ABSTRACT

The Umatilla River Basin Anadromous Fish Habitat Enhancement Project continued to identify impacted stream reaches in the upper Umatilla River Basin for habitat improvements during the 1999 project period. Public outreach efforts, biological and physical monitoring, and Geographic Information System databases assisted the project in fostering public cooperation, targeting habitat deficiencies and determining habitat recovery measures.

Habitat enhancement projects continued to be maintained on 37 private properties, two riparian easements were secured, and six new projects implemented to improve anadromous fish habitat and natural fisheries production capabilities in the upper Umatilla River Basin. New project locations included sites on the Umatilla River, McKay Creek, Moonshine Creek, Cottonwood Creek, Mission Creek and Buckaroo Creek. A root wad revetment project was implemented at approximately River Mile 85 on the Umatilla River to stabilize 250 feet of eroding stream bank and improve instream habitat diversity. Habitat enhancements incorporated into this project included one rock vein, one log, four rock barbs and five root wads. A total of 770 yards of fencing was constructed at approximately River Mile 21.5 on McKay Creek to restrict livestock from flood plain and riparian areas. Fish passage improvement projects were implemented at three box culverts traversing Umatilla County Road 900. These projects included construction of six rock weirs downstream of culverts and installation of parking bumpers within culverts to establish a low flow channel, slow high flow velocities, and pass fish in lower Moonshine Creek, Cottonwood Creek and Mission Creek. Fence materials were provided to build approximately 4,224 yards of livestock exclusion fencing between River Mile 1.25 and River Mile 2.6 on Buckaroo Creek. The Tribal Department of Natural Resources – Environmental Protection/ Rights Protection Staff administered this project, secured five riparian easements and provided Environmental Protection Agency 319 cost share monies to cover fence construction costs. Approximately 12,000 native trees and shrubs were planted in new and existing Umatilla River, Meacham Creek, Greasewood Creek, West Fork of Greasewood Creek, Spring Hollow Creek, Moonshine Creek, Cottonwood Creek and Mission Creek project areas. Approximately 100 pounds of native bunch grasses were seeded in new Umatilla River, Moonshine Creek, Cottonwood Creek and Mission Creek project areas.

Monitoring continued to quantify short and long-term effects of habitat enhancements in the upper basin. Maximum, minimum and average daily stream temperatures were collected from June through September at 19 sites. Suspended sediment samples were obtained at three gage stations to arrive at daily sediment load estimates. A total of six aquatic macroinvertebrate samples were collected upstream and within the Mission Creek Project Area and biotic indices calculated from these samples. Physical and water quality parameters measured in conjunction with macroinvertebrate sampling included stream gradient, depth, velocity, discharge, substrate, stream bank vegetation, temperature, alkalinity, conductivity, sulfate, nitrate nitrogen, orthophosphate and pH levels. Photographs were taken at 81 existing and 13 newly established photo points to document habitat recovery.

Umatilla Basin Watershed Assessment efforts were continued under a subcontract with Washington State University. This endeavor involves compiling existing information, identifying data gaps, determining habitat-limiting factors and recommending actions to improve anadromous fisheries habitat. This watershed assessment document and working databases will be completed by fiscal year 2001 and made available to assist project personnel with sub-watershed prioritization of

habitat needs.

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We would like to acknowledge cooperating landowners, Sharon Crimin, and Gene and Marilyn Cripe, who supported our efforts by providing their properties for habitat enhancements during the project period.

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INTRODUCTION

The Umatilla River Basin Anadromous Fish Habitat Enhancement Project is funded under the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program, Section 7.6 – 7.8 and targets the improvement of water quality and restoration of riparian areas, and specifically the holding, spawning and rearing habitats of anadromous salmonids. Funding of this project provides partial mitigation for losses of salmon and steelhead (*Oncorhynchus spp.*) populations in the Columbia River Basin from the construction and operation of hydroelectric dams. This Umatilla River Basin Anadromous Fish Habitat Enhancement Project Annual Report covers work accomplished by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) from February 1, 1999 through January 31, 2000 as part of the Umatilla Basin Fisheries Restoration Program.

Significant effort and funds have been directed at restoration of anadromous fish in the Umatilla River Basin. This habitat project is one element in the comprehensive Umatilla Basin Fisheries Restoration Program which also includes artificial production, adult and juvenile passage improvements (ladders, screens, and trap and haul), instream flow enhancement, and monitoring and evaluation. Emphasis on watershed-wide habitat is needed for protection and enhancement of the natural production capabilities in the basin.

The primary problems continuing to impact water quality and limit available habitat and natural fisheries production capabilities in the Umatilla River Basin include: non-point source pollution due to poor cropland tillage and rotation practices, livestock overgrazing riparian and upland areas, over-appropriation of instream flows to irrigators, and stream channelization, constriction, and floodplain modification from agricultural and road/railroad building and maintenance activities.

The project focused on implementing cooperative instream and riparian habitat improvements on private lands on the Umatilla Indian Reservation (hereafter referred to as Reservation) from April 1, 1988 to March 31, 1992. These efforts resulted in enhancement of 7.45 river miles on lower Boston Canyon Creek, lower Meacham Creek and the upper Umatilla River in the vicinity of Gibbon, Oregon. In 1993, the project shifted emphasis and began to identify upland and riparian watershed-wide causative factors limiting anadromous fisheries habitat and natural fisheries production capabilities throughout the Umatilla River Basin. Riparian and instream enhancement projects continued and were expanded to include tributaries outside of Reservation Boundaries. An additional 8.55 river miles of fisheries habitat improvement projects have been implemented on private properties, both on and off the Reservation, since shifting to a more comprehensive approach. Additional projects have included habitat enhancements in the upper Umatilla River, Meacham Creek, Mission Creek, Wildhorse Creek, Greasewood Creek, West Fork of Greasewood Creek, Spring Hollow Creek, Buckaroo Creek, Squaw Creek , McKay Creek, Moonshine Creek and Cottonwood Creek drainages. A total of 44 easements have been secured with private landowners since initial 1988 implementation efforts.

The project represents a continuation and evolution of existing efforts to improve natural production in the Umatilla River Basin. A watershed analysis is currently being developed to assist the project with prioritization of fisheries habitat needs and streamlining of project funds. Geographic Information System (GIS) data layers continue to assist the project in identification of habitat impacts and proposed management/restoration actions. The project complements fish passage and artificial production projects in the basin by integrating existing on-the-ground management programs on private and public lands with restoration activities to better justify expenditure of funds

and time. Biological and physical surveys, summaries of existing survey information and follow up surveys are coordinated with CTUIR's Umatilla Basin Natural Production Monitoring and Evaluation (UBNPME) Project. Remedial measures will be implemented to reduce or eliminate detrimental land use activities where possible. Continued operations and maintenance of existing enhancement projects are included under this integrated approach.

The restoration of anadromous fisheries resources in the Umatilla River Basin has been a coordinated effort between CTUIR, state and federal agencies, and the local community. Examples include the Umatilla River Basin Anadromous Fish Habitat Enhancement Project, the Umatilla River Subbasin Fish Habitat Improvement Project, the Umatilla Basin Project, the Umatilla Basin Watershed Council, the Umatilla River Subbasin Salmon and Steelhead Production Plan and development of the Umatilla Hatchery and associated artificial production plans. This coordination has continued and expanded through scoping groups, comprised of local land owners, sportsman clubs, special interest groups and resource agencies, formed to identify issues and develop creative solutions to land use problems in the basin.

DESCRIPTION OF PROJECT AREAS

The following CTUIR Habitat Enhancement Project Table illustrates enhancement project locations, number of stream miles enhanced, and number of landowner agreements secured in each drainage:

FIGURE 1. CTUIR HABITAT ENHANCEMENT PROJECT TABLE

STREAM	RIVER MILE LOCATIONS	NO. OF STREAM MILES ENHANCED	NO. OF LANDOWNER AGREEMENTS
Lower Meacham Creek	0 - 4.5	4.5	15
Upper Umatilla River	78.5 – 85.0	3.2	10
Boston Canyon Creek	0 – 0.3	0.3	1
Wildhorse Creek	10.0 – 12.5	2.0	4
Greasewood Creek	0 – 1.5	1.5	2
West Fork of Greasewood Creek	0 – 0.3	0.3	2
Spring Hollow Creek	3.4 – 4.0	0.6	1
Mission Creek	2.9 – 3.3	0.4	1
Buckaroo Creek	1.0 – 2.6	1.6	6
Squaw Creek	2.0 – 2.9 9.8 – 10.1 (Tribal Properties)	1.2	0 (Tribal Properties)
McKay Creek	21.5 – 22.25	0.6	2
Moonshine Creek	@ 1.1	Passage Site	0
Cottonwood Creek	@ 1.3	Passage Site	0
Mission Creek	@ 1.3	Passage Site	0
TOTAL		16.2	44

The Umatilla River has a drainage basin of 2,290 square miles and is a tributary to the Columbia River at RM 289. The principle aquifer is quaternary alluvium composed of unconsolidated sand and gravel, and some silt. Alluvium may reach a depth of up to 12 feet (Gonthier and Harris, 1977).

Meacham Creek is a major tributary to the Umatilla River, entering at RM 79. It drains approximately 165 square miles and produces 145,000 acre-feet annually at RM 5 near the top of

the project area.

Boston Canyon Creek, entering Meacham Creek at RM 2.1, is the largest tributary to Meacham Creek within Reservation Boundaries. It contributes over 4,000 acre-feet annually to Meacham Creek from a drainage basin of approximately 5.5 square miles. It runs over and through large alluvial deposits as it enters the Meacham Creek floodplain.

Elevations in the Umatilla River, Meacham Creek and Boston Canyon Creek project areas range from 1,760 to 2,000 feet above sea level, giving the area an unusually long growing season. Stream gradients average less than two percent. Flooding in project areas usually occurs in late winter and spring as a result of rain on snow events. The flood peaks tend to be high and the volumes large, but the duration of damaging stages seldom last more than a day or two (U.S. Army Corps of Engineers, 1975).

The Umatilla River, Meacham Creek and Boston Canyon Creek project areas lie in a big game winter grazing zone as outlined by the CTUIR Land Development Code (1983). The primary land use is livestock grazing from May to November. Timber harvest is permissible under a conditional use permit. Major portions of these areas have been disconnected from their floodplains. Intensive land uses within floodplains have resulted in dramatic changes in waterway characteristics. Current and historical land use practices, including road and railroad construction and maintenance activities, overgrazing of riparian and upland areas and extensive timber harvests, have led to stream channelization, diking within floodplains, streambank riprapping and elimination of riparian vegetation. These practices have impacted fish habitat by altering natural channel form and function. Loss of stream channel meander from channelization and diking has accelerated runoff velocity due to an increase in surface gradient.

Wildhorse Creek is a 34-mile intermittent tributary to the Umatilla River, entering at RM 55 in the city of Pendleton, Oregon. It drains approximately 190 square miles and produces 14,000 acre-feet annually at the mouth. The highest point on the drainage divide of the basin is at an altitude of about 3,800 feet (Gonthier and Harris, 1977). Steep headwater topography of 15 to 35 percent contributes to rapid runoff rates. The slope in the lower and mid reaches varies from 0 to 3 percent (USDA, Soil Conservation Service, 1988).

Riparian and water storage capabilities in the upper Wildhorse Creek Watershed have been impacted from past timber harvest practices. Mid and low elevation lands are characterized by dryland crop farming, livestock grazing and residential use. Poor land use practices have significantly impacted upland vegetation communities, reduced riparian vegetation, degraded water quality, and diminished water table elevations and instream flows. Lack of conservation farming practices, such as strip cropping, terrace systems and grass waterways, are common problems in mid and lower watershed areas. Overgrazing of livestock and absence of pasture rotation plans have contributed to poor water quality and loss of flood plain function. The communities of Athena and Adams, county and state highway departments and the Union Pacific Railroad have constrained the mainstem stream channel, resulting in downcutting, loss of flood plain function and water quality impacts.

Greasewood Creek originates approximately 3.25 miles northwest of the town of Helix and flows southeast to enter Wildhorse Creek at RM 9.3, 0.5 miles downstream of Rothrock Road. The West Fork of Greasewood Creek originates 1.75 miles southwest of Helix and enters mainstem Greasewood Creek 1.5 miles upstream of the Wildhorse Creek confluence. The Greasewood Creek Watershed drains approximately 20,452 acres over a 33 square mile area. Annual precipitation

ranges from 12 to 15 inches per year with 70% of this moisture being obtained during October through April. Stream flows in mid and upper watershed areas are intermittent during summer and early fall months. However, in the lower watershed, springs provide year-round flows to the Greasewood Creek and West Fork Greasewood Creek project areas. A study conducted by the Natural Resource Conservation Service (NRCS) estimated the ten year peak flow in the upper 9,650 acres of the watershed (upstream of State Highway 334) at 143 cfs (Ray Wilson, personal communication). Elevations in the watershed range from 1,800 feet above sea level in the headwaters to 1,400 feet above sea level at the confluence with Wildhorse Creek. Soils throughout the drainage are predominantly Walla Walla Series, consisting of deep, well-drained silt loams on 1 to 40 percent slopes.

NRCS personnel estimate that 98% of landuse in the Greasewood Creek Watershed is comprised of cropland practices, primarily winter wheat/summer fallow operations (Ray Wilson, personal communication). The deep soils in this drainage are considered to be some of the most productive agricultural soils in the Umatilla River Basin. However, lack of terraces, grass waterways and contour farming practices, failure to return crop residue to the soil and farming in highway right-of-way areas results in extensive erosion of top soils from steep slopes into roadside ditches and waterways. NRCS staff estimate as much as 130 tons/acre of top soil erodes annually from cropland fields in the Greasewood Creek Watershed (Bob Adelman, personal communication).

Spring Hollow Creek originates in the northeast corner of the Reservation at elevations ranging from 2,166 feet (West Fork headwaters) to approximately 2,755 feet (East Fork headwaters) and flows northwest to empty into Wildhorse Creek at RM 13.7 at a 1,560 foot elevation upstream of Adams. The Spring Hollow Creek Watershed has a drainage basin of 18 square miles and supplies 1,500 acre-feet annually at its confluence with Wildhorse Creek (Gonthier and Harris, 1977). This system is one of the few streams originating on the Reservation which deliver year-round stream flows. Due to significant spring seepage throughout the drainage, stream temperatures commonly average between 60 and 68 degrees Fahrenheit in lower stream reaches during late summer (see stream temperature graph C-7. in Appendix C of this report). Annual precipitation in the upper watershed varies from 18 to 25 inches, while precipitation at lower elevations ranges between 5 and 20 inches annually (USDA, Soil Conservation Service, 1988).

Non-irrigated annual crop farming, typically small grain-pea rotations, is the primary land use in the Spring Hollow Creek Watershed. According to the Soil Survey of Umatilla County Area, Oregon, many of the properties located within this drainage classify as "prime farmlands" because the silt loam soils present have the ability to sustain high crop yields with minimal inputs of energy and economic resources, and farming such soils results in the least damage to the environment (USDA, Soil Conservation Service, 1988). However, failure to leave crop residue, maintain tilth, chisel stubble, contour farm, and construct terraces, diversions and grass waterways in this drainage continue to result in extensive erosion of top soils during wet winter months. Grazing is the second most prevalent land use occurring in the watershed. The majority of grazing occurs within flood plain areas in lower stream reaches. High stocking rates, absence of pasture rotation plans and failure to restrict grazing during wet periods result in compaction of soils, poor tilth and excessive runoff.

Mission Creek originates in the western slope foothills of the Blue Mountain Range at an elevation of about 3,560 feet and flows northwesterly to empty into the Umatilla River at approximately RM 61.5 at an elevation of about 1,270 feet. This watershed is located entirely within Reservation Boundaries and has a total acreage of approximately 3,100 acres. The Mission Creek Watershed is comprised of the following landuse practices: 1) 2,100 acres of rangeland, 2) 670 acres of winter

wheat/summer fallow cropland, 3) 180 acres of Conservation Reserve Program (CRP) land, 4) 140 acres of abandoned cropland and 5) 10 acres of residential property. Average annual precipitation ranges from 16 to 24 inches with most of it falling between October and March as rain. Mission Creek is an intermittent stream with stream flows in the lower reaches and portions of the upper watershed going subsurface by mid-summer.

Conversion of historical, native plant communities to cropland and rangeland combined with realignment and shortening of lower stream channel reaches have altered the hydrologic capabilities of the Mission Creek Watershed, resulting in higher peak runoff rates during storm events, increased channel/streambank erosion and loss of fish and wildlife habitat. Limited portions of the mid watershed sustain year-round stream flows and provide excellent salmonid habitat. Lack of perennial stream flows and insufficient riparian cover are the primary factors limiting anadromous fisheries production in this system.

Buckaroo Creek is an intermittent stream, originating in the vicinity of Deadmans Pass in the Blue Mountains at an elevation of approximately 3,600 feet. This 15 square mile drainage area is located entirely within Reservation Boundaries and flows northeasterly to enter the Umatilla River at Thorn Hollow (approximately RM 73.2) at an elevation of about 1,600 feet. This tributary has an annual stream discharge of 4,000 acre-feet and an average daily discharge of 10 cfs at the mouth (Gonthier and Harris, 1977). Soils within the watershed tend to be a mixture of moderately deep, well drained silt loams and shallow, well drained Gwin cobbly silt loams. Forage tends to be limited by the high content of rock fragments and shallow depth to bedrock in the Gwin soils (USDA, Soil Conservation Service, 1988).

Livestock grazing is the primary land use in the Buckaroo Creek Watershed. This drainage is located within Bureau of Indian Affairs (BIA) Range Unit Six. This system continues to be overgrazed due to high stocking rates and extended grazing seasons. The CTUIR is currently coordinating with the BIA in development of a long-term range management plan to address these concerns. Historical land uses in the watershed included timber harvest and sheep grazing. Impacts from these long ago and current events include increased runoff rates, elevated stream temperatures (see stream temperature graphs C-14. and C-15. in Appendix C of this report), and diminished riparian and upland native vegetation communities.

The Squaw Creek Watershed is located approximately 18 miles east of Pendleton, Oregon. Squaw Creek originates in the western flank of the Blue Mountains in the vicinity of Emigrant Springs and flows approximately 12 miles northward to empty into the Umatilla River at approximately RM 76.7. Elevations range from approximately 4,200 feet in the headwaters to 1,670 feet at the mouth (USDA, Soil Conservation Service, 1991). This drainage has a total area of 24,198 acres with 18,398 acres (including approximately 608 acres owned by the Boise Cascade Corporation) lying within Reservation Boundaries. Approximately 1,800 acres lie within Umatilla National Forest Boundaries and an additional 4,000 acres lies on private property outside of Reservation Boundaries (including approximately 2,628 acres owned by the Boise Cascade Corporation).

Squaw Creek is an intermittent tributary with an annual stream discharge of 2,000 acre-feet (Gonthier and Harris, 1977). Average precipitation ranges from about 24 inches near the village of Meacham to 13 inches at the confluence with the Umatilla River (USDA, Soil Conservation Service, 1991). Stream gradient ranges from eight percent in the upper watershed to one percent at the mouth.

The riparian area has distinct storage and transport zones, but no well defined depositional zone,

and presence of young, shrub seedlings is sparse. Soils within the watershed are highly variable. The stream bed on the lower five to six miles of Squaw Creek transports materials up to six inches in diameter, and the channel and stream banks are extremely unstable. Extensive areas of bed load and scour are apparent (USDA, Soil Conservation Service, 1991).

Land use practices in the Squaw Creek Watershed have primarily consisted of seasonal, May 1 through October 1, livestock grazing and timber harvest. This drainage is popular for recreational and subsistence hunting, and emphasis of these activities will likely increase with recent tribal land acquisitions.

The headwaters of McKay Creek are located within the Blue Mountains, and the drainage divide is at its highest point near Kamela, Oregon at an altitude of about 4,500 feet (Gonthier and Harris, 1977). Mckay Creek flows westward 38 miles to empty into the Umatilla River at approximately RM 51. This stream enters the southernmost portion of the Reservation at RM 23 and exits the West Reservation Boundary at RM 15. McKay Creek drains into the McKay Creek National Wildlife Refuge, which encompasses McKay Creek Reservoir, at approximately RM 10. McKay Creek exits the 1,200 surface acre reservoir (71,500 acre-feet) at McKay Dam, an earth-fill structure with a reinforced concrete upstream slope, located at approximately RM 6 (U.S. Bureau of Reclamation, 2000). Average annual discharge upstream of the reservoir, based on a period of record from 1930 to 1985, is 103 cfs (Alexander et al., 1987).

Historically, it is likely that the McKay Creek Drainage supported abundant summer steelhead populations. Physical stream characteristics within the watershed are representative of preferred steelhead habitat. However, construction of 165-foot high McKay Dam from 1923 through 1927 permanently obstructed all anadromous fish passage. Today, Mckay Creek Reservoir, managed by the U.S. Bureau of Reclamation, provides habitat to various species of waterfowl, non-native warmwater fish and rainbow trout. Rainbow trout also occur within and upstream of McKay Reservoir.

Primary land uses within the McKay Creek Watershed include, 1) home-site development, 2) livestock grazing of rangeland areas and irrigated pastures, 3) production of non-irrigated small grain crops, 4) production of irrigated crops, such as alfalfa hay and small grains, 5) timber harvesting in upper watershed areas, and 6) outdoor recreational opportunities, including fishing, hunting, boating and water skiing.

Development of homes, farm buildings and roads within the floodplain have resulted in straightened and confined stream channels throughout the mid and lower watershed. These construction activities along with McKay Creek Dam operations and water releases have increased stream velocities, increased in-stream gravel movement, and significantly reduced available fish and wildlife habitat in main stem McKay Creek. Failure to implement proper stocking rates, pasture rotation and deferred grazing plans, and restrictive grazing during wet periods throughout the drainage has compacted top soils, resulted in poor soil tilth and excessive runoff, impacted upland and riparian native vegetation communities and degraded water quality. Site-specific cropland management practices, which conserve soil moisture and reduce wind and water erosion of soil surface layers, are not frequently utilized in lower watershed areas and need to be more widespread. Increased use of soil conservation practices, such as stubble-mulch tillage, limited seedbed preparation tillage, early fall seedings, contour farming, windbreak establishments and grass waterways, would improve riparian and upland conditions. Areas within the upper McKay Creek Watershed have been extensively logged, likely resulting in reduced ground water storage, decreased soil permeability and increased soil erosion rates.

McKay Dam was originally constructed to furnish a supplementary supply of water to Stanfield and Westland Irrigation Districts in the lower Umatilla River Basin (U.S. Bureau of Reclamation, 2000). The Congressional Act of March 11, 1976 (90 Stat. 205, Public Law 94-288) reauthorized McKay Dam and Reservoir for the purposes of irrigation, flood control, fish and wildlife resources, recreation, and safety of dams (U.S. Bureau of Reclamation, 2000). The Act of October 28, 1988 (102 Stat. 2791, Public Law 100-557) was authorized for the purposes of mitigating losses to anadromous fishery resources and continuing water service to irrigation districts (U.S. Bureau of Reclamation, 2000). This cooperative local, state, tribal and federal water exchange effort, known as the Umatilla Basin Project, has served to resolve potential conflict between fishery and irrigation needs in the Umatilla River Basin. The project delivers Columbia River water to three irrigation districts in exchange for leaving in-stream flows in the Umatilla River for anadromous fish passage and rearing. In addition, a large portion of space in McKay Reservoir is devoted to in-stream flow augmentation (Heirs, 1996). While upper McKay Creek is inaccessible to anadromous fish, habitat enhancements in these areas are directed at improving water quality conditions for salmon and steelhead downstream in the Umatilla River.

Moonshine Creek is located entirely within Reservation Boundaries and originates in the vicinity of Emigrant Hill at an elevation of approximately 3,720 feet. This stream flows northwesterly to empty into the Umatilla River at approximately RM 67.2 at an elevation of about 1,400 feet. Moonshine Creek drains a total of approximately 5.5 square miles and contributes 2,480 acre-feet annually at RM 1.1 (a drainage area of 4.62 square miles) near the top of the passage improvement site (just upstream of Umatilla County Road 900 Box Culvert). Summer stream temperatures in the lower portion of this Umatilla River tributary generally range from 50 to 79 degrees Fahrenheit (Shaw and Sexton, 1999 and stream temperature graph C-12. in Appendix C of this report.). A habitat survey conducted from the mouth to the stream forks (RM 4.4) in late August and early September of 1995 noted that 58% of the stream channel was dry and salmonid habitat was marginal (Contor et al., 1996). Other physical features characterized during this survey indicate that Moonshine Creek is primarily a single channel confined by high terraces, stream channel gradient averages 2.7%, the average wetted width to depth ratio is 8.9:1 in slow water habitat and 20.0:1 in riffles, the dominant riparian vegetation (51%) is comprised of various grasses, 27 surface springs occur in the lower 4.4 stream miles, and beaver dams are common in the lower watershed (Contor et al., 1996). Annual precipitation varies from 15 to 25 inches throughout the watershed (USDA, Soil Conservation Service, 1988).

The Cottonwood Creek Watershed is located on the Reservation immediately west of Moonshine Creek. Cottonwood Creek originates on Emigrant Hill in the western slope foothills of the Blue Mountain Range at elevations ranging from 3,400 feet (West Fork headwaters) to approximately 3,480 (East Fork headwaters) and flows northwest to enter the Umatilla River at approximately RM 65 at a 1,330-foot elevation. This stream drains an area of approximately 5 square miles and has an average annual discharge of 1,940 acre-feet at RM 1.3 (a drainage area of 4.01 square miles) near the top of the passage improvement site (just upstream of Umatilla County Road 900 Box Culvert). Stream temperatures, recorded between June 20 and August 1, 1995, varied from 51 to 80.6 degrees Fahrenheit (Contor et al., 1996). A habitat inventory conducted from the mouth to the stream forks (RM 4.1) during the summer of 1995 noted that 49.2% of the stream channel was dry and salmonid habitat was marginal (Contor et al., 1996). Other physical features documented during this survey indicate that 7% of Cottonwood Creek is comprised of secondary (braided) channels, high terraces and hill slopes are the most common landform, stream channel gradient averages 3.3%, the average wetted width to depth ratio is 8.9:1 in slow water areas and 20.8:1 in riffles, the dominant riparian vegetation (53%) is comprised of various grasses, 23 surface springs

were identified throughout the watershed, and beaver dams are common in lower stream reaches (Contor et al., 1996).

Soils throughout the Moonshine and Cottonwood Creek drainages are highly variable. Soils consist of deep and shallow, well-drained loams, including silt loams, silty clay loams, cobbly loams and gravelly silty clay loams. Slopes in these drainages range from 0 to 70 percent, have rapid runoff rates and potential water erosion hazard is high (USDA, Soil Conservation Service, 1988).

Vegetation found within the upper watersheds of these drainages includes elk sedge, pinegrass, mallow ninebark, princes pine and myrtle pachystima in the understory, and Douglas fir, ponderosa pine, grand fir and western larch in the overstory. Historically, these areas likely supported extensive communities of native grasses, such as bluebunch wheatgrass, sandberg bluegrass and Idaho fescue. Remnant populations of these grasses still occur, but have largely been out-competed by cheat grass and medusa head.

Primary land use practices in the Moonshine and Cottonwood Creek drainages include home-site development, livestock grazing (pastures and BIA Range Units Three and Six) and production of non-irrigated small grain crops. Several dwellings have been constructed within floodplains in the lower watersheds of these systems. These structures along with road developments have prevented lateral stream channel movement and disconnected portions of the streams from their floodplains. Road culverts, impeding fish passage in these watersheds, were addressed during the project period, and those improvements have been further described within this report. Decades of season-long grazing and poor livestock distribution has resulted in over utilization of native perennial grasses and establishment of nuisance annual grasses (primarily cheat grass and medusa head). Overgrazing has also contributed to reduced riparian canopy cover, eroding stream banks, exposed soil surfaces and increased runoff rates. The majority of farming in the Moonshine and Cottonwood Creek watersheds is a grain-fallow cropping system. Soil conservation practices need to be more widely applied to reduce runoff and control erosion in the lower watersheds. Conservation measures applicable to these watersheds include early fall seeding, stubble-mulch tillage and construction of terraces, grass filter strips and grass waterways.

A map of the Umatilla River, Meacham Creek, Boston Canyon Creek, Wildhorse Creek, Greasewood Creek, West Fork of Greasewood Creek, Spring Hollow Creek, Mission Creek, Buckaroo Creek, Squaw Creek, McKay Creek, Moonshine Creek and Cottonwood Creek project areas is illustrated in Figure 2, on the following page.

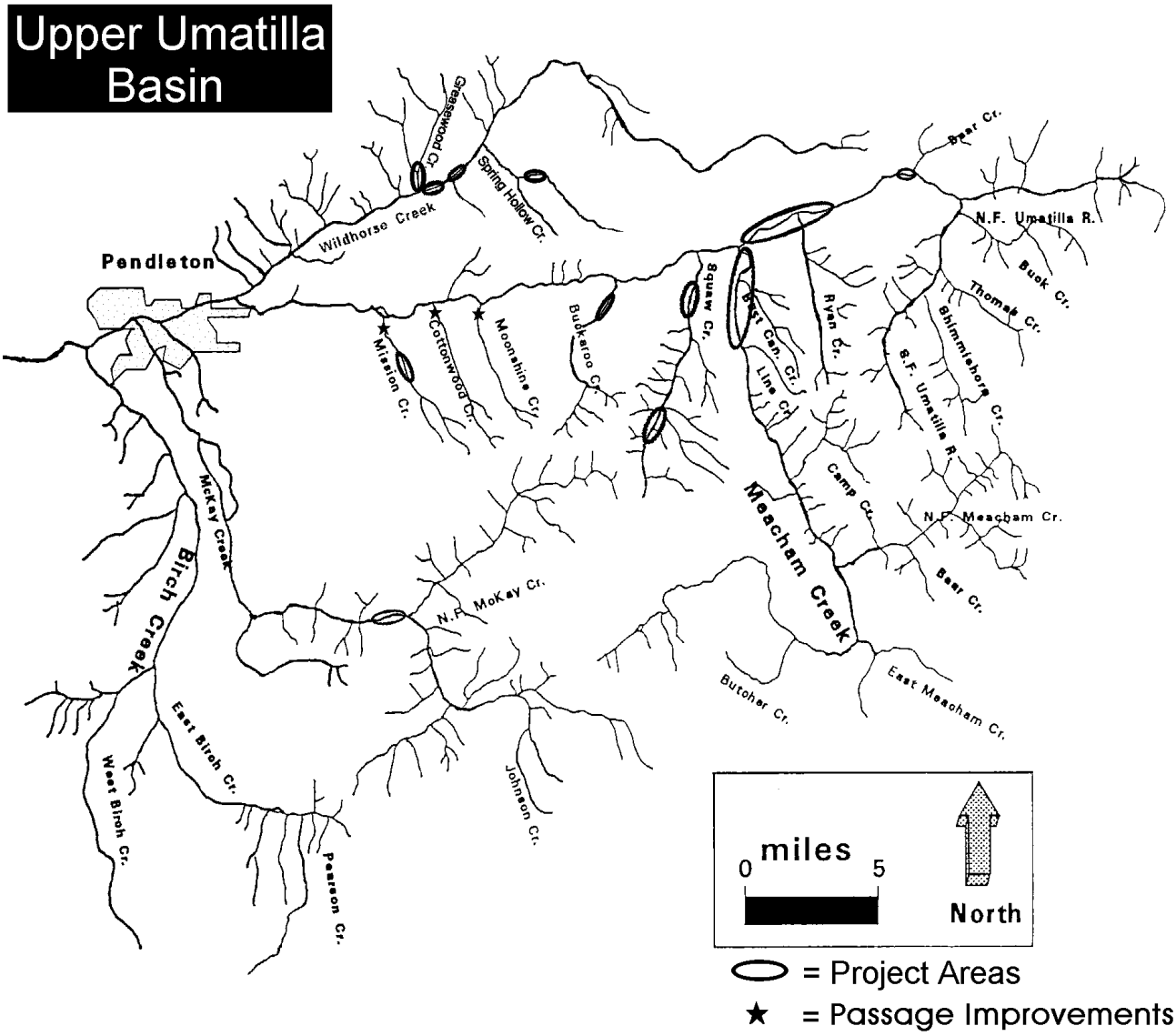


Figure 2. CTUIR Anadromous Fish Habitat Enhancement Project Vicinity Map

METHODS AND MATERIALS

Objective I. **Maintain and Continue Implementation of Habitat Enhancement Projects throughout the Umatilla River Watershed.**

1. Pre-construction Preparation:

a. Assess Maintenance Needs

The physical condition of habitat improvements are annually evaluated in existing project areas, following spring high flow events, to determine effectiveness and prescribe any maintenance to occur during the project funding period.

b. Project Cost Share

Cost share funds are obtained and combined with Bonneville Power Administration (BPA) funds for financial assistance. These efforts effectively forge partnerships between resource agencies and the public and allow BPA funds to go further.

c. Clearances and Land Owner Agreements

Various clearances and landowner agreements must be obtained before CTUIR can initiate habitat improvements on private properties.

The BIA requires a land survey of designated project area boundaries and the acquisition of right-of-way agreements on private-owned, Indian Allotments (trust lands), prior to pursual of riparian easements.

Riparian easements restrict landowners from certain land use activities, such as grazing, removal of vegetation and use of weed or insect control measures, within enhanced riparian corridor areas. The term of the agreements is generally 15 years, and the landowner accepts the costs of all habitat improvements and CTUIR's maintenance of these improvements as consideration for participating in project recovery efforts. An attempt is made to address landowner needs (such as livestock water gaps, stream crossing sites, etc.) and incorporate these needs into the final agreement. Riparian easements protect habitat improvements and initiate recovery within project areas.

Other necessary clearances may include obtainment of permits from Umatilla County to construct habitat improvements within county road right-of-way areas or burning permits to burn noxious weeds within existing project areas. Considerable effort and coordination is required to secure clearances and landowner agreements.

d. Fill and Removal Permits

Instream work activities on the Reservation require a CTUIR Tribal Stream Zone Alteration Permit. Instream work activities off the Reservation generally require a General Authorization for Fish Habitat Enhancement Permit from the Oregon Division of State Lands (ODSL) in conjunction with a U.S. Army Corps of Engineer's (COE) 404 Fill/Removal Permit. Applications for these permits should be completed and returned to the respective

agencies a minimum of 90 days prior to anticipated instream work. Permitted instream work activities in the Umatilla River Basin are restricted to specific instream work periods. These instream work periods are based upon when migrating and spawning salmonids are least likely to be impacted by fill and removal activities. Work windows vary throughout the basin.

e. Endangered Species Act Requirements

The Columbia River population of bull trout (*Salvelinus confluentus*) and mid Columbia Evolutionary Significant Unit of summer steelhead (*Oncorhynchus mykiss*) are listed as threatened species under the federal Endangered Species Act (ESA). Any proposed instream work activities in areas within the Umatilla Basin, currently supporting these species or providing critical habitat for them, require ESA, Section 7 consultation when federal funding is utilized. Upon receiving a completed 404 Fill/Removal permit application, COE initiates Section 7 consultation proceedings with the appropriate federal agencies. The U.S. Fish and Wildlife Service (USFWS) is consulted for potential resident fish species (such as bull trout) impacts. The National Marine Fisheries Service (NMFS) is consulted for potential anadromous fish species (such as summer steelhead) impacts. Instream work in critical bull trout and summer steelhead habitat areas generally requires the project proponent to develop Biological Assessments (BA's) to determine the extent of impact, if any, from proposed habitat enhancements. BA's are reviewed by USFWS and NMFS, during consultation proceedings, and assist in determining if an instream project will occur, as proposed, or if modification is necessary to limit potential impacts. Consultation proceedings can considerably delay obtainment of instream permits.

f. Cultural/Archeological Monitoring

Prior to project implementation, project personnel coordinate with CTUIR's Cultural Resource Protection Program (CRPP) at proposed habitat enhancement sites involving ground disturbance (high tensile fence construction, structures keyed into streambanks, etc.) to obtain cultural clearances. CRPP Staff conduct file and literature searches, pedestrian surveys and/or archeological excavations to determine if cultural resources potentially eligible for inclusion to the National Register of Historic Places are present at proposed enhancement sites. Final reports, documenting their findings, are prepared and submitted to the BIA Umatilla Agency Real Property Management Office (for implementation efforts on the Reservation) and to the State Historic Preservation Office (for implementation efforts, both on and off the Reservation). CRPP Staff may also monitor projects during implementation at culturally sensitive locations. All cultural clearances are obtained in compliance with Section 106 of the National Historic Preservation Act.

g. Design and Layout

Design and layout of proposed projects consists of coordinating with the CTUIR Hydrologist to develop hydraulic designs, determining the quantity and type of materials required to build or repair fence and instream structures, and developing heavy equipment access sites, haul roads and boulder storage sites. Proposed fence lines, instream structure sites and stream bank areas are staked and flagged to provide assistance to subcontractors.

h. Contracts

Proposed implementation activities, requiring rental of operated heavy construction

equipment, construction of fencing, and purchase and transport of rock or root wads, are advertised and pre-bid tours provided to potential subcontractors. Subcontracts are awarded to the lowest bidder.

Prior to commencement of a subcontract, the subcontractor meets with CTUIR Habitat Enhancement Project Personnel to discuss subcontract terms, work performance requirements, a work progress schedule, petroleum spill plans, and fire prevention and suppression plans. Notices to proceed are issued in writing to the subcontractor.

The subcontractor provides and maintains an inspection system acceptable to the CTUIR, covering the services under the subcontract. Complete records of all inspection work performed by the subcontractor are maintained and made available to the CTUIR during subcontract performance and for as long afterwards as the subcontract deems necessary.

Equipment is inspected at the work site at the time of delivery. All equipment must be in good working condition, free from excessive leaks in hydraulic, fuel and power systems and clean enough to allow close inspection of these systems. Any equipment that does not meet subcontract specifications and requirements is rejected.

CTUIR Habitat Enhancement Project Personnel monitor the subcontractor's progress and photo document various stages of project implementation.

i. Transect and Photo Point Establishment

Permanent transects are established at channel cross sections, prior to project implementation, to obtain baseline data regarding channel morphology and riparian vegetation. These measurements are repeated at three to five year intervals.

Permanent photo points are established prior to project implementation in conjunction with permanent transects. Standardized photos are taken each spring and autumn to provide a visual record of changes in channel morphology and riparian recovery.

2. Maintain and Implement Habitat Enhancements:

a. Instream and Stream Bank Improvements

Stream bank revetments, log and boulder weirs, log and boulder deflectors and grade control/sediment retention structures previously placed into the Umatilla River, Meacham Creek, Wildhorse Creek, Greasewood Creek, the West Fork of Greasewood Creek and Spring Hollow Creek project areas are repaired annually as needed. These structures were designed to increase instream habitat diversity, increase pool frequency, stabilize stream banks and stream channels, and recruit and deposit sediments onto stream banks to provide substrate for revegetation.

Newly proposed in-stream and stream bank project designs are determined and developed jointly by the CTUIR Hydrologist and CTUIR Habitat Enhancement Project Personnel. Project personnel place large woody debris into areas where natural wood recruitment and habitat diversity is low. Placement of large woody debris provides additional instream cover for salmonids and organic material for aquatic organisms to feed upon, and assists in rebuilding streambanks by slowing water velocities and capturing sediments. Hydrological

controls (root wad and rock revetments, deflectors, veins, weirs, etc.) are used sparingly and restricted to stream reaches where benefits (grade control, sediment deposition, stream bank stability, growth of riparian vegetation and increased instream habitat) are immediate. More costly bioengineering approaches are reserved for areas that will not recover in a timely or natural manner.

b. Livestock Exclusion and Riparian Corridor Fencing

Fencing is constructed to exclude livestock from floodplain and riparian areas. Livestock exclusion provides stream bank protection and allows vegetative recovery within project areas.

Fences, gates and cross section fences in existing project areas are repaired by project personnel as needed. Frequent fence inspections are conducted to ensure continued exclusion of livestock and to allow for continued riparian recovery inside of project areas.

c. Revegetation

The CTUIR Habitat Enhancement Project utilizes heavy equipment and hand plants native riparian tree and shrub species along bank revetment structures, sediment retention structures and stream margins to improve bank stability, provide insect drop, shade streams and provide future recruitable large woody debris. Streambanks, terraces and disturbed sites within project areas are seeded with native grasses and/or close equivalents of native grasses to improve bank stability and to capture and retain sediments during high flow events.

Native plants are acclimated to the local climate, provide natural forage for wildlife and are much more resistant to the area's disease and insect problems. Studies have found that exotic species may out-compete and displace native riparian vegetation (Gordon et al., 1993). In addition to historical and present impacts of disturbance on riparian vegetation connectivity and diversity, plantings of exotic riparian vegetation (e.g. Russian olive) and the potential of hybrid poplar monocultures could disrupt riparian processes (Li, 1998). In Europe, plantations of exotic monocultures have replaced the natural diversity of riparian vegetation along stream banks of various watersheds (Cortes et al., 1994). This has changed the trophic structure of affected streams and influenced the input of terrestrial invertebrates that form the bulk of drifting prey for surface feeding fishes in headwater streams. The timing and quality of litter inputs from single species plantings or exotic species may differ greatly from diverse systems and lead to reduced food resources for aquatic species (Li, 1998). There may also be concerns about pollution of the gene pool of existing plant populations when non-local plants are introduced to a site (Lambert et al., 1995).

Trees and shrubs planted in CTUIR Habitat Enhancement Project Areas are locally obtained, indigenous species grown out as bareroot stock or tublings. Native grass seed and close replicates of native grass seed are currently unavailable locally and continue to be purchased from Grassland West Seed Company in Clarkston, Washington.

d. Noxious Weed Control

The CTUIR subcontracts Umatilla County Weed Control to chemically treat noxious weeds

three times per year in existing project areas. Only the most invasive noxious weeds, identified as "A" Pest Weeds on Umatilla County's Noxious Weed List, are treated. All chemical applications are consistent with Oregon Revised Statute (ORS).570.505 and Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) Regulations.

When other noxious weed species are identified as detrimental to project success or are of special concern to the landowner, CTUIR Habitat Enhancement Project Personnel treat these weeds as needed.

3. Post-implementation Final Review:

CTUIR Habitat Enhancement Project Personnel visit implementation sites immediately following final construction as indicated by the subcontractor. Subcontracted services are inspected to determine whether they conform with subcontract requirements. If subcontract services are not acceptable, CTUIR may (1) require the subcontractor to perform the services again in conformity with contract requirements, (2) reduce the contract price to reflect the reduced value of services performed, (3) hire another subcontractor to perform the services and charge the original subcontractor any cost incurred by the CTUIR, or (4) terminate the contract for default.

Objective II. <u>Continue Post-project Monitoring and Collect Baseline Data to Identify Habitat Limiting Factors and to Quantify Short and Long-Term Effects of Habitat Enhancement Activities in the Umatilla River Basin.</u>

1. Transect Measurements and Photo Point Monitoring:

Transects and photo points established in the Umatilla River, Meacham Creek, Boston Canyon Creek, Wildhorse Creek, Greasewood Creek, West Fork of Greasewood Creek, Mission Creek, Spring Hollow Creek and Buckaroo Creek project areas during previous project periods continue to be monitored. Transect measurements are repeated at three to five year intervals following project implementation to measure changes in channel morphology and vegetative response to habitat enhancements.

Standardized photos are taken in spring and autumn to provide a visual record of changes in channel morphology and riparian recovery. A photo point notebook, containing 35-mm slides of annual changes, is maintained by the CTUIR Fisheries Habitat Enhancement Project.

2. Fish Habitat Surveys:

The CTUIR UBNPME Staff conduct habitat surveys in conjunction with biological inventories in Umatilla River Basin subwatersheds. These surveys assist in determining relations of anadromous fish habitat and abundance in different types of stream channels from a total basin perspective. CTUIR Habitat Enhancement Project Personnel utilize the summarized data to identify habitat deficient stream reaches within subwatersheds and attempt to focus habitat restoration efforts in these areas. When a recent habitat survey has not been conducted at a proposed enhancement site, project personnel physically survey the site prior to project implementation. All habitat surveys conducted by CTUIR are consistent with survey methodology developed by the Oregon Department of Fish and Wildlife (ODFW) Aquatic Inventory Program.

3. Biological Inventories:

Fisheries communities are good indicators of long-term effects and broad habitat conditions because they are relatively long-lived and mobile (Karr et al., 1986). However, the fish population at any location is influenced by activities throughout the stream length because fish use different habitats at various life stages and may migrate long distances (Bauer and Burton, 1993).

Project staff coordinate with CTUIR UBNPME Project Personnel to collect pre-project fish community data. Representative samples of fish species and size classes are collected with a backpack electrofisher in proposed project areas. One or two passes are made with the electrofisher to evaluate community composition. All salmonids captured are counted, fork lengths measured and identified to species in the field. All other fish species numbers are visually estimated during sampling. Biological inventories are generally completed during the stable low flow period in mid-summer to avoid spawning migrations and seasonal fish movement (Karr et al., 1986).

Fish collection permits are required in the Umatilla River Basin because bull trout and summer steelhead are listed as threatened under the federal ESA. These permits specify sampling gear types and sampling periods. The UBNPME Project applies for and obtains all collection permits utilized by this project for fish sampling efforts.

Post-project biological inventories will occur in future project periods to assess fish utilization of instream enhancements and evaluate habitat recovery.

4. Aquatic Macroinvertebrate Sampling:

Macroinvertebrates are components of the aquatic environment that provide a connecting link in the food chain between multicellular periphyton, detritus from terrestrial sources and the fish population. As a food source they are essential to the growth and production of fish and, because of their strict habitat requirements, are very useful as indicators of changes in aquatic habitat (USDA, Forest Service, 1985). The diet of immature chinook salmon has been shown to be 95% insects, and immature coho salmon consume about 99% insects (Johnson and Ringler, 1980). Steelhead diets are largely insect as well (Johnson and Ringler, 1980).

Aquatic macroinvertebrate communities can reveal the quality of habitat components essential to aquatic fauna, such as water quality, substrate composition, riparian habitat quality, ecosystem stability, and past history (U.S. Bureau of Land Management, 1988). Aquatic macroinvertebrate communities are useful for monitoring biological integrity of streams since they function as integrators of pollution over time and are a direct measure of beneficial uses (aquatic life support) (Meyers, 1987). According to Schoen (1991), macroinvertebrates cover the whole range of pollution sensitivity, from highly sensitive stoneflies and mayflies down to very tolerant aquatic worms, so the presence or absence of particular taxonomic groups provides a good yardstick of pollution. Unlike fish, macroinvertebrates are relatively immobile. So, if macroinvertebrates are absent from their normal habitat, it is likely that pollution drove them out. In a healthy stream, one should find a balanced population consisting of many different kinds of organisms. Adverse chemical or physical changes that disrupt any part of the stream ecosystem often decrease community

diversity.

CTUIR Habitat Enhancement Project Personnel annually sample aquatic macroinvertebrate populations in the Mission Creek and Spring Hollow Creek drainages. Three 100-ft (30 m) stations were previously established in both drainages. Stations are located in stream reaches upstream (a control), within and downstream of habitat enhancement project areas. Station three on Mission Creek, previously located upstream of Umatilla County Road 900, had to be shifted downstream approximately 55 to 80 yards (below the county road bridge) due to lack of stream flows. Three stratified, random macroinvertebrate samples are collected from riffles within each station with a Winget-Modified Surber Net to provide a measure of community representation and data for statistical analysis. The Winget-Modified Surber Net has been used as standard quantitative aquatic macroinvertebrate sampling equipment by the U.S. Forest Service (USFS), U.S. Bureau of Land Management (BLM) and other agencies since 1977. Compared to other sampling devices used for collecting aquatic macroinvertebrates, the Winget-Modified Surber Net is one of the most versatile and reliable for sampling and the benthic communities collected can be used to assess existing current conditions in aquatic ecosystems (USFS Aquatic Ecosystem Lab, 1995). Physical habitat characteristics collected in conjunction with aquatic macroinvertebrate surveys include stream gradient, depth, velocity, discharge, substrate types, and streambank vegetation. Water chemistry parameters measured at the time of the surveys include stream temperature, alkalinity, specific conductance, pH, sulfate, nitrate nitrogen, and orthophosphate concentrations. Aquatic macroinvertebrate samples and field support data are sent to the National Aquatic Monitoring Center at Utah State University in Logan, Utah for analysis. Macroinvertebrate sample results are then used to calculate a variety of indices to assess the stream health.

Biotic indices are calculated using the indicator taxa concept. Taxa are assigned water quality tolerance values based on their specific tolerances to pollution. Scores are typically weighted by taxa relative abundance. In the United States the most common biotic indices in use are the USFS Biotic Condition Index (BCI) and the Modified Hilsenhoff Biotic Index (HBI). Physical habitat characteristics and water chemistry parameters are measured at each station and integrated into the macroinvertebrate analysis to determine the BCI. The USDA Forest Service developed this index over the past 18 years, providing a versatile monitoring tool for evaluating conditions in aquatic ecosystems and associated drainages. This index measures a stream against its own potential, not that of another stream, while integrating biological, physical habitat and water chemistry data. The HBI is also calculated. This organic enrichment index is based broadly upon family taxonomy, and has been used to detect nutrient enrichment, high sediment loads, low dissolved oxygen, and thermal impacts. The Shannon Diversity Index is the most widely used measure of diversity in community ecology and is defined by the relationship between the number of distinct taxa and their relative abundance.

Other data measures calculated to assess stream health using aquatic macroinvertebrates include:

- total abundance,
- Ephemeroptera, Plecoptera and Trichoptera (EPT) Taxa Richness,
- number of families,
- total taxa richness,
- Simpson Diversity Index,
- evenness,

- percent taxon or family dominance,
- percent of functional feeding groups,

Macroinvertebrate surveys will continue to be repeated at established stations in the Mission Creek and Spring Hollow Creek drainages at annual intervals. Macroinvertebrate data will provide an additional element in comparatively detecting trends over time to assist in determining habitat enhancement effectiveness.

5. Water Temperature Monitoring:

Ryan Tempmentor and Ryan RTM 2000 thermographs are deployed within selected stream reaches (see Figure 3 on the following page) in the upper Umatilla River Watershed. Several of these instruments are installed upstream, downstream and/or within project areas in the upper Umatilla River, Meacham Creek, Wildhorse Creek, Greasewood Creek, Spring Hollow Creek, Mission Creek, Buckaroo Creek and Squaw Creek to monitor the effectiveness of habitat improvements on water temperature cooling. The remaining thermographs are installed in Moonshine Creek, Coonskin Creek, Little Buckaroo Creek, Eagle Creek, and at additional Umatilla River sites to obtain data on potential habitat limiting factors and existing water quality conditions.

Thermographs are deployed in May. All instruments are recovered and downloaded into a computer program in October. The thermographs collect one temperature reading per hour. Maximum, average and minimum daily water temperatures are compiled in tabular form. Water temperatures are graphed during warmer months (June, July, August and September) to determine if temperatures are reached which could prove detrimental to salmonids.

Figure 3. Thermograph Locations 1999 Project Period	
	Location
1.	Umatilla River - RM 56 (West Reservation Boundary)
2.	Umatilla River - RM 76.5 (downstream from mouth of Squaw Creek)
3.	Umatilla River - RM 81.7 (USGS Gage Station No. 14020000)
4.	Wildhorse Creek – RM 0 (upstream from confluence with Umatilla River)
5.	Wildhorse Creek – RM 9.5 (upstream from mouth of Greasewood Creek)
6.	Wildhorse Creek – RM 26
7.	Greasewood Creek – RM 0.1 (upstream of confluence with Wildhorse Creek)
8.	Spring Hollow Creek - RM 3.5
9.	Eagle Creek - RM 0.2 (at Umatilla County Road 685 Bridge)
10.	Mission Creek - RM 1.25 (upstream of Umatilla County Road 900 Bridge)
11.	Mission Creek - RM 3.7 (upstream of St. Andrew's Church)
12.	Mission Creek - RM 3.8 (downstream of stream forks)
13.	Moonshine Creek – RM 1.1 (upstream of Umatilla County Road 900 Bridge)
14.	Coonskin Creek – RM 0.2 (upstream of Umatilla County Road 900 Bridge)
15.	Buckaroo Creek – RM 2
16.	Little Buckaroo Creek – RM 0.04 (upstream from confluence with Buckaroo Creek)
17.	Squaw Creek - RM 2
18.	Squaw Creek - RM 9 (at confluence with Little Squaw Creek)
19.	Meacham Creek – RM 2 (USGS Gage Station No. 14020300)
20.	Meacham Creek – RM 5.25 (East Reservation Boundary)

6. Suspended Sediment Monitoring:

Sediment yield and load is of high concern within the Umatilla Basin because of potential increases from land management activities and resultant degradation to the stream system. Turbidity can have a direct effect on the biological components of the system. Highly turbid water has been shown to negatively influence salmonid migration and feeding patterns (Bisson and Bilby 1982, Berg and Northcote 1985). High turbidity over relatively long time periods may also effect primary production by changing the amount of energy entering the stream system.

Three ISCO Model 2700 Wastewater Samplers are deployed to obtain estimates of suspended sediments. These sampling sites include RM 81.7 Umatilla River, RM 56 Umatilla River and RM 2 Meacham Creek. Sampling sites are located at U.S. Geological Survey Gage Stations (see Figure 4 below for gage station identification numbers) and near CTUIR thermographs.

Samples are taken year round at 6-hour intervals to create a composite daily sample. The samples are processed monthly by Umatilla National Forest Service Personnel at the USFS Lab in Pendleton, Oregon. Sample analysis includes a nephelometric reading of turbidity and a measurement of total suspended solids (TSS) through a process of suction-filtration and weighing. Conductivity and total dissolved solids are also calculated from these samples. CTUIR staff correlate suspended sediment data with stream flow data collected from the adjacent gage stations to arrive at daily sediment loads (tons/day) estimates.

Typically the samples are collected on a 21-day cycle; therefore, the first sample bottle is 21 days old before the sample is analyzed. This 21-day lag introduces a high potential for error and a poor turbidity/TSS relationship. Since this sampling schedule did not meet Oregon Department of Environmental Quality (ODEQ) standards of less than 24 hours for turbidity and 48 hours for TSS, the sampling frequency was increased to seven days during the winter months of 1997, 1998, and 1999 for the Umatilla River Basin Total Maximum Daily Load (TMDL) development. Additional samples that are collected by the CTUIR on the 21-day cycle have less reliable turbidity data and the relationship between turbidity and TSS is not expected to be accurate. The TSS data may also have some associated error, but it is assumed that this error is much less than it is for turbidity. Because of this associated error, CTUIR staff disregards data collected during summer months from analysis.

Figure 4. Suspended Sediment Monitoring Sites 1999
Location
Umatilla River – RM 56 @ USGS Gage Station No. 14020850 (West Reservation Boundary)
Umatilla River – RM 81.7 @ USGS Gage Station No. 14020000 (East Reservation Boundary)
Meacham Creek - RM 2 @ USGS Gage Station No. 14020300

Objective III: <u>Continue Watershed Planning, Scoping and Education Process by Developing Creative Solutions to Land Use Problems Impacting Fisheries Habitat in the Umatilla River Basin.</u>

1. Watershed Analysis:

The CTUIR has subcontracted Washington State University (WSU) to conduct and complete a watershed analysis of the Umatilla River Basin by fiscal year 2001. A guiding document and upgradable, working databases are being developed to assist in subwatershed prioritization of anadromous fisheries habitat needs, recommendation of future habitat improvements and determination of cost effective treatments. A prioritization schedule for BPA funded fisheries habitat projects in the Umatilla Basin has not been developed since the Umatilla Drainage Fish Habitat Improvement Implementation Plan (ODFW, CTUIR and USFS, 1988) was produced in 1988. Many of the habitat enhancements recommended in that document are no longer biologically valid (instream hard structures, rip-rapping, etc). Furthermore, most of the habitat deficient areas, identified in the plan, have been addressed. Therefore, an updated watershed analysis is necessary to guide future project activities. The current watershed analysis will include historical watershed conditions, present-day watershed conditions, on-going land use practices, biological data, anadromous fish habitat limiting factors, and identified data gaps.

2. Community Outreach Efforts:

The project provides local outreach efforts including watershed improvement workshops, tours and presentations. These activities assist the project in obtaining public input and support, identifying detrimental land use practices, and developing site-specific habitat restoration and mitigation measures.

RESULTS AND DISCUSSION

Objective I. **Maintain and Continue Implementation of Habitat Enhancement Projects throughout the Umatilla River Watershed.**

1. Pre-construction Preparation:

a. Assess Maintenance Needs

The physical condition and structural integrity of improvements within the Umatilla River, Meacham Creek, Boston Canyon Creek, Wildhorse Creek, Greasewood Creek, West Fork of Greasewood Creek, Spring Hollow Creek, Mission Creek, Buckaroo Creek and Squaw Creek project areas were evaluated in spring 1999. This evaluation determined that subcontracts and material purchases were not required for maintenance of existing projects due to lack of major high flow events and associated project impacts. Minor fence maintenance in project areas was accomplished by project personnel.

b. Project Cost Share

A total of $40,582 in CTUIR funds was secured to cover personnel salaries, fringe benefits and associated overhead expenses. BPA monies funded an additional $141,113 in salary, fringe benefit and overhead expense needs.

WSU provided approximately $30,000 in funds and in-kind services to continue a Umatilla Basin Watershed Analysis through fiscal year 1999. These dollars were cost shared with $10,000 in BPA monies.

U.S. Environmental Protection Agency (EPA) 319 Grant Funding covered approximately $36,162 in fence construction, fence material and personnel salary, fringe benefit and overhead costs to construct a riparian fence exclosure on Buckaroo Creek. BPA provided approximately $7,232 in additional funding for fence materials, personnel salaries, fringe benefits and overhead expenses to implement this project.

Approximately $19,600 in BIA funds was cost shared with $17,692 in BPA project dollars to assist with noxious weed treatments on Reservation Indian Allotments, vehicle leases and insurance, and personnel training opportunities.

The Umatilla County Road Department provided approximately $8,400 in in-kind services (personnel hours and heavy equipment time) to partner with CTUIR in implementing three fish passage improvement projects at three box culverts on lower Moonshine Creek, Cottonwood Creek and Mission Creek. An additional $11,733 in BPA project monies were utilized to fund construction materials, CTUIR Personnel salaries, fringe benefits and associated overhead costs. The Oregon Department of Transportation (ODOT) has obligated $8,627 in off-site mitigation dollars to assist with revegetation and monitoring at these sites in 2000.

Washington School fifth grade students provided in-kind, tree planting services in the Spring Hollow Creek Project Area. CTUIR Project Technicians collected native willow cuttings for this effort. Their salaries, fringe benefits and overhead costs were covered with BPA funds.

A 1.8-million dollar mitigation trust fund has been finalized between the Union Pacific Railroad, ODFW and CTUIR. This funding will provide future habitat enhancement cost share opportunities within the Meacham Creek Watershed.

CTUIR prepared and submitted a grant application, requesting $22,000 in native revegetation cost-share assistance, to the Governor's Watershed Enhancement Board. This proposal was denied funding.

c. Clearances and Land Owner Agreements

A 15-year riparian easement was secured on April 12, 1999 to implement habitat improvements at approximately RM 21.5 McKay Creek. This property is owned by Gene R. and Marilyn C. Cripe and located within Reservation Boundaries. The objective of this agreement is to restrict livestock from riparian and flood plain areas to promote natural habitat recovery.

A five year Access, Implementation and Maintenance Agreement was entered into on May 10, 1999 between CTUIR and Sharon D. Crimin. This property is located at approximately RM 85 Umatilla River. The purpose of this project is to stabilize 250 feet of eroding stream bank and improve instream habitat diversity.

The CTUIR Habitat Enhancement Project coordinated with the CTUIR Department of Natural Resources – Environmental Protection/Rights Protection (EPRP) Staff to construct 4,224 yards of livestock exclusion fencing between RM 1.25 and RM 2.6 Buckaroo Creek. This project was located entirely with Reservation Boundaries. EPRP Staff pursued and acquired all necessary BIA clearances and five riparian easements for implementation of this project.

A Umatilla County Burning Permit was acquired to implement a controlled burn within the Wildhorse Creek Project Area to remove extensive areas of noxious weeds.

d. Fill and Removal Permits

The CTUIR Habitat Enhancement Project submitted a Joint Permit Application to the COE and ODSL for proposed construction of one rock vein, four barbs and placement of one log and five root wads along 250 feet of eroding stream bank at RM 85 Umatilla River. The ODSL granted a General Authorization for Fish Habitat Enhancement Permit on July 19, 1999, and the COE issued a Nationwide Permit Number 13 on August 10, 1999 authorizing implementation of this project. The COE's failure to provide CTUIR with a permit until August 10, 1999 nearly resulted in this project not being implemented during the required July 1 – August 15, 1999 instream work window.

CTUIR Tribal Stream Zone Alteration Permit Applications were submitted to the CTUIR Department of Natural Resources - Water Resources Program to implement fish passage improvements at three box culverts in lower Moonshine Creek, Cottonwood Creek and Mission Creek. The CTUIR Water Resources Program granted three Stream Zone Alteration Permits to the Habitat Enhancement Project to implement these habitat improvements. Each project consisted of construction of two rock weirs downstream of the culverts and parking bumpers installed within the culverts.

e. Endangered Species Act Requirements

CTUIR Habitat Enhancement Project Staff prepared a BA in conjunction with the Joint Permit Application for the proposed stream bank stabilization project at RM 85 Umatilla River. Populations of ESA listed Columbia River bull trout and mid Columbia Evolutionary Significant Unit of summer steelhead commonly occur at various life stages within this stream reach. The BA indicated that potential project impacts to these fish populations were negligible. The BA was concurrently submitted to the USFWS and NMFS, when the Joint Permit Application was submitted to ODSL and COE, to expedite ESA Section 7 consultation proceedings and proposed instream project activities. The USFWS and NMFS found that the proposed project activities would not likely adversely affect ESA listed fish species or their habitats.

f. Cultural/Archeological Monitoring

The CTUIR CRPP conducted file and literature searches for and pedestrian surveys at the proposed RM 85 Umatilla River stream bank stabilization and RM 21.5 McKay Creek riparian livestock exclusion project sites. The literature described the proposed project sites as places traditionally occupied by the Cayuse Indians (Ray, 1938). CTUIR CRPP Staff conducted surface surveys, east-west transects paralleling the Umatilla River and McKay Creek at 20 meter intervals, on June 8, 9, 10 and 14, 1999. No cultural materials were found within the proposed Umatilla River Project Area. Crews did locate three artifacts at two isolated sites within the proposed McKay Creek Project Area. These finds consisted of a caramel colored, cryptocrystalline silica, bifacially worked scraper/graver and two basalt flakes, one primary and one utilized. These finds were located near the stream and most likely, were re-deposited from upstream sources. CRPP prepared a report, documenting these findings, and submitted it to the BIA Umatilla Agency Real Property Management Office and to the State Historic Preservation Office. The CRPP recommended that project activities be implemented.

g. Design and Layout

The CTUIR Hydrologist developed hydraulic designs for the following proposed enhancements:

(1) construction of one rock vein, four barbs and placement of one log and five root wads to stabilize 250 feet of eroding stream bank at the RM 85 Umatilla River project site, and
(2) construction of six rock weirs downstream of box culverts and parking bumpers installed within the culverts to improve fish passage in lower Moonshine Creek, Cottonwood Creek and Mission Creek.

Instream and stream bank stabilization structure locations were staked at proposed structure sites. Riparian corridor fence lines and fence structure sites were staked at the proposed RM 21.5 McKay Creek project site to acquire fence construction bids and assist fence subcontractors in determining construction locations.

h. Contracts

CTUIR Habitat Enhancement Project Personnel met with subcontractors, prior to proposed project implementations, to discuss subcontract terms and work performance requirements,

work progress schedules, petroleum spill plans, and fire prevention and suppression plans.

A ten day operated heavy equipment rental subcontract was awarded to A. Key Excavating on July 18, 1999 to construct one rock vein, four rock barbs and place one log and five root wads at RM 85 Umatilla River. An excavator and crawler loader were inspected at the project site by CTUIR Habitat Enhancement Project Personnel and determined to be in good working order, free from excessive leaks in hydraulic, fuel and power systems.

A fence construction subcontract was granted to Raymond Doherty Fencing on July 21, 1999 to build 770 yards of five-strand, high tensile smooth-wire fenceline in the vicinity of RM 21.5 McKay Creek.

A root wad purchase and delivery subcontract was awarded to Pine Creek Logging, Inc. on July 13, 1999. The purpose of the contract was to provide footer logs and conifer boles with attached root wads for the RM 85 Umatilla River stream bank stabilization project.

Umatilla County Weed Control was subcontracted to eradicate noxious weeds within approximately 13 stream miles of existing project areas (project funds were cost shared with BIA dollars).

i. Transect and Photo Point Establishment

Prior to project implementation, a total of thirteen new photo points were established at the proposed upper Umatilla River, McKay Creek, Moonshine Creek, Cottonwood Creek and Mission Creek project sites. Slides were taken at these sites to document pre-project conditions. Slides will continue to be taken to provide a visual record of changes in riparian vegetative recovery.

Due to limited staff time, no new transects were established during the 1999 project period.

2. Maintain and Implement Habitat Enhancements:

a. Instream and Stream Bank Improvements

A project was implemented in early August 1999 on the Sharon D. Crimin's property at RM 85 Umatilla River to stabilize 250 feet of eroding stream bank and improve instream habitat diversity. This project included construction of one rock vein, four rock barbs and five root wad revetments, instream placement of one log, and excavation and reshaping of a gravel point bar. A total of 170 cubic yards of 36-inch diameter and larger rock was transported to the project site and utilized in construction of the habitat improvement structures. Six large conifer root wads, 18 to 30 inches in diameter at breast height (dbh), with 18 to 20 foot attached boles were delivered to the site for placement in root wad revetments. An additional six smaller conifers, 12 to 20 inches in dbh and 12 to 15 feet in length, were transported to the project site and used as footer logs in the root wad revetments. One large, old growth conifer was salvaged on-site and incorporated into a root wad revetment.

Three fish passage improvement projects were implemented downstream of box culverts traversing Umatilla County Road 900 on lower Moonshine Creek, Cottonwood Creek and Mission Creek. Two rock weirs were constructed downstream of each box culvert to elevate

stream channel grades and assist in passing fish into culverts. Concrete parking bumpers were installed within culverts, diagonal to stream flows, to establish low flow channels and slow water velocities during higher flows. These improvements will provide adequate passage through the culverts for migrating fish. Approximately 250 yards of 6 to 30-inch diameter rock was purchased and transported to the project sites for construction of the six rock weirs. A total of 39 concrete parking bumpers were purchased and delivered to the sites for installation within the three box culverts.

No instream or stream bank maintenance was required to existing habitat structures during the 1999 project period.

b. Livestock Exclusion and Riparian Corridor Fencing

A 770-yard five-strand, high tensile smooth-wire fence was constructed on a property, owned by Gene R. and Marilyn C. Cripe, at approximately RM 21.5 McKay Creek. The purpose of this fence is to restrict trespass livestock access from riparian areas and allow for vegetative recovery.

The CTUIR Habitat Enhancement Project provided fence materials to the CTUIR Department of Natural Resources – EPRP Staff to construct 4,224 yards of livestock exclusion fencing between RM 1.25 and RM 2.6 Buckaroo Creek. This project is located entirely within Reservation Boundaries and was implemented to restrict livestock within BIA Range Unit Six from concentrating in riparian areas during the grazing season.

Minor fence repairs and water gap maintenance were performed by CTUIR Habitat Enhancement Project Personnel in the Umatilla River, Meacham Creek, Boston Canyon Creek, Mission Creek, Wildhorse Creek, Greasewood Creek, West Fork of Greasewood Creek, Spring Hollow Creek, Buckaroo Creek and Squaw Creek project areas.

c. Revegetation

Approximately 12,000 native shrubs and trees were planted during the project period. Species planted included black cottonwood (*Populus trichocarpa*), redosier dogwood (*Cornus sericea*), woods rose (*Rosa woodsii*), black hawthorn (*Crataegus douglasii*), western serviceberry (*Amelanchier alnifolia*), common chokecherry (*Prunus virginiana*) and various willow species (*Salix spp.*). The majority of trees and shrubs planted were bare-rooted stock and tublings. These were planted by project personnel in the Umatilla River, Wildhorse Creek, Spring Hollow Creek, Buckaroo Creek, Moonshine Creek, Cottonwood Creek and Mission Creek project areas. Willow cuttings, obtained by project personnel, were planted within the RM 85 Umatilla River Project Area during project implementation. Washington School fifth grade students planted approximately 1,000 willow cuttings in the Spring Hollow Creek Project Area. All plant source materials were locally obtained from within the Umatilla River Basin.

Stream banks and terraces, disturbed from 1999 implementation activities at the upper Umatilla River, Moonshine Creek, Cottonwood Creek and Mission Creek project sites, were seeded with approximately 100 pounds of native bunch grasses or native grass/legume equivalents. The grass seed mixture used to seed riparian corridors and channel margins was comprised of 40% western wheatgrass (*Agropyron smithii*), 25% sand dropseed (*Sporobolus cryptandrus*), 18% great basin wild rye (*Elymus cinereus*) and 17% sherman

big bluegrass (*Poa ampla*). The grass seed mixture used to seed terraces and dry sites included 36% Indian ricegrass (*Oryzopsis hymenoides*), 36% western wheatgrass, 12% great basin wild rye, 9% sand dropseed and 6% sherman big bluegrass. Seeding of native grasses and native grass equivalents assists with stream channel stabilization and sediment filtering during high flow periods.

d. Noxious Weed Control

Umatilla County Weed Control chemically treated "A" Pest Weeds, as identified on Umatilla County's Noxious Weed List, within all existing project areas. Three chemical treatments were applied over approximately 13 stream miles of project areas throughout the 1999 growing season.

BIA - Umatilla Agency Range Management Staff coordinated with the project to address noxious weeds in upland watershed areas on the Reservation, including Meacham Creek, Squaw Creek, Buckaroo Creek and Mission Creek.

All chemical applications were consistent with ORS.570.505 and FIFRA Regulations.

3. Post-implementation Final Review:

All subcontractors maintained a daily log and work progress schedule.

CTUIR Habitat Enhancement Project Personnel inspected all instream, bank stabilization and fish passage structures at the upper Umatilla River, Moonshine Creek, Cottonwood Creek and Mission Creek project sites immediately following construction of these structures.

High tensile smooth-wire fencing, constructed at the McKay Creek Project Area, was inspected to ensure consistency with CTUIR specifications.

Project personnel inspected all root wads, logs and trees, prior to purchase and delivery to the upper Umatilla River Project Area, to ensure subcontract conformity.

Umatilla County Weed Control provided an annual description and summary of all noxious weeds identified and treated in project areas. Project personnel coordinated closely with Umatilla County Weed Control and individual landowners to assure that nuisance weeds were adequately identified and eradicated.

All subcontract services implemented during the project period met subcontract requirements and were completed in a satisfactory and timely manner. CTUIR Habitat Enhancement Project Personnel photo documented various stages of project implementations.

Objective II. Continue Post-project Monitoring and Collect Baseline Data to Identify Habitat Limiting Factors and to Quantify Short and Long-Term Effects of Habitat Enhancement Activities in the Umatilla River Basin.

1. Transect Measurements and Photo Point Monitoring:

No new stream channel cross sections were established or measurements repeated at existing transect sites during the 1999 project period. Cross sections will continue to be measured as time allows.

Slides were taken during spring and fall of 1999 at 81 existing and 13 newly established photo point locations. Photo points are located within the Umatilla River, Meacham Creek, Boston Canyon Creek, Wildhorse Creek, Greasewood Creek, West Fork of Greasewood Creek, Spring Hollow Creek, Mission Creek, Buckaroo Creek, McKay Creek, Moonshine Creek and Cottonwood Creek project areas. Slides obtained, document project recovery and provide a visual record of annual changes within riparian and floodplain areas. Photographs indicate an upward, downward, or static trend in woody vegetation, streambank stability and cover (Meyers, 1987). However, initial vegetation "expression", obvious in photographs, should not be confused with vegetation "succession" required for stream ecosystem health (Elmore and Beschta, 1987).

2. Fish Habitat Surveys:

No habitat surveys were conducted during the 1999 project period. Habitat surveys were previously conducted on the upper Umatilla River (Contor, et al.,1995), Moonshine Creek, Cottonwood Creek and Mission Creek (Contor, et al., 1996) by the CTUIR UBNPME Staff. Refer to the **DESCRIPTION OF PROJECT AREAS** section of this report to view more complete descriptions of habitat conditions within these subwatersheds. Major flood events occurred in the fall of 1995 and winter of 1996 after the streams were surveyed. These high flow events likely altered some physical characteristics, previously identified and described from the habitat surveys. A habitat inventory of mainstem McKay Creek may be undertaken in the future.

3. Biological Inventories:

Biological inventories were conducted on June 29, 1999 at RM 21.5 McKay Creek and RM 85 Umatilla River prior to implementation of habitat enhancement projects.

Crews conducted sampling in three 50- to 60-meter subsections of the McKay Creek project site. Each subsection was isolated with block nets, and two passes were made with the electrofisher. In total, the McKay Creek project site was electrofished for 1384 seconds and 12 salmonids were sampled. Non-salmonid species included red-sided shiner, dace, sculpin and Oregon minnow.

Crews sampled the entire length of the Umatilla River project site with one pass of the electrofisher. Because of the size of the river, only the downstream end of the site could be isolated with block nets. In total, the Umatilla River project site was electrofished for 2197 seconds and 162 salmonids were sampled including 1 bull trout, 16 chinook salmon, 141 steelhead/rainbow trout, and 4 whitefish. Non-salmonid species included red-sided shiner, suckers, dace, sculpin and Oregon minnow.

These biological inventories provide baseline, pre-project data that can be compared over time. Graphed data can be viewed in Appendix A. Post-project biological inventories will occur in future project periods to compare catch per unit effort (CPU) and assess fish utilization of instream enhancements.

4. Aquatic Macroinvertebrate Sampling:

Macroinvertebrates were sampled in Mission Creek on September 29, 1999. Stations 1 and 2 on Mission Creek were surveyed for the fourth consecutive year. Macroinvertebrates could not be sampled in Station 3 on Mission Creek due to absence of stream flows. A series of beaver dams were constructed on Spring Hollow Creek during the 1999 project period. These dams significantly altered physical stream characteristics. Riffle habitat was replaced with contiguous pool/glide habitat, and stream flows were lacking within sample sites. The three macroinvertebrate sampling stations within Spring Hollow Creek were unable to be surveyed during the project period because of the loss of riffle habitat and absence of stream flows. Data collected at stations 1 and 2 on Mission Creek included the following:

Mission Creek – Station 1 (upstream of project area)
There were indications of some sedimentation at this station. Sediment tolerant indicator taxa present included *Cheumatopsyche* (201 per m^2) and *Baetis* (1785 per m^2). Cleanwater taxa including *Paraleptophlebia* (1065 per m^2) and *Zapada* (229 per m^2) indicated fairly good water quality and some good instream substrate. The HBI of 3.727 indicated that the water at this site was slightly enriched organically. The BCI of 87 indicated that this ecosystem was in good condition. There may be some opportunity for management to improve instream habitat quality and water quality with regard to organic nutrients. The Shannon Diversity Index of 2.524 indicated that the macroinvertebrate community has a good level of diversity.

Mission Creek – Station 2 (within project area)
There were indications of some sedimentation at this station. Sediment tolerant indicator taxa present included *Cheumatopsyche* (1153 per m^2) and *Baetis* (2003 per m^2). Cleanwater taxa including *Paraleptophlebia* (4324 per m^2), *Zapada* (410 per m^2), and *Skwala* (152 per m^2) indicated fairly good water quality and good instream substrate. The HBI of 3.343 indicated that the water at this site was slightly enriched organically. The BCI of 82 indicated that this ecosystem was in good condition. Within this project area, habitat improvements have occurred and riparian recovery is occurring. The Shannon Diversity Index of 2.331 indicated that the macroinvertebrate community has a good level of diversity.

Summarized historical data from the macroinvertebrate surveys can be viewed in Appendix B. By comparing the average Biotic Condition Indices of Mission and Spring Hollow Creek (see Appendix B, Page B-2), the macroinvertebrate communities reveal a difference in ecosystem health. The macroinvertebrates in Mission Creek are indicative of a system with relatively low sediment and organic inputs. On the other hand, Spring Hollow Creek macroinvertebrates reveal comparatively higher sediment. This is an excellent example of how macroinvertebrates can be used as indicators of ecosystem health.

Data about macroinvertebrates is site-specific. Aquatic ecosystems cannot be managed on the basis of average values over large diverse areas (U.S. BLM, 1988). However, site-specific aquatic macroinvertebrate data will assist in assessment and improvement of aquatic habitat and water quality within a given stream reach. Information obtained from aquatic macroinvertebrate surveys should prove useful in showing the effects of physical and water chemistry influences (i.e. habitat improvements) within project areas over time. Aquatic macroinvertebrate sampling will continue to be repeated in the Spring Hollow Creek and Mission Creek project areas.

5. Water Temperature Monitoring:

Temperatures in excess of 65°F impair growth and survival in salmonids (USFWS and National Marine Fisheries Service, 1981). Abnormally high temperature conditions during migration can contribute to outbreaks of disease among adult chinook salmon often resulting in pre-spawning mortality. Temperatures in excess of 68°F have been shown to result in impairment of chinook salmon. High stream temperatures may also stress juvenile steelhead during warm summer months. Temperatures exceeding 73°F result in direct mortality to chinook salmon and steelhead (*Oncorhynchus mykiss*) (Bell, 1984).

Thermographs were deployed at 20 locations throughout the upper Umatilla River Basin (see Figure 3, page 19 for locations). Stream temperature data was summarized into tabular form, illustrating maximum, average and minimum daily Celsius and Fahrenheit temperatures during thermograph deployment periods. A binder containing water temperature tables is maintained in the CTUIR Habitat Enhancement Project Office. Summer (June, July, August and September) stream temperatures were graphed to determine if temperatures exceeded limits detrimental to anadromous salmonids. Graphed data can be viewed in Appendix C.

The thermograph deployed at RM 76.5 Umatilla River was discovered out of water resulting in loss of data from June 9 to June 18, 1999. The thermograph at RM 26 Wildhorse Creek malfunctioned, and 1999 temperature data was unrecoverable for this site.

The table in Appendix C-20 illustrates the total number of days average and maximum stream temperatures exceeded 65°F, 70°F, 75°F and 80°F between June 1 and September 30, 1999 at thermograph deployment sites. Due to the problems mentioned in the previous paragraph, data from two sites could not be summarized, as is indicated in this table.

Mission Creek and Coonskin Creek exhibited the temperatures most conducive for salmonid survival and rearing. However, a habitat inventory conducted by CTUIR UBNPME Staff during the summer of 1995 documented that 77% of Mission Creek was dry by late summer (Contor, et al., 1996). The CTUIR discovered mean salmonid densities in Mission Creek to be 0.0931 fish/m^2 and 0.3200 fish/m^2 in Coonskin Creek (Contor, et al. 1996).

Stream temperatures in Spring Hollow Creek were more than adequate for salmonid utilization. However, extensive erosion of soils from cropland fields within this drainage appears to restrict salmonid production in Spring Hollow Creek. Shaw (1996,1997and 1998) also found high sulfate levels in this system. Average summer stream temperatures within Moonshine Creek and Squaw Creek proved sufficient for fish, but intermittent stream flows limit available fish habitat within these tributaries during summer months.

Stream temperatures averaged eight to ten degrees Fahrenheit cooler within the lower Wildhorse Creek Project Area at RM 9.5 in the summers of 1998 and 1999 than during previous summers. The CTUIR Habitat Enhancement Project has monitored temperatures at this site since the summer of 1995. Temperature data obtained at this site from 1995 through 1997 illustrated much higher temperatures and greater diurnal fluctuations. It is unknown whether CTUIR's habitat improvements have resulted in cooler, more consistent temperatures at this site. Continued out-year monitoring at this location may provide answers to this anomaly.

Stream temperatures were highest, exceeding 85 F on several days, at RM 56 Umatilla River and at RM .04 Little Buckaroo Creek. In general, stream temperatures throughout the Umatilla River Basin averaged two to six degrees Fahrenheit cooler in the summer of 1999 than during previous years. Notable exceptions were temperatures at RM .04 Little Buckaroo Creek and RM 9 Squaw Creek. Both of these sites had maximum stream temperatures reaching several degrees warmer than during past summers. Cooler ambient temperatures likely contributed to more moderate stream temperatures at most sites. It is unknown why maximum stream temperatures were above average at RM .04 Little Buckaroo Creek and RM 9 Squaw Creek.

6. Suspended Sediment Monitoring:

Siltation, a leading cause of non-point source pollution, is especially harmful to fish and aquatic ecosystems. Sediments harm fish by reducing dissolved oxygen levels and by smothering eggs and newly hatched fry. Sediment deposits also can eliminate aquatic plants that provide cover for fish and the invertebrates they consume (Trout Unlimited, 1994).

CTUIR Habitat Enhancement Project Personnel collected daily suspended sediment data from three ISCO Model 2700 Wastewater Samplers. Data obtained was averaged and combined with gage station stream flow data to arrive at daily estimates of total sediment yield at RM 2 Meacham Creek (at USGS Gage Station No. 14020300), RM 56 Umatilla River (at USGS Gage Station No. 14020850) and RM 81.7 Umatilla River (at USGS Gage Station No. 14020000). Suspended sediment data was graphed, and this information is presented in Appendix D (absence of data is indicated by lack of a contiguous sediment yield line on graphs). Tabular daily sediment yield data and stream discharge data is currently maintained at the CTUIR Habitat Enhancement Project Office.

Stream flows during 1999 ranged from a peak of 1390 cfs on March 1 to a minimum of 10 cfs on August 28 and 29 at RM 2 Meacham Creek, a peak of 3,690 cfs on March 1 to a minimum of 39 cfs on August 29 at RM 56 Umatilla River, and a peak of 1,230 cfs on March 1 to a minimum of 38 cfs on several days in late September at RM 81.7 Umatilla River.

Peaks in sediment yield generally corresponded closely with winter and early spring high flow events. Maximum documented 1999 daily sediment yields of 127.48 tons per day occurred at RM 2 Meacham Creek on January 1, 2998.86 tons per day at RM 56 Umatilla River on March 1, and 181.58 tons per day at RM 81.7 Umatilla River on May 25.

Objective III: <u>Continue Watershed Planning, Scoping and Education Process by Developing Creative Solutions to Land Use Problems Impacting Fisheries Habitat in the Umatilla River Basin.</u>

1. Watershed Analysis:

WSU Staff and CTUIR Habitat Enhancement Project Personnel held several watershed analysis coordination meetings to exchange ideas, obtain agency input, and update interested parties on progress. Efforts to develop a Umatilla Basin Watershed Analysis will continue through 2000. A finalized document will be available by fiscal year 2001.

2. Community Outreach Efforts:

The following public outreach efforts occurred during the 1999 project period:

- Participated and provided displays and educational literature to seventh and eighth grade students at the Umatilla-Morrow Education Service District (ESD) Career Showcase.

- Provided slide presentations of CTUIR's on-going habitat enhancement efforts to Umatilla Salmon Corps, the CTUIR Water Health Committee, Hermiston High School Students and Blue Mountain Community College Agriculture Students.

- Participated and provided displays and educational literature to the public at the CTUIR Salmon Restoration Open House.

- Participated in ODFW's Northeast Oregon Habitat Project Review Tour, which entailed visiting BPA funded projects and exchanging information regarding habitat enhancement techniques and successes.

- Provided a tour of CTUIR habitat enhancement projects to approximately 20 environmental coordinators from ODOT.

- Provided a presentation at Umatilla-Morrow County ESD's Resource Roundtable to build awareness among local teachers of educational opportunities that are available through the project.

- Participated in a bioengineering workshop planning meeting with various resource agencies to devise an agenda and objectives for a fall 2000, landowner/contractor oriented bioengineering workshop.

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