall connection to Early Winters Creek. Early Winters Creek water will be supplied from a connection to the Early Winters Ditch Company irrigation canal. A supplemental well will be installed to accommodate “mix water” and to allow for filling the pond in early spring (non-consumptive). The supplemental well will be installed to accommodate the possible additional flow to Early Winters Creek (2-5 cfs) during late season low flow conditions.

Control structures for the water supply and an alarm system will be installed prior to the introduction of pre-smolts for acclimation. Personnel, from Washington Department of Fish and Wildlife Methow Hatchery Program (Winthrop Facility) will be the primary operator of the facility. The property owner will allow connection to the trunk lines for both power and phone service for the alarm system as well as provide access for pre-smolt installation and maintenance. A long term operating agreement has been tentatively reached with the landowner and will be finalized once funding is secure.

It is anticipated that design and permitting efforts will occur late 2002 and early 2003 with construction of the water supply system, pond, and outfall connection occurring in late 2003 when water table and stream levels are low. First opportunity anticipated to acclimate pre-smolts would be March 2004. Maximum number of fish anticipated for this facility is 25,000 annually.

This supplementation project targets endangered spring chinook salmon and is envisioned to “sunset” at a time when the naturally produced population becomes self-sustaining. When acclimation ceases, it is anticipated that the pond and associated components convert to long term off channel and over-wintering habitat for natural fish populations and flow augmentation to the creek.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
199802500	Early Winters Creek Habitat Restoration - restored historic fish, riparian and floodplain habitat, identified methods to augment instream flow to increase spawner success and juvenile survival. Project was completed summer of 2000 with some follow-up monitoring	Provides potential to provide flow augmentation of up to 30% of late season flows and supplement natural production in Early Winters Creek and the Methow system.
	WDFW Spring chinook program	Provides satellite acclimation facility to assist in maintaining supplementation programs and provide for improved distribution. Provides upper basin site to facilitate on-going and future studies.

Relationship to Existing Goals, Objectives and Strategies

Supplementation Program:

2000 Fish and Wildlife Program

The Vision Statement for the 2000 Fish and Wildlife Program states:
"The vision for this 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 hydro system and providing the benefits from fish and wildlife valued by the people of the region. This ecosystem provides abundant opportunities for tribal trust and treaty right harvest and for non- tribal harvest and the conditions that allow for the recovery of the fish and wildlife affected by the operation of the hydro system and listed under the Endangered Species Act."

The Vision Statement further indicates:
"Wherever feasible, this program will be accomplished by protecting and restoring the natural ecological functions, habitats, and biological diversity of the Columbia River Basin. In those places where this is not feasible, other methods that are compatible with naturally reproducing fish and wildlife populations will be used. Where impacts have irrevocably changed the ecosystem, the program will protect and enhance the habitat and species assemblages compatible with the altered ecosystem. Actions taken under this program must be cost-effective and consistent with an adequate, efficient, economical and reliable electrical power supply."

The proposed project will:
1) Mitigate for hydropower affects

2) Promote restoration of natural ecological function by connecting and enhancing habitat through flow augmentation
3) Enhance wild production
4) Assist in the recovery of two Columbia Basin ESU's listed as Endangered under ESA and one DPS listed as Threatened.
5) Upon recovery, ultimately lead to both tribal and non-tribal harvest opportunities, and
6) Is cost-effective due to ability to utilize a site with out need for acquisition.

Meets criteria identified in the strategy section of the 2000 Columbia River Basin Fish and Wildlife Program's compromised habitat section:

"Where the habitat for a target population is absent or substantially diminished and cannot reasonably be fully restored, then the biological objective for that habitat will depend on the biological potential of the target species. The objective also is to restore the population of the target species up to the sustainable capacity of the restored habitat. Sustained supplementation in a limited fashion is a possible policy choice in this instance".

Meets criteria identified in the Subbasin Summary (Fish Goals and Strategies - WDFW):

- Objective 1; Recover ESA listed upper Columbia spring chinook salmon and summer steelhead trout in the Methow Subbasin to a level that supports a harvestable surplus. Strategy 1; Determine adult to adult and smolt to adult return rate for naturally and hatchery produced fish. This project provides the site to facilitate these studies presently and into the future.
- Strategy11; Develop new and modify existing acclimation facilities to improve distribution of spawners at return and reduce point source impact of direct plants (Upper Methow, Early Winters, upper Chewuch, upper Twisp and Lost Rivers). This project provides the only identified opportunity on Early Winters Creek.
- Strategy 13; Maintain supplementation programs for spring chinook and summer steelhead. This project provides for satellite acclimation facility to maintain supplementation and provides for improved distribution.

Meets criteria identified in the National Marine Fisheries Service (NMFS) 2000 FCRPS Biological Opinion Reasonable and Prudent Alternatives (RPAs):

- RPA #184; The action agencies and NMFS shall work within regional prioritization and congressional appropriation processes to establish and provide the appropriate level of FCRPS funding for a hatchery research, monitoring, an devaluation program consisting of studies to determine whether hatchery reforms reduce the risk of extinction for Columbia River basin salmonids and whether conservation hatcheries contribute to recovery.

This project provides an upper basin site and appropriate habitat conditions to study these approaches to recovery. Natural rearing protocol will be followed. Habitat design, enhancement measures, and facility operations will be consistent with "Natural Rearing" approaches. Features of natural rearing system include:

- Natural substrate materials, such as sand and gravel. A mix of such materials is preferred, so that there is complex substrate habitat.
- Substrate materials will be roughly the same color as natural background colors. This allows fish to behaviorally and physically (pigments) adapt to natural conditions.
- In water structures, such as large woody debris or tree branches.
- Overhead cover and shade will be retained during pond construction
- Predator avoidance training. This includes undertaking feeding in a manner that does not allow fish to associate human activities or other external/surface activities with food supply
- Using underwater feeding equipment. This assists in training fish to search for food where it is naturally produced, in training fish to avoid the surface where they would be more prone to predation by avian predators.
- Additionally, plastic rings that have been strung with camouflage netting will be floated on the ponds. These hoops will assist in predator control, as well as enhancing physical habitat traits that are consistent with the natural rearing concept.
- In addition, a Hatchery Genetics Management Plan (HGMP) will be developed for this program, consistent with NMFS criteria.

Meets criteria identified in the Subbasin Summary (Habitat Goals, Objectives and Strategies):

- Objective 2; Improve instream water quantity and quality within Subbasin.
- Strategy 1; address improving low flow conditions in the lower reach and determine biologically based in-stream flows below the two diversions.

Meets criteria identified in the National Marine Fisheries Service 2000 FCRPS Biological Opinion RPA's:

- RPA #151; BPA shall, in coordination with NMFS, experiment with innovative ways to increase tributary flows by, for example, establishing a water brokerage. BPA will begin these experiments as soon as possible and submit a report evaluating their efficacy at the end of 5 years.

The negotiated agreement between NMFS and the Early Winters Ditch Company is currently meeting NMFS's target flow of 35 cfs and the irrigation district is using wells to meet the remainder of its irrigation needs. This agreement eliminated the irrigation companies late season impact to instream flows. The supplementation well required for this project serves multiple purposes:

1) It serves as the make-up water supply in early spring for the pond and outflow channel. Irrigation (river) water will replace well water once irrigation season begins.

2) It serves as mixing water (with Early Winters Creek water via the irrigation ditch) during the time of acclimation.

3) It serves as water supply for the pond and outlet channel in late season and through the winter to provide off-channel and over-wintering refuge.

4) It has potential to provide up to an additional 5cfs to Early Winters Creek in late season and winter low flow conditions. (5 cfs could amount to augmentation of 30% of late season flow based on in stream flow of 15 cfs, which can occur naturally).

Review Comments

The hatchery programs in the Methow are currently undergoing evaluation and potentially restructureing. The PUD hatchery comittee will be organizaing and planning in the near future. The BOR hatchery program is considering moving towards supplementation, but decisions have not been made. This project may be ahead of those efforts and connot be tied to specific planning documents at this time. This project may be a key element in the future, but a t this time that cannot be determined. NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$231,000 Category: Recommended Action	$5,000 Category: Recommended Action	$5,000 Category: Recommended Action

Project: 29010 – Restore Passage on Private Lands in Beaver Creek Drainage to Benefit Spring Chinook, Steelhead and Bulltrout

Sponsor: Washington Department of Fish and Wildlife (WDFW)

Short Description:

This project will further long-term, ongoing efforts to fully restore anadromous fish passage on private lands within the Beaver Creek drainage.

Abbreviated Abstract

Culverts and dams currently block fish passage to important tributary habitat in the in the Beaver Creek drainage. Beaver Creek is a major tributary of the Methow River located in the Methow subbasin. Spring chinook, summer chinook, steelhead, and bull trout all use the Methow River for spawning, rearing and as a migration corridor. Spring chinook are known to use the area around the mouth of Beaver Creek for rearing, and steelhead and bull trout are known to use the Beaver Creek drainage for spawning, rearing and migration. Steelhead spawn and rear in Beaver Creek from between the mouth to Frazer Creek and South Fork Beaver Creek (WSCC 2000).

A 1998 inventory of fish passage barriers conducted by the Washington Department of Fish and Wildlife's Salmonid Screening, Habitat Enhancement and Restoration Division (SSHEAR) in cooperation with the Methow Wildlife Area Manager, Enforcement Program officers, and property owners, identified 55 culverts and 23 dams which created partial and

full fish passage barriers (39 full barriers and 39 partial barriers) in the Beaver Creek drainage (WSCC 2000). Since that time, all known water diversions in the drainage have been screened. Restoration and preservation of this important tributary habitat is an essential component of regional efforts to recover endangered and threatened fish species in the upper Columbia River. There are 21 remaining known fish passage barriers located on private property within the Beaver Creek drainage. These barriers include 12 culverts and 9 dams, which continue to impede fish passage on Beaver Creek, Frazer Creek and Shorer Creek. Washington Department of Fish and Wildlife (WDFW) proposes to restore connectivity and access to habitat within this drainage by addressing these 21 barriers. Correction of these passage barriers will restore approximately 48,000 square meters of spawning habitat and 102,000 square meters of rearing habitat (approximately 10 miles of stream).

Relationship to Other Projects

Project ID	Title	Nature of Relationship
199802500	Early Winters Creek Habitat Restoration	Restore access to and quality of important stream habitat
23024	Hancock Springs Passage and Habitat Restoration	Restore access to and quality of important stream habitat
26015	Methow Basin Screening. This project provides fish screen facilities upgrades, and new fish screen construction, on Methow River Basin irrigation diversions	Restore access to and quality of important stream habitat
199802900	Goat Creek Instream Habitat Restoration	Restore access to and quality of important stream habitat
200106300	Methow Basin Screening	Restore access to and quality of important stream habitat

Relationship to Existing Goals, Objectives and Strategies

Removing barriers to fish passage and enhancing habitat in the Beaver Creek drainage of the Methow subbasin speaks directly to the vision, goals, objectives and strategies outlined in the major salmon recovery documents guiding restoration efforts within the Columbia River Basin. Correcting barriers to fish passage in this drainage specifically addresses survival of ESA listed fish by making available essential habitats associated with those species. Restoring this habitat also addresses local and regional salmon recovery priorities as well as related subbasin needs and objectives identified in the Methow Subbasin Summary.

The Northwest Power Planning Council's (NPPC) 2000 Fish and Wildlife Program
The NPPC 2000 Fish and Wildlife Program (Program) embraces an ecosystem-based approach to habitat restoration and function. This approach acknowledges that rebuilding healthy, naturally producing fish and wildlife populations requires protection, mitigation, and restoration of habitats and the biological systems within them, including anadromous fish migration corridors.

One of the central strategies guiding the Program is the concept of "building from strength." The idea is to expand adjacent habitat that has been historically productive or that has a likelihood of sustaining healthy population by reconnecting or improving habitat. The Methow subbasin has been identified as a region with significant intact habitat. The habitat restoration resulting from removing the Beaver Creek fish passage barriers supports the concept of building out from and supplementing functional habitats.

Nation Marine Fisheries Service (NMFS) 2000 Biological Opinion & Reasonable and Prudent Alternatives (RPA)

The Biological Opinion (BiOp) encourages the Action Agencies to support a Basin wide Recovery Strategy. The BiOp lists measures to avoid jeopardy, and gives specific tributary habitat objectives, which include providing passage and diversion improvements, and supporting overall watershed health of riparian and upland habitat.

The specific BiOp action item addressed by this proposal is:

Action 149 - BOR shall initiate programs in three priority subbasins (identified in the Basinwide Recovery Strategy – the Methow subbasin is one of the three identified for the first year) per year over 5 years, in coordination with NMFS, FWS, the states and others, to address all flow, passage, and screening problems in each subbasin over 10 years. The Corps shall implement demonstration projects to improve habitat in subbasins where water-diversion-related problems could cause take of listed species. Under the NPPC program, BPA addresses passage, screening, and flow problems, where they are not the responsibility of others. BPA expects to expand on these measures in coordination with the NPPC process to complement BOR actions described in the action above.

Upper Columbia Salmon Recovery Board (UCSRB)

The UCSRB has noted that the Methow subbasin has a "high proportion of pristine habitats, relative to other subbasins in the region." The UCSRB has identified restoration of stream flow as the priority objective in the Methow subbasin, and a secondary, but critical, restoration objective of correcting passage barriers created by irrigation diversion dams and road culverts. This proposal directly addresses this secondary objective.

Methow Subbasin Summary

This proposal also supports the overall goals identified in the Methow Subbasin Summary, which include:

- protection and restoration of anadromous and resident fish species and wildlife species within the Methow Subbasin
- use of strategies that rely on natural production and healthy habitat to achieve restoration and protection goals, passing on to future generations a functioning ecosystem capable of supporting self-sustaining populations of anadromous and resident fish and wildlife species with intact populations of those species, and
- balancing economic viability of local communities with fish and wildlife needs through development of cooperative processes that promote adaptive and creative problem solving.

Review Comments

Due to funding for a Coordinated Resource Management Plan from the WA SRFB, the costs for this project can be reduced by 20% across the board and implementation of this project can be defered for one year. NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$0 Category: High Priority	$191,819 Category: High Priority	$153,455 Category: High Priority

Project: 29012 – Replace Rockview Diversion with Groundwater Withdrawal and Restore Instream Habitat

Sponsor: Washington Department of Fish and Wildlife (WDFW)

Short Description:

Replace Rockview Diversion with Groundwater Withdrawal and Restore Instream Habitat.

Abbreviated Abstract

The Rockview diversion is located on the Big Valley Ranch Unit of the Methow Wildlife Area in the upper Methow River subwatershed. The diversion is situated below the Weeman Bridge at Methow River mile 60.6, approximately 8 miles northwest of the town of Winthrop, WA. Washington Department of Fish and Wildlife (WDFW) proposes to remove the Rockview diversion and restore and enhance the immediate surrounding habitat to benefit ESA listed fish including spring chinook and steelhead.

The Rockview diversion and existing bypass channel provide limited rearing and/or overwintering value to spring chinook and steelhead. Lack of functioning side channel habitat and woody debris are identified as limiting factors for ESA listed fish in the Methow Subbasin (WSCC 2000). The present Rockview screen, which was built in 1965, does not meet current NMFS or WDFW criteria for fish protection, including criteria for approach velocities, sweeping velocities, screen orientation or bypass return. WDFW recognizes that there is a valuable opportunity to restore important side channel habitat by removing the screen and restoring the surrounding habitat. WDFW proposes to remove the Rockview screen and headgate, fill in the area and re-plant it with native vegetation. The existing check dam will be removed and the channel will be enhanced with instream structures to provide geomorphological diversity. This site enhancement will restore essential off-channel rearing and overwintering habitat for spring chinook and steelhead and increase and enhance functional connectivity of important fish habitat within the Methow Subbasin.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
199802500	Early Winters Creek Habitat Restoration	Restore access to and quality of important stream habitat
26015	Methow Basin Screening. This project provides fish screen facilities upgrades, and new fish screen construction, on Methow River Basin irrigation diversions	Restore access to and quality of important stream habitat
23024	Hancock Springs Passage and Habitat Restoration	Restore access to and quality of important stream habitat
199802900	Goat Creek Instream Habitat Restoration	Restore access to and quality of important stream habitat
200106300	Methow Basin Screening	Restore access to and quality of important stream habitat

Relationship to Existing Goals, Objectives and Strategies

The proposed Rockview diversion removal and side channel habitat enhancement supports the vision, goals, objectives and strategies for habitat restoration and enhancement identified as priorities in the Northwest Power Planning Council's 2000 Fish and Wildlife Program, the Upper Columbia Salmon Recovery Board's mission statement, the National Marine Fisheries Service's 2000 Biological Opinion, and the Methow Subbasin Summary.

The Northwest Power Planning Council's (NPPC) 2000 Fish and Wildlife Program
The NPPC 2000 Fish and Wildlife Program (Program) embraces an ecosystem-based approach to habitat restoration and function. This approach acknowledges that rebuilding healthy, naturally producing fish and wildlife populations requires protection, mitigation, and restoration of habitats and the biological systems within them, including anadromous fish migration corridors.

One of the central strategies guiding the Program is the concept of "building from strength." The idea is to expand adjacent habitat that has been historically productive or that has a likelihood of sustaining healthy population by reconnecting or improving habitat. The Methow subbasin has been identified as a region with significant intact habitat. The habitat enhancement work proposed here endorses the concept of building out from and supplementing functional habitats.

NMFS 2000 Biological Opinion & Reasonable and Prudent Alternatives (RPA)
The Biological Opinion (BiOp) encourages the Action Agencies to support a Basinwide Recovery Strategy. The BiOp lists measures to avoid jeopardy, and gives specific tributary habitat objectives, which include providing passage and diversion improvements, and supporting overall watershed health of riparian and upland habitat.

The specific BiOp action items addressed by this proposal is:
Action 149 - BOR shall initiate programs in three priority subbasins (identified in the Basinwide Recovery Strategy – the Methow subbasin is one of the three identified for the first year) per year over 5 years, in coordination with NMFS, FWS, the states and others, to

address all flow, passage, and screening problems in each subbasin over 10 years. The Corps shall implement demonstration projects to improve habitat in subbasins where water-diversion-related problems could cause take of listed species. Under the NPPC program, BPA addresses passage, screening, and flow problems, where they are not the responsibility of others. BPA expects to expand on these measures in coordination with the NPPC process to complement BOR actions described in the action above.

Upper Columbia Salmon Recovery Board (UCSRB)

The UCSRB has noted that the Methow subbasin has a "high proportion of pristine habitats, relative to other subbasins in the region." The UCSRB has identified restoration of stream flow as the priority objective in the Methow subbasin, and a secondary, but critical, restoration objective of correcting passage barriers created by irrigation diversion dams and road culverts. This proposal directly addressed both objectives.

The Upper Columbia Regional Technical Team in its recommendations to the Upper Columbia Salmon Recovery Board noted specifically that salmon recovery priorities in the Upper Methow River subwatershed included: protection of functioning floodplain, riparian and side channel habitat within the channel migration zone of the river; and the implementation of water conservation measures to assist in maintaining optimum flows to protect both access to and the quality of existing habitat.

Methow Subbasin Summary

This proposal also supports the overall goals identified in the Methow Subbasin Summary which include:

1) protection and restoration of anadromous and resident fish species and wildlife species within the Methow Subbasin,
2) use of strategies that rely on natural production and healthy habitat to achieve restoration and protection goals,
3) recognition of tribal sovereignty and treaty rights,
4) passing on to future generations a functioning ecosystem capable of supporting self-sustaining populations of anadromous and resident fish and wildlife species with intact populations of those species, and
5) balancing economic viability of local communities with fish and wildlife needs through development of cooperative processes that promote adaptive and creative problem solving.

Strategies noted in the Methow Subbasin Summary specific to the Upper Methow subwatershed include:

1) protecting functioning floodplain, riparian habitat and side channels within the channel migration zone of the Methow River;
2) protection of stream channel sections where ground water recharge occurs and which sustain flow through the winter during dry years; and
3) prevention of further development within the channel migration zone that will constrict or constrain the channel, degrade riparian areas, negatively impact ground water and surface water interactions, or in any other way degrade stream channel functions.

Review Comments

Concept seems highly likely to succeed. The budget has been reduced by $40,000 to reflect eliminating the feasibility study portion of the proposal. Mark recapture techniques are likely to result in permitting difficulties and using snorkel surveys would be more appropriate and reduce costs. An additional $10,000 has been removed from the budget to reflect a modified sampling procedure. NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$91,954 Category: High Priority	$92,000 Category: High Priority	$42,500 Category: High Priority

Project: 29018 – Analyze ground-water and surface-water exchanges influencing anadromous salmonid habitat in the Methow River and its major tributaries

Sponsor: U.S. Geological Survey (USGS)

Short Description:

Identify the locations of ground-water and surface-water exchanges in the Methow, Twisp, and Chewuch Rivers, quantify the exchange rates and their seasonal patterns, and assess the influence of these exchanges on spring chinook habitat.

Abbreviated Abstract

Anadromous salmonids in the Columbia River Basin depend on exchanges between ground water and surface water to maintain perennial aquatic habitat, to moderate extreme winter and summer water temperatures, and to transport dissolved oxygen to eggs buried in streambed sediments. The U.S. Geological Survey (USGS) proposes to characterize the location and magnitude of ground water and surface-water exchanges in the Methow, Twisp, and Chewuch Rivers. The project will use sequential discharge measurements along the rivers to locate and quantify exchanges at a reach scale. Detailed investigations will be conducted in reaches with large exchanges using in-stream piezometers to measure the local hydraulic and thermal gradients between ground and surface waters and thermistors to measure variation in water temperature along the rivers. The results of the field investigations will be integrated with existing ground water data for the Methow subbasin to analyze the sources of ground water discharging to the rivers. Specific products from the project include:

1) estimates and a map of the areas of upwelling and downwelling flow for the Methow, Twisp, and Chewuch Rivers;
2) estimates and a map of reaches with perennial flow;
3) a map of water-temperature extremes for both summer and winter; and
4) a brief assessment of potential sources of recharge for the shallow ground water. The results of the investigations will be relevant for understanding the relations between ground water and surface water exchanges and salmonid habitat; estimating the habitat available to anadromous salmonids, particularly spring chinook, in the Methow

subbasin; and assessing the hydrologic opportunities and constraints for salmonid habitat restoration in the subbasin.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
N/A	N/A	The USGS is currently investigating ground-water and surface-water resources in the Methow subbasin. As part of the current investigation, the USGS is collecting and analyzing hydrologic data to improve the understanding of hydrologic processes in the subbasin in support of planning efforts aimed at assessing water availability in the subbasin. The proposed project will build on the results of the current investigation by focusing specifically on the influence of ground-water and surface-water exchanges on salmonid habitat. The USGS operates a network of 16 stream gages that provide a continuous record of streamflow throughout the Methow River Basin. The Bonneville Power Administration funded two of the gages during FY 2001 and may continue its support for these gages in FY 2002. Data from the gages will assist in identifying gaining and losing reaches, quantifying the gains and losses, and documenting the temporal patterns of ground-water and surface-water exchanges including their annual variation.

Relationship to Existing Goals, Objectives and Strategies

The proposed research project will provide fundamental information necessary for understanding the population biology and ecology of anadromous salmonids in the Methow River basin. The proposed project is anticipated to contribute to:

1) a better understanding of the relations between hydrology and salmonid productivity;
2) 2) improved estimates of current spawning and rearing habitat in the subbasin; and
3) identification of potential spawning and rearing habitat based on hydrologic criteria.

The project will support the Methow Subbasin Summary Habitat Objective 2 (to improve instream water quantity and quality in the subbasin) and Fish Objectives 2 and 3 for spring chinook and summer steelhead (determining salmonid productivity)(CBFWA, 2001).

The project addresses the Methow Subbasin Summary Habitat Need for a better understanding of the hydrologic processes that maintain salmonid habitat in the subbasin (CBFWA, 2001). The project also addresses the Fish Needs for correlating ground-water discharges to fish abundance and estimating the carrying capacity of the subbasin for spring chinook (CBFWA, 2001).

The project responds to the 2000 FCRPS Biological Opinion objectives for tributary habitat (Section 9.6.2.1, NMFS, 2000). In particular, the proposed project will provide information on current water-quantity and water-quality conditions in the Methow subbasin as they relate to anadromous salmonid habitat and the potential for expanding the available habitat based on hydrologic conditions. This information directly supports Reasonable and Prudent Alternatives #151 (increase tributary inflows) and #152 (offsite habitat-enhancement measures).

Review Comments

80% indirect rate on the whole contract is excessive based on rates charged by other projects. NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$188,937 Category: High Priority	$58,712 Category: High Priority	$0 Category:

Project: 29020 – Beaver CR Campground Rehabilitation

Sponsor: Okanogan Conservation District

Short Description:

Restore riparian area of Beaver CR campground by building 1300 feet of fencing to keep users away from stream bank. Plant, as needed, riparian species within the fenced area to speed restoration of riparian zone. Build hitching rails.

Abbreviated Abstract

This rehabilitation project is designed to minimize impacts from livestock and campers in the riparian area of Beaver Creek campground. Currently the area receives heavy use from horse groups and hunters from throughout the state. This project will construct a buck and pole fence 50 feet back from the edge of the stream with two designated watering points for stock. The area inside the fence will be planted with riparian species that are native to the area.

The project will also provide for an expansion of the campground to make up for the area lost to the riparian setback that will involve tie racks, stoves, tables, site prep and application of crushed rock.

Cooperators in the project include the Okanogan Conservation District, who will administer the grant, perform the campground work and assist in material gathering and construction of the fence; the Methow Chapter of Back Country Horseman, who will provide the labor and poles to build the fence; the King County Outdoor Sportsman's Council, who will assist in the construction of the fence and the Washington Department of Fish & Wildlife.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
N/A	N/A	The rehabilitation of Beaver CR Campground is part of an on-going effort by the Okanogan Conservation District, WDFW, and some local residents to correct the problems that can be corrected in the drainage. A WDFW barrier survey on the stream resulted in a Salmon Recovery Funding Board grant to rebuild five irrigation diversions that are currently blockages to the passage of steelhead, Chinook and Bull Trout, the grant was awarded and construction is anticipated in the fall of 2002. A Coordinated Resource Management Plan is also being attempted in the drainage that involves landowners and agency regulators in an attempt to identify problems and solutions that will work on the ground to everyone's satisfaction. BOR has agreed to do the preliminary engineering on a piping project that would pipe water up the creek and then flow back down in dry years to increase flow. The Okanogan Conservation District has two Department of Ecology grants available in the spring of 2002. One for irrigation water management that will work with farmers to apply the correct amount of water for their crops. The other that will work toward irrigation systems upgrades that will allow Irrigation Districts and farmers to correct conveyance and delivery problems. Both of these grants will work toward more flow in the stream.

Relationship to Existing Goals, Objectives and Strategies

This project will perform exactly what has been identified as needed by the Methow Subbasin Summary and the Limiting Factors Analysis. Healthy riparian habitats are high on the priority list of plans and studies or that have been issued by National Marine Fisheries Service, US Fish Wildlife Service, and Washington Dept Fish and Wildlife.

Review Comments

NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$60,445 Category: Recommended Action	$5,325 Category: Recommended Action	$5,435 Category: Recommended Action

Project: 29030 – Early life history and survival of spring chinook salmon and steelhead in the Methow River Basin

Sponsor: Pacific Northwest National Laboratory (PNNL)

Short Description:

Investigate differential survival, behavior and habitat selection of juvenile spring chinook salmon and steelhead in relation to associated with warm groundwater presence, river ice, and other habitat parameters.

Abbreviated Abstract

The goal of this project is to provide information that will reduce uncertainty related to identifying habitats that are valuable for the improved recruitment of juvenile spring chinook salmon and steelhead. By examining survival, identifying critical habitat types, and relating early life history to river processes in the Methow River drainage, we will identify habitat features that are important to the survival of these species. Identification of these important features will be useful for identifying optimal areas for habitat protection and enhancement. Specific project objectives include:

1) Determine differential survival of juvenile spring chinook salmon and steelhead in relation to habitat quality and quantity;
2) Describe fish behavior and quantify habitat use and selection using underwater videography and snorkeling;
3) Investigate how life history and survival is associated with warm groundwater presence, river ice, and other habitat parameters.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
N/A	N/A	This project would tie into several of the following projects: Methow Hatchery Supplementation and Evaluation Plan (Wells Settlement Agreement), Mid-Columbia Mainstem Conservation Plan (Draft 1997) and current draft incorporating NMFS issued Biological Opinions, Methow Basin Planning Unit and the Use of a Precipitation Model to Simulate Natural Streamflow Conditions in the Methow River Basin, Washington (USGS 2001), Chewuch Basin Council draft HCP, Methow Basin Limiting Factors Analysis, Yakama Nation Coho Re-introduction Project, Eastbank Hatchery Supplementation and Evaluation Project (Rock Island Settlement Agreement), A Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region, A Report to the Upper Columbia Salmon Recovery Board (Upper Columbia Regional Technical Team draft 2001), Production and Habitat of Salmonids in Mid-Columbia River Tributary Streams, U.S. Fish and Wildlife Serv. Monogr. I. (Mullan et al.). Rock Island Smolt Bypass Project

Relationship to Existing Goals, Objectives and Strategies

This project directly addresses several of the needs outlined in the Methow River subbasin summary. In general, this project would provide information on the life history, habitat use, and population dynamics of juvenile spring chinook salmon and steelhead in the ecosystem. This project is specifically targeted at reducing uncertainty relative to the importance of various habitat features and over-winter survival of spring chinook salmon and steelhead. Identification of critical habitats for these species will increase the probability of acquiring/protecting habitats that may result in improving recruitment of spring chinook salmon and steelhead.

These objectives specifically address statements of need by the subbasin summary to:

- "Design and implement an over-winter ecology and fish abundance study"
- "Design and implement a study that evaluates which life history stages of fish species utilize which habitat components at various times of the year"

- Understand the relationship between fish abundance and ground water discharge
- Monitor smolt outmigration of spring chinook salmon
- Examine and determine natural life history characteristics of steelhead.
- Identify limiting factors to increased productivity of spring chinook salmon and steelhead in distinct watersheds within the Methow Basin
- To quantify use and survival of stream type spring chinook salmon and steelhead through summer and winter of their first year.

Data collected in this project will also be useful in determining winter instream flow needs of juvenile spring chinook salmon and steelhead.

This project also addresses several biological opinions of the National Marine Fisheries Service.

One goal of this project is to identify critical habitats of juvenile spring chinook salmon and steelhead so that they can be protected, this directly supports Action 150 which states: in subbasins with listed salmon and steelhead, BPA shall fund protection of currently productive non-Federal habitat, especially if at risk of being degraded, in accordance with criteria and priorities BPA and NMFS will develop by June 1, 2001. This project also addresses Action 185: which states: the Action Agencies shall continue to fund and expand, as appropriate, fish marking and recapturing programs aimed at defining juvenile migrant survival for both transported and non-transported migrants and adult returns for both groups. Also by using some new an innovative techniques to track movements and site fidelity of fish, this project supports Action 193 which states: the Action Agencies shall investigate state-of-the-art, novel fish detection and tagging techniques for use, if warranted, in long-term research, monitoring, and evaluation efforts.

This project also addresses goals presented by the Washington State Conservation Commission as stated in the water resource inventory of area 48. While the sole focus of this study is not to examine groundwater surface water interactions, it does make steps toward a stated goal to evaluate how groundwater and surface water interactions moderate low wintertime surface water conditions and to identify locations where groundwater contributes to surface water. This study also would work at filling a stated data gap, which is "temperature monitoring of summer and winter thermal refugia."

Review Comments

NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$382,939 Category: Recommended Action	$384,000 Category: Recommended Action	$384,000 Category: Recommended Action

Project: 29031 – Out Year Operations and Maintenance Costs Required to Implement/Carry out MVID Rehabilitation Project

Sponsor: Yakama Nation (YN)

Short Description:

Proposal requests O & M support for MVID Rehabilitation Project (MVID_RP). Assured long-term funding for O&M costs is essential for MVID_RP completion and realization of its water conservation, in-stream flow and habitat benefits.

Abbreviated Abstract

This proposal requests long-term funds for the Operation and Maintenance (O & M) costs of the new pumping stations associated with the rehabilitated water distribution system of the Methow Valley Irrigation District (MVID) anticipated to be constructed by 2004. The new system, coupled with rehabilitation of canals including installation of new ESA-compliant fish screens, replacement of laterals and water conservation education, provide a number of fish related benefits. These include:

- improved water conservation in the Methow via reduction of water use by the MVID;
- increased in-stream flow in both the Twisp and Methow rivers;
- complete removal of surface water diversion and fish passage barrier (fish screen) from the Twisp River; and
- increased habitat in the Methow and Twisp watersheds.

Final development and approval of the MVID Rehabilitation Project, which has been negotiated through a NWPPC-mandated facilitation process, is contingent on obtaining funds for O & M costs of the new pumping system for the duration of the Rehabilitation project. The submitted project proposals request funding for the out-years 2004-2007, the first four years of operation under the new system. The solicitation process does not provide for needs beyond FY 2007; however, commitment to funding of O&M costs on a long-term basis is critical for the success the MVID Rehabilitation Project. O & M costs include the power needed to operate the new system's pumping stations, the costs of their day-to-day operation and maintenance, and the cost of replacing the two pump stations at the end of 25 years.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
199603401	Methow Valley Irrigation District Rehabilitation Project: Rehabilitation of MVID's distributing system and mitigation of remaining environmental concerns associated with the system.	This proposal requests support of the O & M costs associated with the MVID Rehabilitation project. Without funds for O & M costs, the implementation of the MVID Rehabilitation project is in jeopardy
	Replacement of laterals needed to promote water conservation	This subcontract of the MVID Rehabilitation project has been completed. The O &M costs requested will help assure that the maximum benefits are realized from this project.

Project ID	Title	Nature of Relationship
	Development of conceptual plan for MVID Rehabilitation Project	A conceptual plan for a revised MVID Rehabilitation project was prepared by Fred Ziari. O & M funds requested are required for the results of this work to be realized.

Relationship to Existing Goals, Objectives and Strategies

This O&M project begins to provide the needed operations and maintenance monies to fully implement, operate and maintain the MVID Rehabilitation Project. The monies provided through this proposal will pay ongoing costs associated with operation and maintenance of pumps for the MVID Rehabilitation Project. These include electrical costs for pumping, day-to-day operation of the pumps, long-term maintenance of the pumps and future pump replacement.

This proposal can be classified indirectly as a habitat strategy (restorable habitat category) as it's described in the 2000 FWP document. Specifically this proposal in conjunction with the MVID Rehabilitation project is designed to address low flow conditions in the lower Twisp River as a consequence of the MVID West diversion dam, as well as improve instream flows in Methow River. In this way, it supports the strategy of restoring habitat. The Methow Subbasin Summary document states that the Twisp River is currently on the Washington State's 303(d) because of excessive water temperatures (summer months) and low flow conditions, especially below river mile 3.9 where the MVID West diversion is located. The Methow Subbasin Summary lists a major habitat objective (See Existing Goals, Objectives and Strategies section) as "Improve instream water quantity and quality within the Subbasin". Under that objective, an identified strategy is to investigate strategies to improve instream flows in the Twisp River. This proposal is critical to the MVID Rehabilitation Project, which has identified a successful strategy to both improve instream flows and eliminate irrigation-related diversions and fish passage barriers from the Twisp River.

This O&M project, in conjunction with the MVID Rehabilitation Project, supports several of the Reasonable and Prudent Alternatives (RPA's) from the NMFS 2000 Biological Opinion. In particular, Actions 150 and 152 are habitat-related, and Action 149 relates to NWPPC/BPA responsibilities to address passage, screening and flow problems, where they are not the responsibility of others.

Review Comments

Monitoring and evaluation not adequately described and may be funded from other sources if project gores forward. Funding may not be needed. NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$0 Category: Recommended Action	$70,000 Category: Recommended Action	$65,000 Category: Recommended Action

Project: 29034 – Life History Study of Salmonid Rearing In The Upper Methow River

Sponsor: Yakama Nation (YN)

Short Description:

This research proposal is design to address the need to understand salmonid temporal and spatial life history patterns and productivity in the upper Methow River, with the focus in the intermittent portion of this reach.

Abbreviated Abstract

With the recent listing of spring chinook, steelhead and bull trout in the Methow Basin, much focus is being directed towards habitat protection and restoration projects. A 10 mile reach of the upper Methow River naturally becomes intermittent most years in the late fall and winter months. Little is known pertaining to juvenile salmonid productivity and life history within the upper Methow River. This lack of knowledge makes it difficult to clearly define the biological benefits to salmonids for projects being proposed in this reach. The goal of this study is to better understand salmonid life histories and production in the upper Methow in order to propose projects that will best address the biological needs of listed salmonids residing in the upper Methow River.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
23012	Arrowleaf/Methow River Conservation Project	The Arrowleaf property exists within the study reach (Lost River-Hancock Springs).
23024	Hancock Springs Passage and Habitat Restoration Improvements	The spring enters the Methow River 3-4 river miles below the lower most portion of the intermittent reach.

Relationship to Existing Goals, Objectives and Strategies

The value of the proposed study is to provide a basic understanding of the life history patterns for salmonids utilizing the upper Methow River in the intermittent reach, so that the biological benefits from proposed projects can be better assessed. It will also guide those in the basin who are looking to propose habitat protection and restoration projects to maximize the benefit to salmonids for the dollars invested. There are at least two groups, the Methow Salmon Recovery Foundation and the Methow Nature Conservancy in the Methow Basin currently seeking and implementing habitat protection and restoration projects within the basin. The knowledge gained from this study will be useful to these local groups and others. The Methow Subbasin Summary (Foster 2001) in the Fish Needs section states the need for this type of a study. The stated fish needs are presented as needs for the entire basin; however, this proposed study would focus strictly on the upper Methow River. This study would address the upper Methow data gap issues such as-carrying capacity, the relationship of fish abundance to groundwater discharge, and how the

various salmonid species are utilizing the different types of habitat components throughout their freshwater life history. In addition, information from this study would be useful for an EDT analysis (which is being proposed).

Review Comments

NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$273,710 Category: Recommended Action	$210,166 Category: Recommended Action	$215,213 Category: Recommended Action

Project: 29036 – Ali Long Rearing Channel Habitat Improvements- Upper Methow River

Sponsor: Yakama Nation (YN)

Short Description:

Reconnect a historic side channel in the upper Methow River, and addition of in-channel structure as needed to increase channel complexity.

Abbreviated Abstract

The Ali Long side channel is located on the upper Methow River at river mile 69. The channel is located within the reach of the Methow River that naturally becomes intermittent most years during the late fall and winter months. Side channel is approximately one mile in length and the channel width varies between 5 to 20 feet. The channel is protected from future development through an easement agreement with the landowners. The side channel is situated in a cottonwood and ponderosa gallery within the floodplain. The lower portion of the main channel has several lateral channels that diverge off the main channel. The side channel is currently disconnected from the Methow River mainstem. This appears to be the result of gradual down cutting of the main channel at the inlet and because of a dike at the outlet.

The project involves reconnecting the side channel by removing the gravel plug at the inlet and removal of the dike at the outlet to reestablish flow connectivity. Additional instream structure (most likely LWD) will be added throughout the channel as needed (some structure exists). This will provide an immediate benefit to channel complexity, as well as, provide a physical mechanism to catch future LWD during high flow events. Interpretive signage will be placed the length of the channel, which to a large extent parallels the trail system.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
23012	Arrowleaf/Methow River Conservation Project	Proposed project is located within the Arrowleaf property.
23024	Hancock Springs Passage and Habitat Restoration Improvements	No direct linkage, however, the proposed project is located approximately 11 river miles downstream and has similar objects to provide additional off-channel rearing habitat.

Relationship to Existing Goals, Objectives and Strategies

The objective of this project is to, 1) increase floodplain conveyance and 2) provide off-channel habitat for newly emergent spring chinook and steelhead fry in the spring and summer months.

Given our current limited understanding of the temporal and spatial life history patterns for all salmonids residing in the upper Methow River, the absolute significance of this project is towards increasing floodplain function. We know that the consequences of floodplain restriction at a specific location in a river system will be expressed (usually downstream) as negative impact to channel stability as that increased hydrological energy is released. Presently it is difficult to describe the importance this additional side channel habitat might provide to salmonids because it is located within that portion of the Methow River that frequently de-waters each fall/winter. However, newly emergent spring chinook fry have been observed rearing in these off-channel habitat types in the upper Methow during the peak runoff period (Hubble pers. comm. 1998). An EDT analysis is needed to elucidate the biological benefit to salmonids for these types of intermittent side channels.

As stated in Subsection b, reconnection of existing side channels is one of the stated strategies in the Methow Subbasin Summary to provide a more normative floodplain function. Loss of side channel habitat in the Lost River to Winthrop reach primarily from diking is identified in the Methow Subbasin Summary (Foster 2001) as an impact to fish habitat quality. This project addresses to varying degrees several habitat objectives listed in section 7.6 of the 1994 FWP. These are:

- Sedimentation by reducing stream bank scour through increased flood conveyance;
- Bank Stability by increasing flood conveyance;
- Water Quality by increasing bank storage during spring run-off;
- LWD retention within the side channel resulting in increased nutrient and sediment storage; and
- Stream Morphology by increasing channel complexity.

Review Comments

The reviewers expressed concern about dewatering in some years. NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$58,000 Category: Recommended Action	$12,250 Category: Recommended Action	$6,250 Category: Recommended Action

Project: 29038 – Supplement Summer Steelhead Eightmile Creek/Chewuch River

Sponsor: Methow Salmon Recovery Foundation

Short Description:

Develop a "natural" acclimation/rearing site on Eightmile Creek to supplement native fish stocks.

Abbreviated Abstract

The project includes the design and re-development of existing ponds on the Mason property on Eightmile Creek and will expand the present use to include acclimation for endangered summer steelhead. A new “natural” outfall connection from the last pond to Eightmile Creek will be constructed to replace the piped outfall connection in place and utilized in past acclimation efforts on this site. The existing irrigation canal will provide water for the ponds and outfall channel, however, a supplemental well will be installed to accommodate “mix water” and to allow for filling the pond in early spring (non-consumptive).

Additional control structures between ponds will be designed to address water supply and water balancing between the ponds and the outflow channel. Alarm and feeding systems will be installed prior to the introduction of steelhead pre-smolts for acclimation. Personnel, from Washington Department of Fish and Wildlife Methow Hatchery Program (Winthrop Facility) will be the primary operator of the facility with steelhead pre-smolts supplied from the Wells Dam Hatchery. A long term operating agreement has been discussed and tentatively reached with the landowner and will be finalized once funding is secure.

It is anticipated that design and permitting efforts will occur late 2002 and early 2003 with construction of the water supply system, pond re-development, and outfall connection revisions occurring in late 2003 when water table and stream levels are low. The first opportunity anticipated to acclimate steelhead pre-smolts would be March 2004. The maximum number of fish anticipated for this facility is 25,000 annually.

This supplementation project targets endangered summer steelhead and is envisioned to “sunset” at a time when the naturally produced population becomes self-sustaining. When acclimation ceases, it is anticipated that the pond and associated components convert to long term off channel and over-wintering habitat for natural fish populations.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
9604000	Mid-Columbia Coho Feasibility Reintroduction Study- gather data to develop and implement a plan to restore coho to the Methow	Provides potential long-term acclimation facility for the program. This site has been utilized for the coho program in past years.
	Mid-Columbia River Hatchery Program	Provides additional facility to contribute to the recovery of naturally spawning populations
	WDFW/ Wells Hatchery Steelhead Program	Provides satellite acclimation facility to assist in maintaining supplementation programs and provide for improved distribution. Provides summer steelhead site to facilitate on-going and future studies.
9026	Respect the River	Provides additional information for public education on recovery options

Relationship to Existing Goals, Objectives and Strategies

2000 Fish and Wildlife Program

The Vision Statement for the 2000 Fish and Wildlife Program states:
"The vision for this 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 the benefits from fish and wildlife valued by the people of the region. This ecosystem provides abundant opportunities for tribal trust and treaty right harvest and for non- tribal harvest and the conditions that allow for the recovery of the fish and wildlife affected by the operation of the hydrosystem and listed under the Endangered Species Act."

The Vision Statement further indicates:
"Wherever feasible, this program will be accomplished by protecting and restoring the natural ecological functions, habitats, and biological diversity of the Columbia River Basin. In those places where this is not feasible, other methods that are compatible with naturally reproducing fish and wildlife populations will be used. Where impacts have irrevocably changed the ecosystem, the program will protect and enhance the habitat and species assemblages compatible with the altered ecosystem. Actions taken under this program must be cost-effective and consistent with an adequate, efficient, economical and reliable electrical power supply."

The proposed project will:
1) Mitigate for hydropower affects
2) Enhance wild production by providing a “natural rearing” facility.
3) Assist in the recovery of two Columbia Basin ESU's listed as Endangered under ESA and one DPS listed as Threatened.

4) Upon recovery, ultimately lead to both tribal and non-tribal harvest opportunities, and
5) Is cost-effective due to ability to utilize a site with out need for acquisition.

Meets criteria identified in the strategy section of the 2000 Columbia River Basin Fish and Wildlife Programs compromised habitat section:
"Where the habitat for a target population is absent or substantially diminished and cannot reasonably be fully restored, then the biological objective for that habitat will depend on the biological potential of the target species. The objective also is to restore the population of the target species up to the sustainable capacity of the restored habitat. Sustained supplementation in a limited fashion is a possible policy choice in this instance".

- Objective 1; Recover ESA listed upper Columbia spring chinook salmon and summer steelhead trout in the Methow Subbasin to a level that supports a harvestable surplus.
- Strategy 1. Determine adult to adult and smolt to adult return rate for naturally and hatchery produced fish.
- Strategy 3. Enlarge existing hatchery facilities and construct additional facilities to increase effectiveness, not through quantity but through quality, of the hatchery programs to supplement natural production.
- Strategy 8. Use only locally adapted brood fish for artificial production.
- Strategy 10. Design and implement shared monitoring and evaluation goals and objectives specific to the upper Columbia River steelhead artificial production program.
- Strategy 11. Develop new and modify existing acclimation facilities to improve distribution of spawners at return and reduce point source impact of direct plants (Upper Methow, Early Winters, upper Chewuch, upper Twisp and Lost rivers).
- Strategy 13. Maintain supplementation programs for spring chinook and summer steelhead.

Meets criteria identified in the Subbasin Summary (Research, Monitoring and Evaluation -WDFW)

The recovery and enhancement activities for summer steelhead in the Methow Subbasin involve adult supplementation using a single broodstock source derived from steelhead stock endemic to the Methow and Okanogan rivers. Adult supplementation programs, like most hatchery programs require evaluation to help minimize impacts to natural populations and to assess the efficacy of the production activities toward recovery and enhancement. Evaluation, research and monitoring efforts will include:

- Estimating the reproductive potential of hatchery and wild steelhead in the natural environment.
- Evaluating the migration preparedness of smolts released into the Methow River and providing an assessment of volitional releases versus scatter planting.
- Assessing the need and the feasibility of developing a broodstock collection location on the Methow River in an effort to maintain and enhance local tributary stock attributes

- Determining the natural cohort replacement rate for steelhead in the Methow Subbasin.

This project provides the site to facilitate studies identified in the Methow Subbasin Summary and provides the only identified site available on Eightmile Creek. This satellite acclimation facility assists in maintaining ongoing supplementation programs and provides for improved distribution of summer steelhead in the basin.

Meets criteria identified in the National Marine Fisheries Service 2000 FCRPS Biological Opinion RPA's:
RPA #184; The action agencies and NMFS shall work within regional prioritization and congressional appropriation processes to establish and provide the appropriate level of FCRPS funding for a hatchery research, monitoring, an devaluation program consisting of studies to determine whether hatchery reforms reduce the risk of extinction for Columbia River basin salmonids and whether conservation hatcheries contribute to recovery.

This project provides a Chewuch subbasin site and appropriate habitat conditions to study these approaches to recovery. Natural rearing protocol will be followed. Habitat design, enhancement measures, and facility operations will be consistent with "Natural Rearing" approaches. Features of natural rearing system include;

- Natural substrate materials, such as sand and gravel. A mix of such materials is preferred, so that there is complex substrate habitat.
- Substrate materials will be roughly the same color as natural background colors. This allows fish to behaviorally and physically (pigments) adapt to natural conditions.
- In water structures, such as large woody debris or tree branches.
- Overhead cover and shade will be retained during pond construction
- Predator avoidance training. This includes undertaking feeding in a manner that does not allow fish to associate human activities or other external/surface activities with food supply
- Using underwater feeding equipment. This assists in training fish to search for food where it is naturally produced, in training fish to avoid the surface where they would be more prone to predation by avian predators.
- Additionally, plastic rings that have been strung with camouflage netting will be floated on the ponds. These hoops will assist in predator control, as well as enhancing physical habitat traits that are consistent with the natural rearing concept.
- In addition, a Hatchery Genetics Management Plan (HGMP) will be developed for this program, consistent with NMFS criteria.

Review Comments

Need more definitive data to be sure project will succeed. The hatchery programs in the Methow are currently undergoing evalutaiton and potentially restructureing. The PUD hatchery committee will be organizing and planning in the near future. The BOR hatchery program is considering moving towards supplementation, but decisions have not been made. This project may be ahead of those efforts and cannot be tied to specific planning

documents at this time. This project may be a key element in the future, but at this time that cannot be determined.

Budget

FY2003	FY2004	FY2005
$205,000 Category: Recommended Action	$5,000 Category: Recommended Action	$5,000 Category: Recommended Action

Project: 29044 – Protecting Habitat on Private Lands in the Methow Watershed

Sponsor: Methow Conservancy

Short Description:

Protect and provide long-term stewardship of habitat on private lands in the Methow Watershed through the use of perpetual conservation easements

Abbreviated Abstract

The Methow Conservancy is committed to protecting critical habitat for fish and wildlife in the Methow watershed through perpetual conservation easements on private lands. In order to ensure the greatest protection for fish and wildlife across political and ownership boundaries, the Methow Conservancy works collaboratively between private landowners and public agencies, and has invested a significant amount in local conservation outreach and education projects. All three aspects of the Methow Conservancy's work (easements, education and collaboration) are represented in this proposed project. The Methow Conservancy has proven its capacity to protect critical habitat in the Methow Valley with its past Riparian Habitat Protection Project success, and was awarded the WDFW Organization of the Year Award for 2001. Funding for the proposed project will allow the Methow Conservancy to protect an unprecedented amount of fish and wildlife habitat with conservation easements in the Methow Valley.

Conservation easements are growing in popularity and familiarity in the Methow Valley, and the Methow Conservation Easement Project will help to build on the growing success of conservation easements as a voluntary, collaborative, effective and legally binding method for long term land protection. In addition, all conservation easements have a baseline assessment, a stewardship plan and an annual monitoring commitment that the Methow Conservancy must continue into the foreseeable future.

While conservation easements are an important land protection tool, all conservation easements are not created equal. Many of the past watershed assessments (Limiting Factors Analysis, Subbasin Summary, USFS Watershed Analyses) have identified critical areas for fish, and others (WDFW Priority Habitats Analysis, DNR Natural Heritage Program) have identified critical areas for wildlife. The areas where the greatest population pressure occurs (in the lower portions of each stream reach) are also often the areas of greatest importance to wildlife and at the greatest risk of fragmentation by roads and development. It is important to both identify and prioritize protection of these critical crossroads between people and wildlife.

In the Methow Basin, only 10% of the total land in the Valley is privately owned, but 40% of the riparian habitat is privately owned. Thus, while private landowners are a small minority in the total Valley ownership, they impact a significant amount of critical habitat for riparian species, and they determine the degree of connectivity between upland and lowland habitats.

With a firm basis in collaborative participation from several key agencies (the Nature Conservancy, the Washington Department of Fish and Wildlife, other stakeholders) this Project will help to strategically balance resources between various conservation opportunities and leverage conservation dollars from both private donors and government agencies to ensure protection of the greatest amount of contiguous, biologically important habitat in the Methow Valley. Because this project combines a strategic and scientific foundation to land protection with conservation easement protection, it has the potential to permanently and significantly affect how wildlife, fish and people coexist in the Methow Valley.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
9208200	Eastern Washington Landowners Adopt-Stream	Complimentary and mutually supportive
199603401	Methow Irrigation District/Yakama Nation Conservation Alternatives	Complimentary and mutually supportive
199802500	Early Winters Creek Habitat Restoration	Complimentary and mutually supportive
199802900	Goat Creek Instream Habitat Restoration	Complimentary and mutually supportive
9026	Respect the River (USFS)	Complimentary and mutually supportive
200103700	Arrowleaf Conservation Easement	Complimentary and mutually supportive
23024	Hancock Creek Passage and Habitat Restoration	Complimentary and mutually supportive

Relationship to Existing Goals, Objectives and Strategies

The Methow Conservation Easements Project closely matches many of the National Marine Fisheries Service's relevant and prudent action (RPA) recommendations for the Columbia Basin. The RPA's that the Methow Conservation Easement Project specifically addresses include:

150 In subbasins with listed salmon and steelhead, BPA shall fund protection of currently productive non-Federal habitat, especially if at risk of being degraded, in accordance with criteria and priorities BPA and NMFS will develop by June 1, 2001.

152 The Action Agencies shall coordinate their efforts and support offsite habitat enhancement measures undertaken by other Federal agencies, states, Tribes, and local governments by:

- Sharing technical expertise and training with Federal, state, Tribal, regional, and local entities (such as watershed councils or private landowners).

- Using or building on existing data management structures, so all agencies will share water quality and habitat, data, databases, data management, and quality assurance.
- Leveraging funding resources through cooperative projects, agreements and policy development (e.g., cooperation on a whole-river temperature or water quality monitoring or modeling project).

153 BPA shall, working with agricultural incentive programs such as the Conservation Reserve Enhancement Program, negotiate and fund long-term protection for 100 miles of riparian buffers per year in accordance with criteria BPA and NMFS will develop by June 1, 2001.

154 BPA shall work with the NWPPC to ensure development and updating of subbasin assessments and plans; match state and local funding for coordinated development of watershed assessments and plans; and help fund technical support for subbasin and watershed plan implementation from 2001 to 2006. Planning for priority subbasins should be completed by the 2003 check-in. The action agencies will work with other Federal agencies to ensure that subbasin and watershed assessments and plans are coordinated across non-Federal and Federal land ownership and programs.

This project represents a relatively novel approach, where a land trust (the Methow Conservancy) will serve as a bridge for land protection between many agencies and individuals. Because of the landscape-scale conservation planning aspects of this project, the Methow Conservancy envisions its role as a hub-of-the-wheel, where many of the individual restoration and monitoring projects serving the NMFS RPA's for the Methow Valley will be recognized, and the various entities will find a local context through which to coordinate individual habitat protection work.

In addition to protecting important habitat for salmonid fish, the proposed project has the potential to proactively protect and enhance habitat for numerous WDFW Priority Species. Habitat protection for species such as the Prairie Falcon, Ferruginous Hawk, Lark Sparrow, Burrowing Owl, Townsend's Big-Eared Bat and Sharp-tailed Grouse will occur as an additional benefit from the conservation easements and planning of the proposed project.

Review Comments

Proposal lacks detail necessary for through technical review (how will properties be selected?) Monitoring and evaluation is inadequate and need is questionable. Riparian and salmon habitats are the same thing and would not need separate easements. This project received $424,900 from the Washington Salmon Recovery Funding Board funding for 2002. CBFWA supports this project at a reduced rate. The budget has been modified to reflect a reduced rate of implementation of $75,000 per year. NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$200,000 Category: High Priority	$200,000 Category: High Priority	$200,000 Category: High Priority

Project: 29046 – Develop a Coordinated Resource Management Plan for Beaver Creek and plan and implement habitat restoration activities

Sponsor: Okanogan Conservation District

Short Description:

Develop a Coordinated Resource Management Plan for the Beaver Creek drainage; restore habitat complexity; protect and restore riparian habitat; and research alternatives for ensuring perennial flow in lower Beaver Creek

Abbreviated Abstract

A Coordinated Resource Management Plan (CRMP) in the Beaver Creek basin will be designed over the next three years and data gathering and habitat restoration measures will be implemented. Coordinated Resource Management is a planning and problem-solving tool that helps landowners and government agencies identify and address fish and wildlife habitat concerns on private lands. The Beaver Creek CRMP will address fish passage and instream flow, and aquatic and riparian habitat conditions. The CRMP will also help landowners preserve the rural character of the Beaver drainage and practice stewardship of their land.

Year 1 will emphasize data gathering and identification of data gaps, restoration prioritization, and public outreach to landowners. Fencing on Frazer Creek will be planned and implemented, a monitoring pilot plan will be developed, and the Bureau of Reclamation (BOR) will assess options for restoring year-round flow to the lower Beaver Creek. The BOR is taking a leadership role in addressing instream flow concerns, and will provide technical and field support to develop and implement a flow restoration plan for Beaver Creek. Options include increasing storage, upgrading irrigation systems, improved on-farm water management, conversion to wells, and pump exchange from the Methow River. Three gaging stations will be installed in Beaver and Frazer Creeks to support the BOR actions, and to address the need for long term flow data throughout the Methow Basin.

In Year 2, data gaps will be addressed, either directly, or through coordination with other projects in the basin. A pilot monitoring plan drafted in Year 1 will be implemented.

In Year 3, a draft CRM plan will be completed, and a long term monitoring and evaluation plan will be developed based on the results of the pilot plan. Action items in the CRM will be implemented as funding allows.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
9604200	Restore and enhance anadromous fish populations & habitat in Salmon Creek	Support. The Salmon Creek project is addressing similar habitat and water use conditions and as exist in Beaver Creek
9704900	Teanaway instream flow restoration	Support. The Teanaway Creek project addresses similar habitat and water use

Project ID	Title	Nature of Relationship
		conditions as exist in Beaver Creek.
25021	Teanaway: Implement actions to reduce water temps and meet water quality standards	Support. The Teanaway Creek project addresses similar habitat and water use conditions as exist in Beaver Creek.
198710001	Enhance Umatilla River Basin Anadromous Fish Habitat	Support. The Umatilla project addresses similar habitat and water use conditions as exist in Beaver Creek.
	Barrier Removal (WDFW proposal to BPA)	Complement. Barrier removal on Beaver Creek will further the goal of improving fish habitat conditions in Beaver Creek.
	State Campground fencing (OCD proposal to BPA)	Complement. Riparian protection at the state campground on Beaver Creek will further the goal of improving fish habitat conditions in Beaver Creek.
	Provide Analytical Foundation for Columbia Cascade Subbasin Plans - EDT analysis (WDFW proposal to BPA)	Complement. The Beaver Creek proposed project will make use of data collected and analyzed for EDT. The Beaver Ck proposed project will also provide data to the EDT effort.

Relationship to Existing Goals, Objectives and Strategies

The Beaver Creek CRMP and habitat restoration will help to meet the following goals and objectives:

2000 Columbia River Fish and Wildlife Plan

- Restore the widest possible set of healthy naturally reproducing populations of salmon and steelhead in each relevant province by 2012.
- Take action to reintroduce anadromous fish into blocked areas, where feasible.
- Maintain and restore healthy ecosystems and watersheds
- Protect and restore freshwater habitat for all life history stages of the key species. Protect and increase ecological connectivity between aquatic areas, riparian zones, floodplains, and uplands.
- Allow patterns of water flow to move more than at present toward the natural hydrographic pattern in terms of quantity, quality, and fluctuation.
- Enhance the natural expression of biological diversity in salmon and steelhead populations to accommodate mortality and environmental variability in the ocean.

Methow Subbasin Summary

- Restore and maintain normative biological and physical processes such that healthy indigenous populations of aquatic and terrestrial species can sustain themselves over the long-term.
- Protect intact healthy habitat and restore habitat connectivity and overall habitat quality in degraded areas.
- Maintain the ecological function and associated biodiversity of deciduous riparian forest within the Subbasin.

- Collect hydrologic data throughout the basin over periods spanning a range of climatic conditions.

Wy-Kan-Ush-Mi- W-Kish-Wit, Spirit of Salmon, Volume 1, Yakama Nation

- Restore anadromous fishes to the rivers and streams that support the historical, cultural and economic practices of the tribes
- Reclaim the anadromous fish resource and environment on which it depends for future generations.

DRAFT Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region

- Allow unrestricted stream channel migration, complexity, and flood plain function
- Protect existing stream flows in order to maintain biological productivity.

Funding this project will provide landowners and agencies in the Beaver drainage with a forum to identify, prioritize, and implement restoration and protection efforts in order to achieve the above goals. The CRM will facilitate long term water use management and habitat and flow restoration projects in Beaver Creek through cooperation between state and federal agencies, tribes, and private land owners. The CRMP engages willing landowners motivated to improve both on-farm efficiency and fish and wildlife habitat conditions. The CRM will act as a liaison in this effort between landowners, tribes, and state and federal agencies.

The project will help to meet the above goals to restore anadromous fish populations in the region; as well goals aimed at removing passage barriers. This will occur through cooperative efforts with BOR to assess options for instream flow restoration. In addition, riparian restoration will improve habitat conditions, which will improve steelhead reproductive success in the Beaver drainage.

Three of the documents above list increased habitat connectivity and complexity among their objectives. This project will help to meet these objectives by addressing instream flow concerns in lower Beaver Creek, as well as by restoring and protecting riparian and aquatic habitat.

An early action fencing project on Frazer Creek will meet the Methow Subbasin Summary (MSS) objective to protect deciduous riparian forest from livestock grazing. Installation and maintenance of 3 stream gage stations in the lower Beaver drainage will address the need stated in the MSS for long term hydrologic data in the Methow basin. The subbasin summary also outlines several strategies for habitat restoration on National Forest lands in the Beaver. The CRMP provides a vehicle for interagency collaboration to implement these strategies.

Review Comments

NMFS has identified this project as a BiOp project. Due to WA SRFB funding, the project sponsor has requested that the budget for 2003 be reduced by $27,325 (1/3 FTE = $20,000, 3 pressure transducers = $6,500, and office space rental = $825). The total FY 2003 project cost of $51,783 has been reduced to $24,458 accordingly.

Budget

FY2003	FY2004	FY2005
$24,458 Category: Recommended Action	$21,000 Category: Recommended Action	$26,000 Category: Recommended Action

Research, Monitoring and Evaluation Activities

New proposals in the Methow Subbasin include the following research, monitoring, and evaluation activities:

Project 29002 will:

- Monitor habitat conditions between Goat Creek and Winthrop during and after flow augmentation to evaluate the optimal operational parameters and evaluate seasonal and long-term benefits of augmentation.
  Pilot groundwater monitoring will include:
  - Discharge rate and pumping levels in the CURE well;
  - Water-levels in nearby wells;
  - Field water quality of the discharged water (temperature, pH, specific conductance, turbidity, dissolved oxygen); and
  - Water quality sampling for major ions, metals, and nutrients.

  Surface water monitoring will include:
  - Field water quality (temperature, pH, specific conductance, turbidity, dissolved oxygen);
  - Flows at three gaging stations (Weeman Bridge, and two downstream locations); and
  - Water quality sampling for major ions, metals, and nutrients.

Project 29006 will:

- Evaluate the performance and attributes of the facility. A daily log will be utilized detailing water quality standards and environmental conditions of the facility as well as costs associated with the ongoing operations. Standard fish health and growth parameters will be monitored and recorded. Following the release of all fish, an annual report will be prepared detailing the performance of the facility.
- Assess out-migration with results expected to be collected at Rocky Reach, Rock Island, McNary, John Day, and Bonneville dams. Data will be used to verify out-migration success and timing. Collaboration with other concurrent spring Chinook PIT tagging programs will be explored.
- Assess Adult Returns (Years 3 and beyond). Adult recovery will be the primary tool used to assess the program. Adult recoveries will be primarily at Wells Dam (adult detection system). PIT tag recovery data will be automatically incorporated into the PIT Tag Information System (PTAGIS) maintained by the Pacific States Marine Fisheries Commission.

Project 29010 will:

- Assess fish passage at new structures annually and document site using fixed point photo analysis.
- Conduct snorkeling and/or spawner surveys to confirm fish presence about and below former site of barriers
- Assess fish passage at all project sites on a bi-annual basis based on guidelines described in the WDFW, "Fish Passage Barrier And Surface Water Diversion Screening Assessment and Prioritization Manual."
- Conduct snorkeling/spawner surveys to confirm salmonid presence and to verify success of the project.

Project 29012 will:

- Evaluate pre-project use of site by a) Capturing, marking and determining species distribution/abundance, growth and survival rates of juvenile salmonids using the existing diversion channel prior to project; b) Capturing, marking and determining species distribution/abundance, growth and survival rates of juvenile salmonids using the connected and enhanced side channel habitat after project completion; and c) measuring water quality parameters, changes in distribution and abundance of invertebrates, fish, amphibians, pre and post project.
- Evaluate fish use of the restored side channel in years two and three.

Project 29018 will:

- Conduct seepage runs along the Methow, Twisp, and Chewuch Rivers. Reaches with large exchanges between ground and surface waters (gains and losses in river flow) will be identified using a series of simultaneous discharge measurements or seepage runs. Seepage runs will be conducted during low-flow periods in the autumn, winter, early spring, and late summer. During each seepage run, discharge measurements will be made approximately every 2 to 10 km along perennially flowing reaches of the Methow, Twisp, and Chewuch Rivers and at the mouths of major tributaries.
- Water temperature will be measured continuously at selected points in the Methow, Twisp, and Chewuch Rivers, with an emphasis on gaining reaches or other areas with strong thermal gradients (where temperature varies significantly along a reach). Water temperature data collected by other organizations (for example, U.S. Forest Service and Pacific Watershed Institute) will be incorporated in the analysis.

Project 29030 will:

- Monitor differential survival of juvenile spring chinook salmon and steelhead in relation to habitat quality and quantity.
- Perform bi-weekly surveys of the behavior of juvenile spring chinook salmon and steelhead during the late fall/winter period. Observe habitat positions and quantify habitat use, availability and selection.
- Utilize videography to determine habitat use and availability.
- Monitor behavior of fish both during snorkeling and by videography.
- Identify fish individually during snorkeling surveys, to assess movement and site fidelity.

- Habitat use and availability data will be transformed into suitability curves which can be used in determining instream flow needs for fish.
- Identify and quantify distinct habitat types.
- Quantify the extent and thermal properties of warm groundwater areas
- During the first year groundwater will be quantified spatially.
- In the second and third year of the study relationships between groundwater discharge and fish survival or site fidelity will be examined further using the information gathered during the first field season.

Project 29031 will:

- Assess habitat conditions for salmonids below the MVID West diversion.
- Assess salmonid usage in the study reach.

Project 29034 will:

- Monitor two rotary traps within the Lost River-Hancock Springs reach. The upper trap will be located in the lowermost section of the dewatered reach (near Boulder Creek), while the lower trap will be located in the vicinity of Hancock Springs.
- Enumerate the number of juvenile spring chinook captured at the upper trap from the time of emergence in the spring to when the reach becomes intermittent.
- Mark fish captured in the upper trap for potential recapture at the lower trap.
- Conduct monthly surveys of the reach from March through October.
- Conduct daily surveys of the reach at the onset of intermittent conditions until the reach becomes completely intermittent (mid-September through mid-November).
- In the late fall as intermittent conditions become eminent in the Lost River-Hancock Springs reach radio tag five fish per week (up to 15 fish). The approximate tag life is 10-14 days. Track these fish from the time of tagging through the reach. Determine the utility of this methodology to better understand and quantify the outmigration of juvenile salmonids in the intermittent reach. If proven useful this research tool will be incorporated into the FY 2004 and 2005 fieldwork.

Project 29036 will:

- Conduct a geomorphologic-hydrological assessment of the side channel and adjacent main channel.
- Monitor and evaluate project the project in terms of usage by fish and changes in channel formation of the side channel.
- Conduct spawner surveys for spring chinook, steelhead and bulltrout.
- Assess general macro-habitat conditions for salmonids in the side channel.
- Re-survey transect use in the initial geomorphological-hydrological assessment (FY04 and FY07).

Project 29037 will:

- Characterize the physical environment for each subbasin under the historic (pre-European) and current reference conditions.

- Identify, by using the EDT model, key habitat factors hypothesized to limit the potential production of indicator species (chinook salmon and steelhead in all subbasins, including coho salmon in the Wenatchee) in each subbasin.
- Develop a working hypothesis regarding the condition and processes affecting the ecosystem within each subbasin and identify alternative management strategies to protect, or restore to, healthy aquatic and riparian characteristics.
- Identify potential Alternative Management Strategies and estimate, using the EDT model, changes in the carrying capacity, species productivity, and habitat diversity of indicator species (associated with reference conditions in each subbasin).
- Evaluate and describe expected Costs, Benefits and Risks for potential Alternative Management Strategies relative to attainment of subbasin goals towards salmonid recovery.
- Using information derived from the EDT evaluation and other available information (State 2514 process, NMFS Technical Review Team findings, etc.) identify a preferred Management Strategy for each subbasin and highly refine the Cost, Benefit and Risk assessment for potential site-specific projects consistent with a prioritized strategy.
- Develop a preferred Subbasin Management Strategy, for each subbasin, that will best attain stated long-term goals and objectives towards protection and restoration of aquatic/riparian resources.

Project 29038 will:

- Evaluate the performance and attributes of the facility.
- Assess Juvenile Out-migration (Years 2 and beyond).
- Assess Adult Returns (Years 3 and beyond)

Project 29044 will:

- Monitor conservation easement compliance and keep landowners informed using annual monitoring, photopoints, special surveys and mapping that are part of the standard Methow Conservancy conservation easement process.
- Continuously update conservation easement landowners about conservation or restoration funding opportunities, natural history and community-based conservation projects.

Project 29046 will:

- Support the BOR in their assessment of options to reestablish flow in lower Beaver Creek. Monitor and evaluate changes in fish populations and aquatic and riparian habitat in the long term. A pilot plan, will be designed in 2003, and will involve the tribes and agencies. The plan will be implemented and results reported in 2004. A long-term monitoring and evaluation plan will be developed in 2005 based on the results of the pilot plan. The long-term monitoring and evaluation plan will be implemented in 2006.

Needed Future Actions

While the current suite of proposed projects provides a start in addressing long-overdue mitigation and restoration activities and related funding shortfalls, there is a need for an ongoing and concerted commitment by federal, state and local agencies, as well as citizens, non-profit organizations, and community groups, to develop, fund and implement high quality restoration and mitigation projects throughout the Methow Subbasin. In addition, there is a great deal of research, monitoring and evaluation work that is urgently needed in this region. Following is a brief summary of some of the key actions that are needed in the near future.

Management tools that predict the effect of land-use practices on streamflow temperatures in the Methow Subbasin are needed. Research and monitoring programs to determine the extent of structural changes to stream channels and floodplains in the Methow Subbasin and assess the effect of these changes on geomorphic processes (channel migration) and aquatic habitats is necessary to designing and implementing effective future restoration and planning activities. Additionally, knowing the effects of different forest management practices on the timing and amounts of water and sediment yields in streams would minimize potential adverse impacts and increase potential benefits to salmonid habitat in the basin.

There is still a great deal of conflicting information about actual water use in the Methow Subbasin. An assessment of agricultural use including water rights, claim and certificates and actual acreage of irrigated land, as well as municipal, industrial and domestic water use is needed. Additional assessments regarding the potential and actual water use benefits of converting the Methow Subbasin open ditch irrigation systems to closed systems is also needed.

There is a need to develop base information regarding the current and historical anadromous carrying capacity of the Methow Subbasin. An analysis of anadromous carrying capacity for the Methow Subbasin in its current state correlated with historical carrying capacity drawn from review of historic literature, reports, and archived documents would provide valuable data for current fish and wildlife managers. Additionally, insufficient data exists regarding the relationship between fish abundance and ground water discharge. Documentation of the chronology of human activities and environmental factors like drought with fish abundance to establish a cause and effect continuum would provide valuable planning information. Insufficient information exists about the habitat preferences, spawn location, recruitment and abundance trends for Mountain Whitefish in the Methow Subbasin. Insufficient information exists in the Methow Subbasin regarding over-winter ecology and fish abundance.

There is a need for research, monitoring and evaluation projects to: determine carrying capacity of existing habitat and further define limiting factors; track adult return and spawning to quantify productivity of hatchery and natural stocks; provide stock status reports every 5-years and re-assess management direction and strategies every 10-years to assist in implementing a management plan consistent with current data analysis and population response; examine inter and intra-specific species interactions involving natural production coho cohorts and determine potential impacts to summer chinook in the Methow Subbasin and the mainstem Columbia River. There is also a remaining need to develop and implement a network hatchery database for all state, tribal and federal

hatchery facilities in the mid-Columbia region. There is also a need for monitoring of fluvial/adfluvial emigration from the Methow River and associated tributaries, genetic analysis of the existing bull trout population to determine the Subbasin linkages, and quantifications of distribution of bull trout in the Methow Subbasin.

While some of the project proposals included in the projects recommended by the provincial group for funding include wildlife components, in general, the attention to wildlife needs in the subbasin is inadequate. Many wildlife needs remain substantially unmet within the current suite of proposed projects. For instance, there is a pressing need for projects that restore native species in shrub-steppe habitat, projects to reintroduce fire to shrub-steppe and dry conifer forest habitat types, and development of programs to control and reduce the spread of noxious weeds within the Methow subbasin. Inventorying, maintaining and developing wildlife corridors within the subbasin and throughout the Cascade Columbia Province as a whole is also an important unmet need. Projects that protect and enhance the last active historical sharp-tailed lek site and surrounding habitat are urgently needed, as are inventories of other potential sharp-tail grouse habitat in the subbasin. Additionally, there is an ongoing need for development of projects that improve forest health and reduce upland erosion such as projects that reduce stocking density of young trees in Ponderosa dominated stands, reduce ORV use on National Forest lands, programs to reduce upland erosion through noxious weed control and proper grazing management, and programs to minimize forage competition between livestock and mule deer on critical seasonal ranges.

There is a need for individuals and agencies involved in the Methow Subbasin to continue to seek means to balance coordination, planning and implementation of recovery and planning efforts amongst tribal, state and local governments; there is a need to continue to seek means of balancing competing demands for limited water resources; there is a need to continue to seek means of maintaining and promoting healthy rural economies, while simultaneously protecting and preserving fish and wildlife habitat and species. There is also a need to develop and encourage approaches that emphasize adaptability, creativity, and patience.

Finally, there is a need to support and reinforce efforts to coordinate with other agencies, provinces and organizations in natural resource management planning (e.g. -- the upcoming subbasin planning efforts, the Washington State 2514 process, TRT subbasin recovery goals, USFS, etc.) in order to achieve the best possible results for the most efficient expenditure of resources. Adequate funding necessary to effectively coordinate, plan, and implement identified strategies and needs is essential to the success of all of these efforts.

Actions by Others

In the Columbia Cascade substantial efforts to coordinate and prioritize recovery, mitigation, evaluation, monitoring and research activities among the County Commissions, state and tribal governments are already underway. The Upper Columbia Salmon Recovery Board is playing a central role in coordinating these efforts and in providing a forum to prioritize and plan within each of the Province's subbasins and across the Province. The Upper Columbia Salmon Recovery Board's mission is *to restore viable and sustainable populations of salmon, steelhead and other at-risk species through the collaborative*

efforts, combined resources, and wise resources, and wise resource management of the Upper Columbia region. There is a need for ongoing support of these efforts at an institutional, organizational, and financial level.

Towards this end, the Upper Columbia Salmon Recovery Board is involved in three major planning and watershed assessment processes within the Columbia Cascade, those include the State's 2514 watershed planning process, the NPPC subbasin planning process, and the National Marine Fisheries Service's Technical Review Team (TRT) process. All three of these efforts directly affect the Methow Subbasin. The mandate of the TRT process is to develop recovery plans for fish species federally listed as endangered. These plans set standards for recovery and outline specific steps necessary to improve a protected population's status to the point where it can be removed from the endangered species list. The State's 2514 process was established in 1998 when the legislature passed the Watershed Management Act. The Act provides a framework for local citizens, interested groups and government organizations to collaboratively identify and solve water-related issues in each of the 62 Water Resource Inventory Areas of the State. This Act enables, but does not require local groups called "planning unites" to form for the purpose of conducting watershed planning. There is a need to effectively coordinate these efforts in order to eliminate duplication of work and to align funding sources and specific funds most effectively with identified strategies and implementation activities. Subbasin planning will play an important role as an umbrella under which to align and coordinate these different efforts. Through this process and others, BPA-funded actions need to be more closely coordinated with the actions of city, county, state, and federal agencies and other organizations that are directed at benefiting fish and wildlife and their habitats. Agencies need to investigate, document, and monitor population trends and develop coordinated recovery plans for high-priority management species and other species that show declining populations.

Developing consensus and support for projects and recovery strategies in the Methow Subbasin will require substantial local and agency participation, negotiation, and commitment. There is a need to develop incentives and strategies to encourage positive, proactive, participation by community members and local governments in promoting and implementing recovery activities. Activities that emphasize and encourage economic viability of local communities while simultaneously facilitating recovery goals are particularly necessary. Achieving these goals requires an ongoing commitment to public education and outreach, as well as coordination with other salmon recovery boards and groups doing recovery work throughout the basin. Public education efforts need to include community groups, schools, tourists, homeowner associations, environmental groups, irrigation districts, and local governments. Education efforts need to be two-way with local citizens and citizen groups, tribes, and state and federal agencies sharing information in both directions. There is also a need to continue efforts that assure the provision of fish and wildlife in sufficient numbers to meet the cultural, spiritual, and subsistence needs of tribal members.

Additionally, local governments and community members, in cooperation with state and tribal governments need to develop long-term strategies for balancing fish and wildlife needs with population growth and real estate development in the Methow subbasin. These entities will also need to work cooperatively with the other subbasins that comprise the

Cascade Columbia Province to develop strategies that promote environmental and economic health throughout the entire Province without threatening or harming the ecology or economy of any one subbasin.

Table 38. Subbasin Summary FY 2003 - Funding Proposal Matrix

Project Proposal ID	*29037	29002	29006	29010	29012	29018	29020	29030	29031	29034	29036	29038	29044	29046
Provincial Team Funding Recommendation	**High Priority**	**Recomm. Action**	**Recomm. Action**	**High Priority**	**High Priority**	**High Priority**	**Recomm. Action**	**Recomm. Action**	**Recomm. Action**	**Recomm. Action**	**Recomm. Action**	**Recomm. Action**	**High Priority**	**Recomm. Action**
Overall Methow Subbasin Objectives														
Objective 1: Protect intact habitat and restore habitat connectivity and overall habitat quality in degraded areas.	x	x		x	x		x		x		x		x	x
Objective 2: Improve instream water quantity and quality with Subbasin.	x	x	x	x	x	x			x				x	
WDFW Spring Chinook and Summer Steelhead Objectives														
Objective 1: Recover ESA listed upper Columbia spring chinook salmon and summer steelhead trout in the Methow Subbasin to a level that supports a harvestable surplus	x	x	x	x	x	x	x	x		x	x	x		
Objective 2: Determine natural smolt production capabilities within the Methow Subbasin.	x							x						
Objective 3: Determine and quantify natural and artificial limitations to natural production.	x							x		x				
Objective 4: Achieve a natural cohort replacement rate of 1.0% or greater for at least five consecutive years.														
Objective 5: Provide adult spawning escapement of 2,212 steelhead to the Methow Subbasin.														
Objective 6: Maintain artificial production programs using locally adapted brood fish to meet recovery, conservation and harvest needs, while mitigating for fish losses from the Columbia River hydropower system.														
Objective 7: Assess the applicability of a captive brood program.														
Objective 8: Maintain the genetic diversity and integrity of the locally adapted stocks that are artificially propagated.														
Objective 9: Minimize impacts of artificial propagation on resident and naturally produced anadromous fish through genetic and fish health monitoring, juvenile rearing and release strategies, and brood collection.														
Objective 10: Determine natural life history characteristics and quantify polymorphism to the extent possible.														
Objective 11: Improve smolt to adult survival in the mainstem migration corridor.			x											
Objective 12: Provide species status report every five years to evaluate effectiveness of vision, with adoption of changes as necessary every ten years.	x													
WDFW Summer Chinook Objectives														
Objective 1: Increase the natural spawning escapement to pre-				x										

Project Proposal ID	*29037	29002	29006	29010	29012	29018	29020	29030	29031	29034	29036	29038	29044	29046
1980 numbers in the Methow Subbasin, consistent with 3,500 adults run past Wells Dam.														
Objective 2: Maintain sport and tribal fisheries, consistent with the protection of endemic naturally produced stocks.			x	x	x									
Objective 3: Maintain artificial production programs that supplement natural production using locally adapted stocks.														
Objective 4: Determine natural production smolt capabilities within the Methow Subbasin.	x							x						
Objective 5: Determine and quantify natural and artificial limitations to natural production.	x									x				
Objective 6: Minimize impacts of artificial propagation on resident and naturally produced anadromous fish through juvenile rearing and release strategies, brood collection and genetic monitoring.														
Objective 7: Improve smolt to adult survival in the mainstem migration corridor.														
Objective 8: Provide species status report every five years to evaluate effectiveness of vision, with adoption of changes as necessary every ten years.	x													
Objective 9: Identify, conserve and monitor life history characteristics of summer chinook salmon, as they relate to juvenile migration pattern and timing.	x													
Objective 10: Maintain and expand evaluation of the artificial production program.														
WDFW Bull Trout Objectives														
Objective 1: Identify, monitor and evaluate resident bull trout populations.	x													
Objective 2: Quantify resident recruit to fluvial and adfluvial populations.														
Objective 3: Quantify and measure available spawning habitat.	x													
Objective 4: Eliminate brook trout populations, and reintroduce bull trout populations in historical reaches where extirpation has occurred (Eightmile and Beaver creeks).				x										
Yakama Nation Coho Objectives														
Objective 1: Determine whether hatchery adults from lower Columbia River brood stock return in increasing numbers to the Wenatchee and Methow basins so that their progeny may be expected to reach replacement, thus significantly limiting the infusion of the lower river hatchery stock, with the long-term goal of eliminating use of the lower river stock altogether.	x													
Objective 2: Begin to develop a locally adapted brood stock, starting with adult returns to Winthrop NFH and Wells Dam in 1999.														
Objective 3: Begin coho releases in areas of low risk to listed species that will be allowed to return as adults to spawn naturally. These areas currently are located in the Wenatchee basin at sites at Chumstick and Brender creeks.														
Objective 4: Study interactions among coho and listed and sensitive species, particularly spring Chinook, steelhead, and bull trout.														
Objective 5: Minimize potential negative interactions among coho and listed and sensitive species.														
Objective 6: Annually evaluate project performance and expand or adapt studies as data indicate is necessary or	x													

Project Proposal ID	*29037	29002	29006	29010	29012	29018	29020	29030	29031	29034	29036	29038	29044	29046
appropriate.														
Wildlife Objectives – Riparian/floodplain														
Objective 1: Maintain the ecological function and associated biodiversity of deciduous riparian forest within the Subbasin.				x			x		x				x	x
Wildlife Objectives – Shrub-steppe														
Objective 1: Halt of reverse loss of shrub-steppe to development and weed invasion.													x	
Objective 2: Evaluate shrub-steppe condition for proper ecological function.	x													
Wildlife Objectives – Dry Forest														
Objective 1: Restore ponderosa pine stands to historical conditions.														
Objective 2: Evaluate forest condition for proper ecological function.	x													
Wildlife Objectives – Mule Deer														
Objective 1: Maintain adequate winter range and unobstructed migration corridors.														
Objective 2: Maintain/improve range condition.														
Objective 3: Maintain healthy herd population parameters.														
Wildlife Objectives - Sharp-tail Grouse														
Objective 1: Provide suitable habitat in three or more blocks of 10,000 or more acres.														
Objective 2: Re-establish a viable sharp-tail grouse population within the Subbasin.														
Wildlife Objectives - Wide-ranging Carnivores														
Objective 1: Identify movement patterns of wide-ranging carnivores to locate preferred travel routes and blockages at the landscape level.														
Objective 2: Prevent habitat fragmentation/isolation.														
Objective 3: Recover viable grizzly bear population in the North Cascades Grizzly Bear Ecosystem.														
Objective 4: Maintain viable, well-distributed lynx population within the Subbasin.														
Objective 5: Maintain and enhance viability of wolverine population within the Subbasin.														
Objective 6: Reestablish viable fisher populations in the Subbasin.														

These projects are referenced by ID above:

*29037 – Ecosystem Diagnosis and Treatment in the Columbia Cascade Province
29002 – Conjunctive Use and River Enhancement (CURE) for Habitat Improvement in the Upper Methow River
29006 – Supplement Spring Chinook in early Winters Methow Creek
29010 – Restore Fish Passage on Private Lands in beaver Creek Drainage to Benefit Spring Chinook, Steelhead and Bulltrout
29012 – Replace Rockview Diversion with Groundwater Withdrawal and Restore Instream Habitat
29018 – Analyze Ground-Water and Surface-Water Exchanges Influencing Anadromous Salmonid Habitat in the Methow River and its Major Tributaries
29020 – Beaver Creek Campground Rehabilitation
29030 – Early Life History and Survival of Spring Chinook Salmon and Steelhead in the Methow River Basin
29034 – Life History Study of Salmonid Rearing in the Upper Methow River
29036 – Ali Long Rearing Channel Habitat Improvements – Upper Methow River
29038 – Supplement Summer Steelhead Eightmile Creek/Chewuch River
29044 – Protecting Habitat on Private Lands in the Methow Watershed
29046 – Develop a Coordinated Resource Management Plan for Beaver Creek and Plan and Implement Habitat Restoration Activities
* Note: Project 29037 encompasses the entire Columbia Cascade Province

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