Umatilla River Basin Anadromous Fish Habitat Enhancement Project

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Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

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UMATILLA RIVER BASIN ANADROMOUS FISH HABITAT

ENHANCEMENT PROJECT

2001 ANNUAL REPORT

Prepared by:

R. Todd Shaw, Fish Habitat Biologist
and
Amy D. Sexton, Assistant Fish Habitat Biologist

Confederated Tribes of the Umatilla Indian Reservation
Department of Natural Resources
Fisheries Program

Prepared for:

U.S. Department of Energy
Bonneville Power Administration
Environment, Fish and Wildlife
P.O. Box 3621
Portland, OR 97208-3621

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ABSTRACT

The Umatilla River Basin Anadromous Fish Habitat Enhancement Project continued to identify impacted stream reaches throughout the Umatilla River Basin for habitat improvements during the 2001 project period. Public outreach efforts, biological and physical monitoring, and continued development of a Umatilla Subbasin Watershed Assessment assisted the project in fostering public cooperation, targeting habitat deficiencies and determining habitat recovery measures.

Projects continued to be maintained on 49 private properties, one 25-year Non-Exclusive Bureau of Indian Affairs' Easement was secured, six new projects implemented and two existing project areas improved to enhance anadromous fish habitat. New project locations included sites on the mid Umatilla River, upper Umatilla River, Mission Creek, Cottonwood Creek and Buckaroo Creek. New enhancements included: (1) construction of 11,264 feet of fencing between River Mile 43.0 and 46.5 on the Umatilla River, (2) a stream bank stabilization project implemented at approximately River Mile 63.5 Umatilla River to stabilize 330 feet of eroding stream bank and improve instream habitat diversity, included construction of eight root wad revetments and three boulder J-vanes, (3) drilling a 358-foot well for off-stream livestock watering at approximately River Mile 46.0 Umatilla River, (4) installing a 50-foot bottomless arch replacement culvert at approximately River Mile 3.0 Mission Creek, (5) installing a Geoweb stream ford crossing on Mission Creek (6) installing a 22-foot bottomless arch culvert at approximately River Mile 0.5 Cottonwood Creek, and (7) providing fence materials for construction of 21,300 feet of livestock exclusion fencing in the Buckaroo Creek Drainage. An approximate total of 3,800 native willow cuttings and 350 pounds of native grass seed was planted at new upper Umatilla River, Mission Creek and Cottonwood Creek project sites. Habitat improvements implemented at existing project sites included development of a 105-foot well for off-stream livestock watering at approximately River Mile 12.0 Wildhorse Creek and construction of an engineered stream ford at approximately River Mile 3.0 Mission Creek.

A total of $277,848 in financial cost share assistance was provided by the Confederated Tribes of the Umatilla Indian Reservation, U.S. Bureau of Indian Affairs, U.S. Environmental Protection Agency, U.S. Department of Agriculture, National Oceanic and Atmospheric Administration, U.S. Workforce Investment Act, Oregon Watershed Enhancement Board, Umatilla County and Pheasants Forever for planning efforts and habitat enhancements.

Monitoring continued to quantify baseline conditions and the effects of habitat enhancements in the upper basin. Daily stream temperatures were collected from June through September at 22 sites. Suspended sediment samples were obtained at three gage stations to arrive at daily sediment load estimates. Photographs were taken at 96 existing and three newly established photo points to document habitat recovery and pre-project conditions. Transects were measured at three stream channel cross sections to assist with engineering and design and to obtain baseline data regarding channel morphology. Biological inventories were conducted at River Mile 3.0 Mission Creek to determine pre-project fish utilization above and below the passage barrier. Post-project inventories were also conducted at River Mile 85.0 of the Umatilla River at a project site completed in 1999.

Umatilla Subbasin Watershed Assessment efforts were continued under a subcontract with Eco-Pacific. This watershed assessment document and working databases will be completed in fiscal year 2002 and made available to assist project personnel with sub-watershed prioritization of habitat needs. Water Works Consulting, Duck Creek Associates and Ed Salminen Consulting were subcontracted for watershed assessment and restoration planning in the Meacham Creek Subwatershed. A document detailing current conditions in the Meacham Creek Subwatershed and necessary restoration actions will be available for review in 2003.

ACKNOWLEDGMENTS

This project was funded by the Bonneville Power Administration. The Confederated Tribes of the Umatilla Indian Reservation wish to thank Peter Lofy and other Bonneville Power Administration personnel for their assistance. Thanks also to the Bureau of Indian Affairs-Umatilla Agency for providing personnel, Bureau of Indian Affairs funding and Oregon Watershed Enhancement Board grant dollars to cost share noxious weed treatments within Umatilla Indian Reservation watersheds, Chet Hadley for his assistance in obtaining and providing Pheasants Forever cost share funds for the Wolfe Ranches Fencing Project, Columbia River Inter-Tribal Fisheries Staff for assistance in obtaining National Oceanic and Atmospheric Administration – Pacific Coastal Salmon Recovery cost share funding to replace a culvert on Mission Creek, Hal Phillips, Umatilla County Public Works Director, and Vern Purcell, Umatilla County Public Works Bridge Foreman, for providing expertise, equipment and personnel to replace a culvert on Mission Creek, and Darin Saul, Eco-Pacific Director, and staff for continued coordination and development of the Umatilla Subbasin/Willow Subbasin Watershed Assessment.

We would like to acknowledge cooperating landowners, Stephen and Fern Wolfe (Bill Wolfe Ranches, Inc.), Emma Stroud, George and Rochelle Peck, Dixie Ruchmann, Tonya Wojak, Bruce and Colette Carson, and numerous landowners on Indian Allotment C0101, who supported our efforts by entering into easements and/or providing their properties for habitat enhancements during the 2001 project period.

Thanks also to Confederated Tribes of the Umatilla Indian Reservation staff, whose cooperation and contributions are evident in this report. Special thanks to Julia “Ju Ju” Withers, Tribal Personnel Director, for providing a temporary employee funded under the U.S. Workforce Investment Act to assist with project implementations, monitoring and maintenance, Donald “Eagles” Williams for collecting sediment data and servicing sediment samplers, Randy Bonifer, Mike Jones, James Bill, Laki Oakhurst and Randy Alexander for long hours performing office duties, monitoring habitat enhancements, and implementing and maintaining improvements in project areas, to Jim Webster for development of hydraulic designs for 200l habitat enhancements and proposed 2002 projects and coordinating and providing cost-share funding to construct livestock exclusion fencing in the Buckaroo Creek Drainage and for watershed assessment and restoration planning in the Meacham Creek Subwatershed, to Pam Shippentower for secretarial services, to Julie Burke and Celeste Reeves for administrative office support, to Gary James for support and guidance, and to Michelle Thompson for administration of this agreement.

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INTRODUCTION

The Umatilla River Basin Anadromous Fish Habitat Enhancement Project is funded with Bonneville Power Administration (BPA) funds and is consistent with the 1994 Northwest Power Planning Council's (NPPC) Columbia River Basin Fish and Wildlife Program, Section 7.6 – 7.8, which targets the improvement of water quality and restoration of riparian areas, and specifically the holding, spawning and rearing habitats of anadromous salmonids. This project is also compatible with the Habitat Strategies section of the 2000 NPPC Columbia River Basin Fish and Wildlife Program, in that emphasis in the basin will depend "heavily on protection of, and improvements to, inland habitat as the most effective means of restoring and sustaining fish and wildlife populations". 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, 2001 through January 31, 2002 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 11.7 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 mid Umatilla River, 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 50 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 subbasin summary and watershed assessment are currently being developed to assist the project with prioritization of fisheries habitat needs and streamlining of project funds. 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:

Table 1 - CTUIR Habitat Enhancement Project Table.

STREAM	RIVER MILE LOCATIONS	NO. OF STREAM MILES ENHANCED	NO. OF LANDOWNER AGREEMENTS
Mid Umatilla River	37.3 – 37.4	0.1	1
Mid Umatilla River	43.0 – 46.5	3.0	2
Upper Umatilla River	63.5	0.05	1
Upper Umatilla River	78.5 – 85.0	3.2	11
Lower Meacham Creek	0 – 4.5	4.5	15
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 and 9.8 – 10.1 (Tribal Properties)	1.2	0 (Tribal Properties)
McKay Creek	21.5 – 22.25	0.4	2
Moonshine Creek	@ 1.1	Passage Site	0
Cottonwood Creek	@ 0.5 and 1.3	Passage Site	1
Mission Creek	@ 1.3 and 3.0	Passage Site	0
TOTAL		19.15	50

The Umatilla River has a drainage basin of 2,290 square miles and is a tributary to the Columbia River at RM 289 (Gonthier and Harris, 1977). Elevations in the subbasin range from about 5,800 feet near Pole Springs on Thimbleberry Mountain to 260 feet at the mouth of the Umatilla River. After leaving the Blue Mountains, the North and South Fork of the Umatilla River merge to form the mainstem, a 90 mile reach of river which flows through a series of broad valleys that drain low rolling lands. All of the primary tributaries of the Umatilla River drain the Blue Mountains and enter

the Umatilla River from the south. The North and South Forks of the Umatilla River and Meacham Creek account for approximately 14% of the Umatilla River subbasin drainage area, yet supply 40-50% of the average flow to the Umatilla River (Saul et al., 2001). 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 65 square miles and produces 145,000 acre-feet annually at RM 5 near the top of the project area. The average annual discharge for Meacham Creek is 193 cubic feet per second (cfs) (Saul et al., 2001).

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 upper 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 gradient averages less than two percent. Flooding in project areas usually occurs in late winter and spring as a result of a rain on snow event. 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 upper 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, stream bank rip-rapping 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.

The mid-Umatilla River has been highly altered by human development. Stream channel morphology and flows have been significantly altered by irrigation dams and pumps, channelization, and the development of farms, homes and industry in the riparian area and adjacent uplands (Contor et al, 1997). Modern human activities loaded the river with agricultural fertilizers, sewage, pesticides, suspended sediments as well as urban and industrial pollution (Contor et al, 1997). However, stream temperatures in the Barnhart vicinity (RM 35.0 through 49.0) are positively influenced by cold water releases from McKay Reservoir. These releases elevate flows from about 45 to 250-325 cfs (Yoakum gage), increase turbidity and decrease water temperatures (Zimmerman and Duke, 1996). The gradient in this reach is constant, and the increased flows provided abundant fast water habitat types (Contor et al, 1997). Flows released from McKay Reservoir are from the cooler hypolimnion layer, providing suitable stream temperatures for salmonids. Stream temperatures from RM 35.0 through RM 49.0 are comparable to those found in the Umatilla River's headwaters (RM 80.0 through 90.0) (see Figure 1 below).

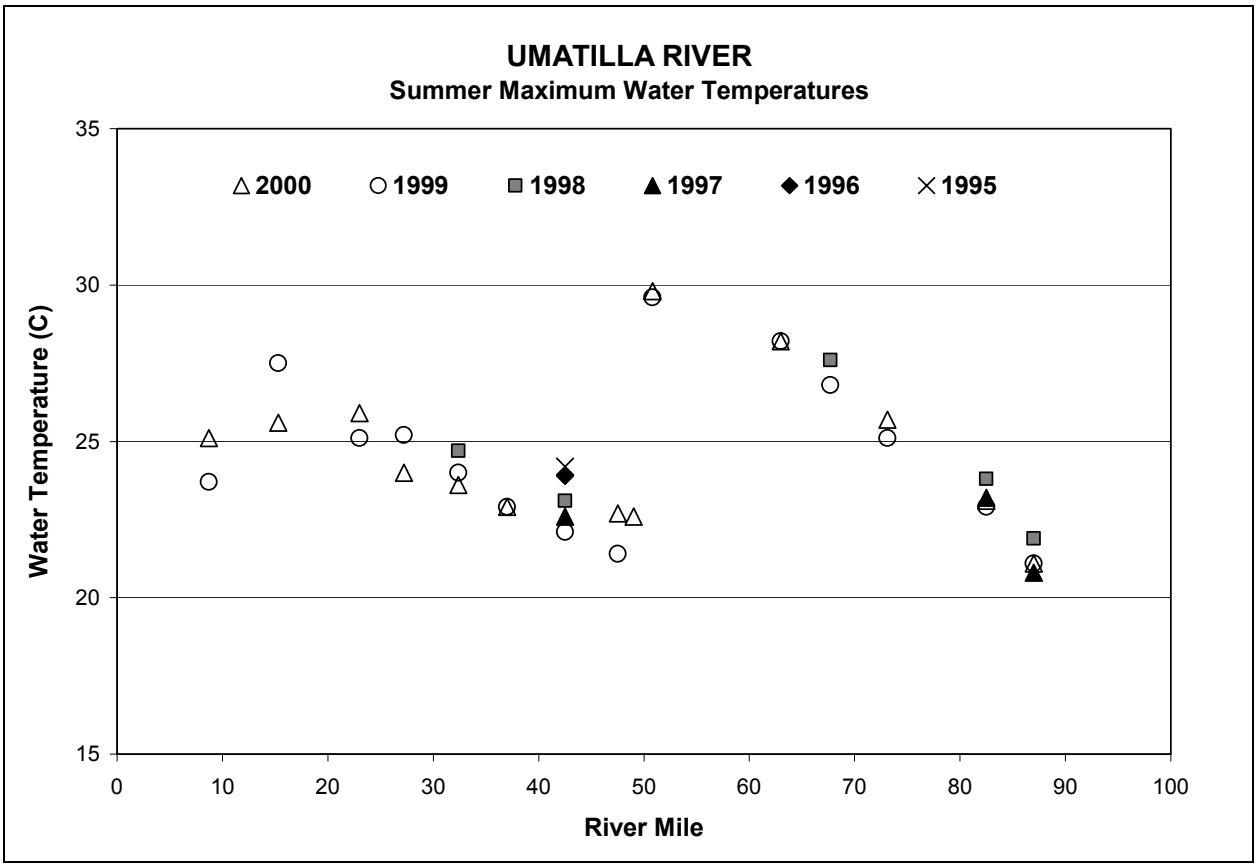


Figure 1 - Maximum summer water temperatures along the length of the Umatilla River.

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% contributes to rapid runoff rates. The slope in the lower and mid reaches varies from 0 to 3% (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 floodplain 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 floodplain 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% 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 sections 29, 26 and 23, T.3N., R.35E. 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. 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 floodplain areas in lower stream reaches. High stocking rates, absence of pasture rotation plans and failure to restrict grazing during wet periods results 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/stream bank 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 graph A-12.), 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 (U.S. 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 (U.S. 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 (U.S. 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 at its highest point near Kamela, Oregon is 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 (based on a period of record from 1930 to 1985) upstream of the reservoir 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 would have 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 warm-water 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. 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 the McKay Creek Watershed 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). 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 20:1 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 upper 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 dranages range from 0 to 70%, 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, prince's 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. A culvert, impeding fish passage in lower Cottonwood Creek, was addressed during the project period. This improvement is 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 mid Umatilla River, upper 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.

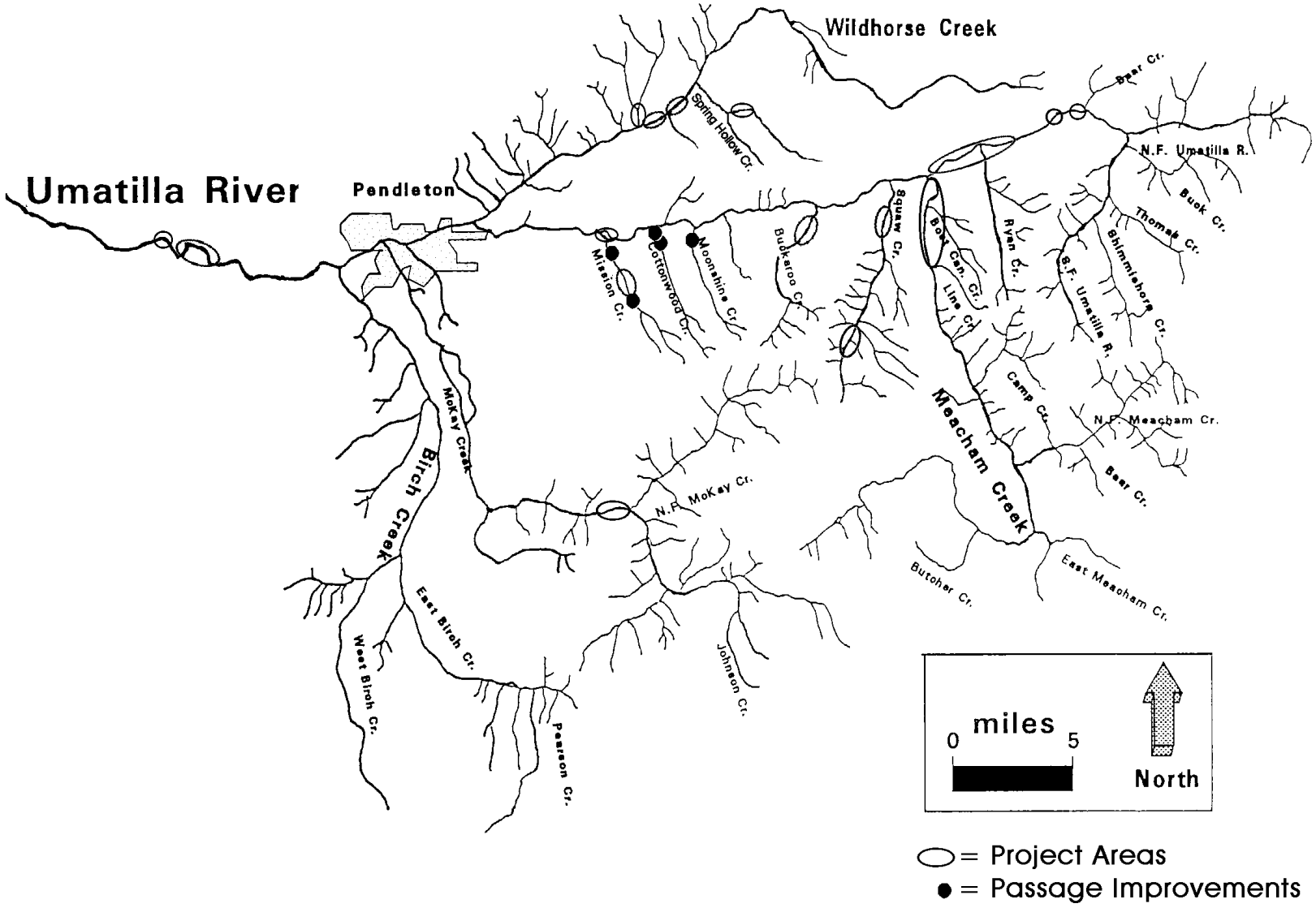


Figure 2 - CTUIR Anadromous Fish Habitat Enhancement Project Vicinity Map.

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 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 pursuit of riparian easements.

Riparian Conservation Agreements 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 ensure an early recovery period within project areas.

Access, Implementation and Maintenance Agreements are obtained for projects strictly involving in-stream habitat enhancements. These agreements typically have a five-year term. As with the Riparian Conservation Agreements, the landowner accepts the costs of all habitat improvements and CTUIR's maintenance of these improvements as consideration for participating in project recovery efforts. The purpose of these projects is to improve stream bank stability and increase in-stream habitat diversity. The five-year term provides a period in which to monitor project recovery and perform any necessary maintenance to in-stream structures.

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. Removal/Fill Permits

Instream work activities on the Reservation require a CTUIR Tribal Stream Zone Alteration Permit and a U.S. Army Corps of Engineer's (COE) 404 Removal/Fill Permit. Any instream work proposed within CTUIR's identified flood hazard sub-district or potential special flood hazard areas require a Tribal Development Permit from the CTUIR Planning Office.

Instream work activities off of the Reservation either require a General Authorization for Fish Habitat Enhancement Permit or a Removal/Fill Permit (dependent upon the scope of activities and scale of the proposed project) from the Oregon Division of State Lands (ODSL) in conjunction with a COE 404 Removal/Fill 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 Removal/Fill 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

The project coordinates with CTUIR's Cultural Resource Protection Program (CRPP) at proposed habitat enhancement sites involving ground disturbance (fence construction, structures keyed into stream banks, etc.), prior to project implementation 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 conduct on-site monitoring of 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 and Professional Services Agreements

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.

2. Maintain and Implement Habitat Enhancements:

a. Instream and Stream Bank Improvements

Stream bank revetments, log and boulder weirs, log and boulder deflectors, rock vanes 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 are 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 stream banks by slowing water velocities and capturing sediments. Hydrological controls (root wad and rock revetments, deflectors, vanes, 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 bio-engineering approaches are reserved for areas that will not recover in a timely or natural manner.

b. Fish Passage Improvements

The CTUIR Habitat Enhancement Project attempts to address various fish passage impediments, previously identified by the CTUIR UBNPME Project (Saul et al., 2001), throughout the Umatilla Basin. Improvements at these sites will continue to include removal or modification of culverts, bridges, grade control structures and water diversion structures to allow fish to migrate over or around such obstacles.

c. 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 to occur within project areas.

The project constructs both, smooth-wire high tensile and barbed-wire fencing for livestock management. Smooth-wire high tensile fencing is utilized in areas where livestock are distributed over vast areas (open range) and tree blow-down is frequent. Barbed-wire fencing is useful when livestock pressure is significant, such as when large numbers of cattle are confined in pastures, there is high potential for fire damage, and tree density is low.

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.

d. Off-stream Livestock Water Developments

Off-stream water sources are developed to prevent stream bank erosion from livestock trailing and eliminate high maintenance costs associated with water gaps in fenced riparian corridors. Existing springs are developed and shallow or deep wells drilled to provide a necessary water source for livestock.

Typically, these projects involve landowner financial and in-kind cost share assistance. The project funds any subcontracted services, electrical hook-ups and installations, and solar panels, pumps, pipe and associated hardware, water troughs and other material items. The landowner pays for electrical costs to operate pumps, and provides equipment and labor to install plumbing and water troughs.

e. 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. Stream banks, 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 various grass seed companies.

f. Noxious Weed Control

The CTUIR subcontracts herbicide applicators to chemically treat noxious weeds up to 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, Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) Regulations, and NMFS and USFWS recommendations regarding ESA concerns.

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>Collect Baseline Data to Assess Pre-project Conditions and Continue Post-project Monitoring 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:

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 following project implementation to measure changes in channel morphology and vegetative responses to habitat enhancements.

Permanent photo points are established prior to project implementation in conjunction with permanent transects. Standardized photos are taken each spring and autumn in existing project areas 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 have conducted habitat surveys in conjunction with biological inventories in Umatilla River Basin Subwatersheds. These surveys have assisted the project 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 sometimes 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. A single pass with the electrofisher is made 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 assist in evaluation of habitat recovery.

4. Aquatic Macroinvertebrate Sampling:

Macroinvertebrates are components of the aquatic environment that provide a connecting link in the food chain between multicelled 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. Macroinvertebrate populations usually recover more quickly than fish populations in response to water quality improvements and thus, appear to provide better subjects for assessing habitat recovery.

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. A total of nine macroinvertebrate samples are collected per stream. 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 data collected in conjunction with aquatic macroinvertebrate surveys includes information regarding: stream gradient, depth, velocity, discharge, substrate types, and stream bank vegetation. Water chemistry parameters measured at the time of the surveys includes: 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. Macroinvertebrate sample results are then used to calculate biotic indices to assess 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. The most common biotic indices in use in the United States are the USFS Biotic Condition Index (BCI) and the Modified Hilsenhoff Biotic Index (HBI). The physical habitat characteristics and water chemistry parameters, measured at each station, are integrated into the macroinvertebrate analysis to determine the BCI. The USFS developed this index to provide 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, an organic enrichment index based broadly upon family taxonomy, is also calculated and can be 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,
- % taxon or family dominance,
- % 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:

Vemco Minilog Thermographs are deployed within selected stream reaches (see Table 2) in the upper Umatilla River Watershed. Several of these instruments are installed upstream, downstream and/or within project areas in the 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 and Wildhorse Creek 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, minimum and average daily water temperatures are compiled in tabular form.

Water temperatures are graphed for warmer months (June, July, August and September) to determine if temperatures are reached which could prove detrimental to salmonids.

Table 2 - Thermograph locations for the 2001 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 1.4 (Oregon Water Resources Gage)
6.	Wildhorse Creek – RM 9.5 (upstream from mouth of Greasewood Creek)
7.	Wildhorse Creek – RM 18.3 (at Pambrun Road Bridge)
8.	Wildhorse Creek – RM 26
9.	Greasewood Creek – RM 0.1 (upstream of confluence with Wildhorse Creek)
10.	Spring Hollow Creek - RM 3.5
11.	Eagle Creek - RM 0.2 (at Umatilla County Road 685 Bridge)
12.	Mission Creek - RM 1.25 (upstream of Umatilla County Road 900 Bridge)
13.	Mission Creek - RM 3.7 (upstream of St. Andrew's Church)
14.	Mission Creek - RM 3.8 (downstream of stream forks)
15.	Moonshine Creek – RM 1.1 (upstream of Umatilla County Road 900 Bridge)
16.	Coonskin Creek – RM 0.2 (upstream of Umatilla County Road 900 Bridge)
17.	Buckaroo Creek – RM 2
18.	Little Buckaroo Creek – RM 0.04 (upstream from confluence with Buckaroo Creek)
19.	Squaw Creek - RM 2
20.	Squaw Creek - RM 9 (at confluence with Little Squaw Creek)
21.	Meacham Creek – RM 1.4 (USGS Gage Station No. 14020300)
22.	Meacham Creek – RM 5.25 (East Reservation Boundary)

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).

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 Table 3 below) and near CTUIR thermographs.

Samples are taken year round at 6-hour intervals to create a composite daily sample. The samples are collected every 21 days and analyzed by Umatilla National Forest Service Personnel at the USFS Lab in Pendleton, Oregon to determine turbidity (NTU), specific conductivity and total suspended solids. CTUIR staff correlate suspended sediment data with stream flow data collected from the adjacent gage stations to calculate total sediment load (tons/day).

Table 3 - Suspended sediment monitoring sites in 2001.

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: Continue Watershed Planning, Scoping and Education Process by Identifying and Developing Creative Solutions to Land Use Problems Impacting Fisheries Habitat in the Umatilla River Basin.

1. Watershed Assessment:

Eco-Pacific continues to develop a Umatilla Subbasin Watershed Assessment. This document will assist in subwatershed prioritization of anadromous fisheries habitat needs and determination of future habitat improvements. 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 (in-stream hard structures, rip-rapping, etc). Furthermore, many of the habitat deficient areas, identified in the plan, have been addressed. Therefore, an updated watershed assessment should prove useful in guiding future project activities.

The current watershed assessment will include historical watershed conditions, present-day watershed conditions, on-going land use practices, biological data, anadromous fish habitat limiting factors, and data gaps.

The project is also coordinating with the CTUIR Environmental Protection/Rights Protection (EP/RP) Program to develop watershed assessment and restoration efforts in the Meacham Creek Subwatershed.

Project staff participated in the development of the Draft Umatilla Subbasin/Willow Subbasin Summary (Subbasin Summary) by providing technical input and writing portions of that document.

2. Community Outreach Efforts:

The project conducts local outreach efforts. Outreach activities are coordinated with landowners, special interest groups and resource agency personnel. 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. Watershed improvement workshops, tours and presentations are provided to area residents, students, agency personnel and other interested individuals.

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 upper and mid Umatilla River, Meacham Creek, Boston Canyon Creek, Wildhorse Creek, Greasewood Creek, West Fork of Greasewood Creek, Spring Hollow Creek, Mission Creek, Moonshine Creek, Cottonwood Creek, Buckaroo Creek, Squaw Creek and McKay Creek project areas were evaluated in spring 2001. It was determined that two water gaps between RM 11.5 and RM 12.5 Wildhorse Creek would be eliminated due to increasing repairs and associated high maintenance costs. Plans were developed to drill a well at approximately RM 11.0 to provide off-stream livestock watering at this project site. The project also determined that an engineered stream ford would be beneficial at approximately RM 3.0 Mission Creek. Frequent vehicle crossings at this site were impacting the downstream project area, and the landowner was proposing to construct a bridge, which might negatively, impact the performance of the project's new passage project (a bottomless arch culvert) located 285 feet upstream. Project personnel accomplished minor fence maintenance in project areas during the project period.

b. Project Cost Share

A total of $277,848 in financial cost share assistance was obtained from various sources, in addition to landowner and agency in-kind contributions.

A total of $22,764 in CTUIR funds was secured to cover personnel salaries, fringe benefits and associated overhead expenses. An additional $ 9,744 in U.S. Workforce Investment Act funds were obtained to provide 1,218 hours of seasonal employee assistance. BPA moneys funded the remaining $159,596 in salary, fringe benefit and overhead expense needs.

The project and CTUIR EP/RP Personnel cooperatively collected daily suspended sediment data from three ISCO Model 2700 Wastewater Samplers at RM 2 Meacham Creek, RM 56 Umatilla River and RM 81.7 Umatilla River. EP/RP provided $3,654 in EPA cost share funds to cover salary, fringe benefits and associated indirect costs for a CTUIR Water Quality Technician to collect data and service the sampling stations. The CTUIR Habitat Enhancement Project provided $3,618 in BPA project dollars to finance USFS lab analysis of sediment samples and associated indirect expenses.

The U.S. Department of Agriculture's (USDA) Environmental Quality Incentive Program (EQIP) provided $45,333 in funds for pasture rotational fencing in the Buckaroo Creek Watershed. CTUIR provided an additional $18,921 in funds towards this effort. Approximately $3,130 in BPA dollars under this project were provided for purchase of fence construction materials. The purpose of this project is to better distribute livestock within the Buckaroo Creek Watershed and minimize grazing impacts in the riparian area.

The BIA Umatilla Agency provided personnel, $38,509 in BIA funds and $24,327 in Oregon Watershed Enhancement Board grant dollars for noxious weed treatments within

Reservation watersheds. BPA project dollars provided an additional $3,182 to assist with noxious weed control in these areas.

Pheasants Forever provided a $4,995 grant to assist with construction of 6,829 feet of fencing to exclude livestock from portions of the floodplain and riparian corridor between RM 45.2 and RM 46.5 Umatilla River on the Bill Wolfe Ranches, Inc., Property. BPA provided fence materials and funded the remaining $3,458 in construction costs necessary to complete the project.

BPA funding covered $ 21,926 in costs to drill a 358-foot well, install electrical services, and provide 17,400 feet of PVC pipe and associated plumbing materials, six livestock water tanks and a pump to provide off-stream water sources for livestock on the Bill Wolfe Ranches Property between RM 43.0 and RM 46.5 Umatilla River. The landowner provided 50% ($1101) for purchase of electrical amortization services from Pacific Power and Light and equipment and labor to install all plumbing and water tanks, and will pay monthly electricity charges to operate the well pump.

A 50-foot bottomless arch culvert was purchased with $11,300 in Pacific Coastal Salmon Recovery Funds obtained from the U.S. Department of Commerce's National Oceanic Atmospheric Administration. This culvert replaced an outdated culvert, impeding fish passage, at RM 3.0 Mission Creek. The Umatilla County Road Department provided $18,809 in personnel services (636 man-hours) and $4,499 in in-kind heavy equipment services to install the culvert. They further contributed $1406 in construction materials, including gravel, rock, form oil, scaffold nails and plywood. Additional construction materials necessary to complete the project, plywood, concrete, grout and re-bar, and pumper services were purchased with $3,425 in BPA funding.

An engineered stream ford was constructed at approximately RM 3.0 Mission Creek. The CTUIR EP/RP Program contributed $2909 in EPA cost share funding to purchase all necessary soil stabilization products for this project. The project covered the remaining $3416 in costs incurred, including the purchase of gravel and re-bar and the rental of an operated excavator.

The project also provided 26% ($25,000) of the total cost for subcontracting Water Works Consulting, Duck Creek Associates and Ed Salminen Consulting for watershed assessment and restoration planning in the Meacham Creek Subwatershed. Other project partners included the EPA, who provided 48% ($45,749), Blue Mountain Habitat Restoration Council (Union Pacific Railroad Mitigation Trust Fund) committed 19% ($18,109), and the USFS contributed 6% ($5719) cost share. A document detailing current conditions in the Meacham Creek Subwatershed and recommended restoration actions will be available for review in 2003.

c. Clearances and Land Owner Agreements

CTUIR secured a 25-year Non-Exclusive Easement from the BIA-Umatilla Agency on October 2, 2001 for replacement of an undersized culvert with a 22-foot bottomless arch culvert at RM 0.5 Cottonwood Creek. This easement is approximately 120 feet long, 30 feet wide and contains a 0.08-acre area, and is located in the southeast corner of the northeast quarter of Section 7, Township 2 North, Range 34 East, West Meridian, Umatilla County, Oregon on Tract C-101.

Umatilla County Burning Permits were acquired for implementing controlled burns within the McKay Creek and Wildhorse Creek Project areas to restrict noxious weed growth.

d. Removal/Fill Permits

The CTUIR Habitat Enhancement Project submitted a Joint Permit Application to the COE to stabilize 330 feet on the south stream bank and improve instream habitat diversity at RM 63.5 Umatilla River. Proposed removal/fill activities under this project included construction of eight root wad revetments and three boulder J-vanes with six whole conifer trees incorporated into the J-vanes, and stinging approximately 2,500 native willow cuttings into the stream bank. The COE issued a Nationwide Permit Number 27 on October 9, 2001. A removal/fill permit was not required from DSL for this work because the project was located within Reservation Boundaries. The CTUIR Planning Office provided a Tribal Development Permit on August 14, 2001. A Tribal Stream Zone Alteration Permit had been previously obtained on September 12, 2000.

A CTUIR Tribal Stream Zone Alteration Permit Application was submitted to the CTUIR Department of Natural Resources - Water Resources Program to replace an undersized culvert with a 22-foot bottomless arch culvert at RM 0.5 Cottonwood Creek. The permit application proposed to install the new culvert, construct concrete footings and a headwall, place 150 yards of fill over the culvert, and armor the culvert inlet and outlet with 10 yards of rip-rap, joint planted with approximately 500 native willow cuttings. The existing culvert was not adequately routing flood flows and organic debris within the culvert was impeding fish passage. The new culvert is designed to accommodate 25-year flood events and pass debris more readily. A Tribal Stream Zone Alteration Permit was issued for this work on July 31, 2001.

A Joint Permit Application was submitted to COE to remove a six-foot diameter round culvert, impeding fish passage, and install a 50-foot bottomless arch replacement culvert at approximately RM 3.0 Mission Creek. The permit application also included construction of an engineered stream ford 285 feet downstream from the proposed culvert replacement. The purpose of improving the crossing site was to address ongoing erosion and to deter the landowner from constructing a bridge, which could potentially impact the performance of the upstream culvert. Authorization was granted by the COE on October 5, 2001 to replace the culvert under a Nationwide Permit Number 3 and to construct the stream ford under a Nationwide Permit Number 27. A removal/fill permit application was not submitted to DSL because all proposed activities were within the jurisdiction of the Reservation. The project also submitted a CTUIR Tribal Stream Zone Alteration Permit Application to the CTUIR Department of Natural Resources - Water Resources Program for these proposed activities. A Tribal Stream Zone Alteration Permit was issued on August 13, 2001.

e. Endangered Species Act Requirements

CTUIR Habitat Enhancement Project Staff prepared a BA in conjunction with the removal/fill permit application for the proposed culvert replacement and stream ford construction projects at RM 3.0 Mission Creek. The BA indicated that potential negative impacts to fish at this site were considered unlikely or of low magnitude and only short-term duration. This BA was submitted to BPA, whom forwarded it onto the USFWS and NMFS to initiate ESA, Section 7 consultation proceedings for the proposed implementation activities. A BA was not prepared for the proposed RM 0.5 Cottonwood Creek culvert replacement project because BPA Environmental Compliance Staff determined that this project would have no

effect on ESA listed species. A BA had been previously completed during the 2000 project period for the proposed stream bank stabilization project at RM 63.5 Umatilla River. Populations of ESA listed Columbia River bull trout and mid Columbia Evolutionary Significant Unit of summer steelhead occur at various life stages throughout the Umatilla Basin.

The USFWS and NMFS concurred that proposed project activities at RM 3.0 Mission Creek and RM 63.5 Umatilla River may affect, but would not likely adversely affect ESA listed fish species or their designated critical habitats. ESA clearances were received for all proposed 2001 instream habitat enhancements.

f. Cultural/Archeological Monitoring

The CTUIR CRPP conducted a file and literature search and pedestrian cultural resource reconnaissance survey on the Bill Wolfe Ranches, Inc. property (RM 43.3 to RM 46.5 Umatilla River) in 2001. Cultural resource inventory surveys were conducted on the Emma Stroud (RM 63.5 Umatilla River) and Bruce Carson (RM 3.0 Mission Creek) properties on August 8, 2001. The survey on the Stroud Property proceeded downstream, three to five meters from the edge of the Umatilla River's south stream bank, from the Mission Creek confluence through the length of the proposed project area. A 28-foot by 26-foot concrete foundation and concrete manhole were found immediately west of Mission Creek. A CRPP Technician surveyed the Carson Property from St. Andrews Road downstream 285 feet along Mission Creek to the site of the proposed engineered stream ford. Considerable trash and debris were noted within the stream channel, but no items diagnostically historic in age were discovered. Survey details regarding these two properties have been combined into one report, *A Cultural Resource Inventory of the Emma Stroud, David Richards and Bruce Carson Properties, Umatilla County, Oregon* (Miller, 2001. No cultural resources were discovered at any of these implementation sites, and the CRPP recommended that proposed project activities be implemented. The above mentioned reports were submitted to the State Historic Preservation Office.

Due to potential subsurface archeological resources, a cultural resource monitor was required on site during excavation activities at RM 63.5 Umatilla River, RM 3.0 Mission Creek and RM 0.5 Cottonwood Creek. The cultural resource monitor's salary was funded with project monies. No subsurface archeological resources were discovered at any of these sites during excavation.

g. Design and Layout

The CTUIR hydrologist and the project's assistant habitat biologist developed hydraulic designs for the following instream projects:

- Removal of a 6-foot diameter culvert at RM 3.0 Mission Creek, which was creating a passage barrier of over 3 feet for migrating juvenile and adult steelhead, and installation of a 50-foot long, 13-foot span, bottomless arch culvert with a 5-foot and 1-inch rise, designed to maintain the natural stream bed and gradient.

- Improving a stream-crossing site, located 285 feet downstream from the culvert replacement project on Mission Creek, by determining the appropriate construction materials and installation procedures.

- Replacement of a debris jammed culvert with a 22-foot long, 9-foot span multi-plate bottomless arch culvert with a 4-foot and 8-inch rise to accommodate natural stream channel functions and provide adequate fish passage.

The CTUIR hydrologist had previously developed hydraulic designs for eight root wad revetments and three boulder J-hook vanes with six whole conifer trees incorporated into the J-vanes to address 330 of stream bank erosion and provide in-stream habitat diversity at RM 63.5 Umatilla River during the 2000 project period.

The CTUIR hydrologist and the project's assistant habitat biologist completed designs for implementation of a single-threaded channel with large woody debris additions on a property located at approximately RM 87.0 Umatilla River and for a stream channel restoration project at RM 83.0 Umatilla River. CTUIR will attempt to implement both of these projects during the 2002 project period.

CTUIR Habitat Enhancement Project Technicians closely coordinated with Bill Wolfe Ranches, Inc. to layout fence lines and gate locations for proposed construction of 11,264 feet of four-strand barbed-wire livestock exclusion fencing between RM 43.0 and 46.5 Umatilla River.

h. Contracts and Professional Services Agreements

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 $4,700 professional services agreement was awarded to Calvin R. Hendrickson Fencing on February 28, 2001 for construction of 4,435 feet of four-strand barbed-wire livestock exclusion fencing and installation of three Powder River Gates and two wire gates. This project was implemented on the Bill Wolfe Ranches, Inc. Property between approximately RM 43.0 and RM 43.8 Umatilla River.

Larry Burd Well Drilling, Inc. was awarded a subcontract on May 30, 2001 to drill, case, develop, test pump, and cap a 358-foot well on Bill Wolfe Ranches, Inc. Property. The purpose of this well is to provide an off-stream water source for livestock between approximately RM 43.0 and RM 46.5 Umatilla River. Total subcontract costs for completion of well drilling services was $8,048.

Alabar Construction, Inc. entered into a $7,070 subcontract with CTUIR on September 26, 2001 for construction of a 22-foot bottomless arch culvert at RM 0.5 Cottonwood Creek. The contractor was required to transport and install the culvert, determine and purchase necessary construction and fill materials, and sting native vegetation into rip-rap placed around the culvert.

K.R. Strickland was subcontracted on September 27, 2001 to slope 330 feet of stream bank at RM 63.5 Umatilla River, install eight root wad revetments, construct three boulder J-vanes, incorporate six whole conifer trees into J-vanes, sting approximately 2,500 native willow cuttings into stream banks, and train two CTUIR project technicians to operate an excavator for implementation of instream enhancements. The total cost for these services was $13,215.

A $2,100 professional services agreement was awarded to K.R. Strickland on September 27, 2001 for construction of an engineered stream ford at RM 3.0 Mission Creek. The contractor was required to excavate fill from the stream channel and banks, slope the stream banks, install a Geoweb Channel Protection System, place and compact gravel in cells of the Geoweb grid and remove excess fill materials off-sites.

Calvin and Rick Hendrickson were awarded a $8453 subcontract on November 16, 2001 for construction of 6,829 feet of four-strand barbed-wire livestock exclusion fencing and installation of six 18-foot wire gates. Fence construction activities were implemented on the Bill Wolfe Ranches, Inc. Property from approximately RM 45.2 to RM 46.5 Umatilla River.

The CTUIR hired Wallace Drilling under a $2,700 Professional Services Agreement on December 18, 2001 to drill, case, develop, test pump, and cap a 105-foot well for off-stream livestock watering between approximately RM 11.5 and RM 12.5 Wildhorse Creek.

McLain Spraying was subcontracted to eradicate noxious weeds in approximately 8.2 miles of stream corridor within the mid Umatilla River, McKay Creek, Wildhorse Creek, Greasewood Creek, the West Fork of Greasewood Creek, Spring Hollow Creek and Mission Creek project areas. Umatilla County Weed Control was subcontracted to address noxious weed problems in 7.4 stream miles of riparian habitat within the Buckaroo Creek, lower Meacham Creek, Boston Canyon Creek and upper Umatilla River project areas. A total of $10,136 in project funds was expended in 2001 to treat noxious weeds.

CTUIR Habitat Enhancement Project Personnel inspected all equipment utilized under the above agreements upon project initiation and determined all equipment was in good working order and free from excessive leaks in hydraulic, fuel and power systems. .....

2. Maintain and Implement Habitat Enhancements:

a. Instream and Stream Bank Improvements

A stream bank stabilization project was implemented along 330 feet of the south stream bank on the Emma Stroud Property at RM 63.5 Umatilla River, immediately downstream of the Mission Creek Confluence. The overall goal of this project was to increase stream bank and channel stability, while improving aquatic habitat. Specific project objectives included, arresting bank undercutting and mass wasting, improving floodplain connectivity, improving channel morphology, and enhancing instream and riparian habitat. The project was implemented in late September and October 2001.

Instream structures were constructed to assist with meeting project objectives. Eight root wad revetments were placed into the south stream bank to address bank erosion, provide instream and overhead cover for fish, and to supply terrestrial insect habitat. The root wad revetments were constructed from eight whole conifer trees and have a minimum total length of 18 feet, a minimum diameter at breast height of 18 inches and a minimum root wad diameter of 4 feet. Eight footer logs were placed under each root wad. These logs are 18 to 20 feet in length and vary in diameter from 18 to 30 inches. Approximately 40 cubic yards of rock, ranging from 30 to 42 inches in diameter were utilized to achieve stability in the root wad revetments.

Three J-vanes were constructed to create fish and aquatic insect cover, remove shear stress away from the near bank region, increase stream depth by decreasing the

width/depth ratio and obtain grade control to prevent further channel down cutting. Each J-hook vane was constructed from 30 cubic yards of 30 to 42-inch diameter boulders. A foundation layer of rock was buried into the stream channel bed below the substrate elevation and placed upstream at a 60-degree angle. A second layer of boulders was installed on the upstream portion of each structure and at a slightly higher elevation, spaced approximately 18-inches apart to allow bedload movement across the structure. The top of each structure resides at approximately two-thirds of bankfull stage and is at a 1.5% slope from the bank to the center of the channel. Each structure was keyed approximately 8 feet into the stream bank, and the channel end of each structure is hooked downstream to assist in pocket pool formation and thalweg definition. Two whole conifer trees were keyed into the foundation layer of each J-vane to provide additional instream habitat and diversity for fish.

Approximately 2,500 native willow cuttings were collected by CTUIR project technicians. Trenches were excavated in the stream channel margin and a stinger was utilized to create holes in the instream structures to insure that willow cuttings were planted at a year-round water table depth. Project technicians seeded disturbed banks and terraces with 150 pounds of native grass seed. Reestablishment of native plant communities will promote vegetative regeneration and succession, reduce erosion potential and sediment deposition, provide recruitable large woody debris, improve aquifer storage, increase insect drop, provide stream channel shade, and supply thermal cover for various species of mammals and birds. Pre-project site conditions and project designs of the Stroud Project can be viewed in Appendix C.

An engineered stream ford was constructed on the Bruce Carson Property within the existing project area at RM 3.0 Mission Creek. The purpose of this project was to decrease ongoing bank erosion and stream sedimentation by improving an existing crossing site and to deter the landowner from constructing a proposed bridge at this location. The project had coordinated with the Umatilla County Road Department during the 2001 project period to remove a culvert, impeding fish passage, and install a 50-foot bottomless arch culvert approximately 285 feet upstream from this site. There was concern that a bridge constructed at this location might negatively, impact the performance of the upstream culvert. The stream ford was constructed in October 2001.

The engineered stream ford was constructed from a Geoweb Channel Protection System, manufactured by Presto Products Company. During construction, channel and bank materials were excavated so that the top of the installed Geoweb section was flush with the grade of the channel and bank. A geotextile underlayer was installed on the prepared surface, ensuring the required overlaps were maintained and outer edges of the geotextile were buried a minimum of 6 inches below grade. The Geoweb section were then anchored at the crest of the bank slope. Each Geoweb section was expanded uniformly to the required dimensions and the outer cells of each layer were correctly aligned. The Geoweb grid was then anchored as prescribed and the expanded cells were infilled with35 cubic yards of angular crush gravel. Fill material was then compacted and overfill material was approximately 2 inches above the top edges of the Geoweb cells. Because the Geoweb grid has side perforations, subsurface water will be able to flow freely through the gravel substrate. Geoweb stream ford designs can be viewed in Appendix D.

b. Fish Passage Improvements

Two round pipe culverts, impeding fish passage, were removed during the 2001 project period and replaced with bottomless arch culverts. These culverts were selected because a

natural stream bed and gradient is maintained, and they sufficiently pass high flow events, preventing debris jams from blocking the culvert inlet to create out-of-channel flows and erosion of headwalls and banks. They also provide a better option for preserving natural stream width, thereby having less effect on local flow velocity and downstream scour.

A Contech Construction Products, Inc. multi-plate bottomless arch culvert was purchased with BPA project funds in 1998. This 22-foot long culvert with a 9-foot span and a 4-foot and 8-inch rise was installed at RM 0.5 Cottonwood Creek in September 2001. The culvert was designed to pass 364 cfs, a 25-year flow event in the Cottonwood Creek Drainage. The culvert assumed a headwall to diameter ratio of 1.2 or greater. Three feet of fill was placed on top of the culvert, and a cement headwall was installed to contain the fill. The inlet and outlet of the culvert was armored with 12 to 36-inch rip-rap, which was keyed into surrounding stream banks. Rip-rap was joint planted with (? Number) willow cuttings and disturbed areas were seeded with (? Number) pounds of native grasses. Cross section and longitudinal profile data for this culvert can be viewed in Appendix E.

An existing 6-foot diameter round culvert at RM 3.0 Mission Creek was positioned at a lower gradient than the natural stream channel bed, resulting in the culvert outlet sitting over three feet above the stream channel and creating a fish passage barrier. A 50-foot long, 13-foot span, Big R Manufacturing & Distributing, Inc. bottomless arch culvert with a 5-foot and 1-inch rise was installed in cooperation with the Umatilla County Road Department in October 2001. This culvert is designed to pass a 100-year flood event. Project personnel assisted with stinging in 800 native willow cuttings and seeding 100 pounds of native grasses on banks and terraces disturbed from heavy equipment. Project design drawings for this culvert can be viewed in Appendix E.

c. Livestock Exclusion and Riparian Corridor Fencing

A total of 11,264 feet of four-strand barbed-wire fencing was constructed and three Powder River Gates and eight wire gates installed on the Bill Wolfe Ranches, Inc. Property between RM 43.0 and 46.5 Umatilla River. The purpose of this fence was to exclude livestock from 103 acres of floodplain and riparian corridor to provide vegetative recovery and long-term habitat protection. All fences were built to NRCS specifications.

The CTUIR Habitat Enhancement Project provided fence materials to the CTUIR Department of Natural Resources – EPRP Staff to construct 21,300 feet of pasture rotational fencing in the Buckaroo Creek Watershed. The purpose of this project is to better distribute livestock within BIA Range Reservation Units Two and Six and minimize grazing impacts in the riparian area. BPA project funds were cost shared with EQIP and CTUIR moneys to implement this project.

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, Squaw Creek and McKay Creek project areas.

d. Off-stream Livestock Water Developments

A 358-foot well was developed and a pump installed on Bill Wolfe Ranches, Inc. Property to provide an off-stream water source for livestock. The landowner provided equipment and

labor to install six aluminum water tanks and 17,400 feet of PVC pipe for watering cattle between approximately RM 43.0 and RM 46.5 Umatilla River. This project in conjunction with 11,264 feet of constructed fencing (mentioned above under c. Livestock Exclusion and Riparian Corridor Fencing) restricts livestock from 103 acres of Umatilla River floodplain and riparian corridor.

Two livestock water gaps on the John Adams' Property within the upper Wildhorse Creek Project Area were abandoned due to excessive unraveling and sloughing off of stream banks. These sites required frequent fence maintenance and renewal of in-stream permits and ESA clearances on an annual basis. The landowner also expressed concern on several occasions regarding potential injuries to his cattle. A 105-foot well was developed and a pump and livestock water tank installed at approximately RM 11.0 to eliminate resource impacts and high maintenance costs, associated with the water gaps, and to provide a new off-stream livestock watering source.

A pump was replaced at an existing well on the S&M Farms Property in the vicinity of the lower Wildhorse Creek Project Area. Two high maintenance water gaps will be eliminated and a livestock water tank installed during the 2002 project period to complete construction of this off-stream water development.

e. Revegetation

The CTUIR Habitat Enhancement Project Staff gathered and planted approximately 3,800 native willow (*Salix spp.*) cuttings during the project period. These were planted at the two culvert replacement sites at RM 0.5 Cottonwood Creek and RM 3.0 Mission Creek, and at the RM 63.5 Umatilla River stream bank stabilization site during instream project implementation. All willow cuttings were stung into stream banks with a stinger mounted on an excavator bucket or trenched into stream channel margins with an excavator. These planting techniques achieve greater soil depths, insuring that cuttings are placed well within the annual water table, resulting in increased tree survival. Plant source materials were locally obtained from within the Umatilla River Basin.

Stream banks and terraces, disturbed from implementation activities at these sites were seeded with a total of 350 pounds of native bunch grasses or native grass/legume equivalents. The grass seed utilized at the RM 0.5 Cottonwood Creek and RM 3.0 Mission Creek culvert replacement sites was comprised of a mixture which included 41.6% rosana western wheatgrass (*Agropyron smithii*), 25% sand dropseed (*Sporobolus cryptandrus*), 16.7% magnar basin wild rye (*Elymus cinereus)* and 16.7% sherman big bluegrass (*Poa ampla).* A 150 pound mixture containing 25% sherman big bluegrass, 25% critania thickspike wheatgrass (*Agropyron dasystachyum*), 25% whitmar beardless wheatgrass (*Agropyrun inerme*) and 25% magnar basin wildrye was used at the RM 63.5 Umatilla River stream bank stabilization site. Seeding of native grasses and native grass equivalents assists with stream channel stabilization and sediment filtering during high flow periods.

f. 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 15.6 stream miles of project areas throughout the 2001 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, FIFRA Regulations, and NMFS and USFWS recommendations regarding ESA concerns.

3. Post-implementation Final Review:

All subcontractors maintained a daily log and work progress schedule.

CTUIR Habitat Enhancement Project Personnel inspected all instream, stream bank and passage improvements, including sloped stream banks, root wad revetments, J-vanes, the engineered stream ford, installed bottomless arch culverts and willow plantings at upper Umatilla River, Mission Creek and lower Cottonwood Creek project sites immediately following project implementation.

Four-strand barbed-wire fencing, constructed between RM 43.0 and RM 46.5 Umatilla River, was inspected to ensure consistency with NRCS specifications.

Wells drilled and developed to provide sources for off-stream livestock watering were inspected in the mid Umatilla River and upper Wildhorse Creek project areas to ensure contract conformity.

Umatilla County Weed Control and McLain Spraying provided annual descriptions and summaries of all noxious weeds identified and treated in project areas. Project personnel coordinated closely with these subcontractors and individual landowners to assure that nuisance weeds were adequately identified and eradicated.

The project experienced coordination and scheduling conflicts with K.R. Strickland during implementation of the Stroud Stream Bank Stabilization Project at RM 63.5 Umatilla River and construction of the engineered stream ford at RM 3.0 Mission Creek. Due to delays and exceeding maximum hours stated in contract quote schedules, this contractor has been deemed ineligible for future contracts under this project. All other 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. <u>Collect Baseline Data to Assess Pre-project Conditions and Continue Post-project Monitoring 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:

Three new stream channel cross sections were established to provide geomorphic information for instream design. Cross sections will continue to be measured as time allows.

Slides were taken during spring and fall of 2001 at 96 existing and three 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, stream bank 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 2001 project period. Habitat surveys were previously conducted on the mid Umatilla River (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 the Umatilla Basin. Major flood events occurred in the fall of 1995 and winter of 1996 after streams were surveyed. These high flow events likely altered some physical characteristics, previously identified and described from the habitat surveys.

3. Biological Inventories:

The CTUIR UBNPME Staff conducted biological inventories above and below St. Andrew's culvert to assess the extent of the passage problem. During the inventory, it was noted that there was very little usable large woody debris within the channel. Fifty salmonids were sampled below the culvert and 39 above the culvert. All fish were *O. mykiss*. Only two fish greater than 100 mm were found upstream of the culvert, which may indicate that the culvert is a partial passage barrier to specific size class of fish. After the installation of the new culvert, additional electrofishing surveys will be conducted to assess fish passage.

Biological inventories were conducted on October 2, 2001 at RM 21.5 McKay Creek. 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 1140 seconds and only one salmonid was sampled. Therefore the catch-per-unit-effort (CPUE) is only 0.05 salmonids of minute of electrofishing time. Non-salmonid species included red-sided shiner, dace, sucker and Northern pike minnow. There was also evidence of recent beaver activity within the project site.

Crews sampled the entire length (217 meters) of Crimin's project site on the Umatilla River (RM 85) with one pass of two electrofishers. 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 2300 seconds and 605 salmonids were sampled including 479 chinook salmon and 126 steelhead/rainbow trout. The CPUE was calculated to be 15.8 salmonids per minute of electrofishing time. The UBNPME staff pit-tagged all chinook salmon greater than 80 mm in length (217 fish). Non-salmonid species included dace, sculpin, red-sided shiner, Northern pike minnow and crayfish.

A presence/absence electrofishing survey was also completed on September 25, 2001 in a backwater area immediately upstream of the Umatilla River project area located on RM 37.4 that was completed last fiscal year. This survey was conducted to determine the utilization

of the backwater area (75 m long and 1 m wide) adjacent to the project area and its potential for restoration. Twenty-four juvenile coho between 71 and 111mm long were found in this area. Summer thermograph data in this backwater show daily average summer stream temperatures (June – September, 2001) ranging between 52 and 62 degrees Fahrenheit, making this area suitable for restoration as summer rearing habitat for coho salmon. This thermograph data is on file with the CTUIR Umatilla Habitat Enhancement Project.

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

4. Aquatic Macroinvertebrate Sampling:

No macroinvertebrate samples were collected under the project in 200l due to concerns raised by the NPPC's Independent Scientific Review Panel (ISPRP) during project reviews. Although we were only sampling macroinvertebrates at two project sites (4.9% of our total stream miles in recovery) the ISRP felt that there was an unorthodox reliance on macroinvertebrate sampling. The ISRP indicated that “the invertebrate monitoring should be focused on qualitative rather than attempting quantitative analysis”. However, Kerans, Karr and Ahlstedt (1992) compared qualitative and quantitative sampling methods. They found that replicated, quantitative sampling in riffle and pool habitats, using a variety of biological attributes, provided the strongest assessment of biological condition. Bauer and Burton (1993) indicated that EPA’s Rapid Bioassessment Protocols 1 and 2 are not quantitative enough for the detection of trends over time needed for project evaluation. The ISRP states that with quantitative analysis, organism abundance can be variable from sample to sample. However, we believe that the Aquatic Ecosystem Inventory Macroinvertebrate Analysis Methodology (USDA, 1985), which we utilize, was designed to remove such bias. It is important to note that abundance is not the primary factor used in comparative analysis. Our evaluation of ecosystem integrity and health is based upon aquatic macroinvertebrate data along with physical habitat, fish utilization surveys and water quality information. We also use the Biotic Condition Index (BCI), which has been developed by the USDA Forest Service over the past 20 years and provides a versatile monitoring tool for evaluating conditions in aquatic ecosystems.

Aquatic macroinvertebrate monitoring will resume at established sampling sites in project out years if the project receives direction, support and necessary funding from BPA. The project believes that project-specific macroinvertebrate monitoring, in combination with other forms of biological and physical analysis, is useful in assessing aquatic habitat and water quality. Information obtained from macroinvertebrate surveys should assist in determining the effects of habitat improvements within project areas over time.

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 22 locations throughout the upper Umatilla River Basin (see Table 2 on Page 21 for locations). Stream temperature data was summarized into tabular form, illustrating maximum, average and minimum daily Celsius and Fahrenheit temperatures during thermograph deployment periods. Digital copies of these water temperature tables are 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 A.

Table 4 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, 2001 at thermograph deployment sites. Data from six sites could not be retrieved, as is indicated in Table 4. This is most likely a result of improper deployment of the instruments.

Table 4 - Number of days the average and maximum stream temperatures exceeded 65, 70, 75 and 80 degrees Fahrenheit from June 1 - September 30, 2001.

Thermograph Location	Number of days temp > 65°F		Number of days temp > 70°F		Number of days temp > 75°F		Number of days temp > 80°F	
	Avg ˚F	Max ˚F	Avg ˚F	Max ˚F	Avg ˚F	Max ˚F	Avg ˚F	Max ˚F
Umatilla River (RM 56.0)	88	116	49	98	13	70	0	41
Umatilla River (RM 76.5)	42	94	0	59	0	16	0	0
Umatilla River (RM 81.7)	8	66	0	32	0	0	0	0
Wildhorse Creek (RM 0.0)	66	99	21	54	1	21	0	1
Wildhorse Creek (RM 1.4)	76	99	33	74	0	39	0	4
Wildhorse Creek (RM 9.5)	Incomplete data set		Incomplete data set		Incomplete data set		Incomplete data set	
Wildhorse Creek (RM 26.0)	13	47	0	7	0	0	0	0
Greasewood Creek (RM 0.1)	42	70	6	27	0	0	0	0
Eagle Creek (RM 0.2)	8	54	0	19	0	0	0	0
Spring Hollow Creek (RM 3.5)	No data		No data		No data		No data	
Mission Creek (RM 1.25)	1	33	0	15	0	3	0	1
Mission Creek (RM 3.7)	No data		No data		No data		No data	
Mission Creek (RM 3.8)	No data		No data		No data		No data	
Moonshine Creek (RM 1.1)	No data		No data		No data		No data	
Coonskin Creek (RM 0.2)	No data		No data		No data		No data	
Buckaroo Creek (RM 2.0)	39	97	6	73	0	43	0	7
Little Buckaroo Creek (RM 0.04)	No data		No data		No data		No data	
Squaw Creek (RM 2.0)	7	101	0	62	0	18	0	0
Squaw Creek (RM 9.0)	20	101	0	73	0	40	0	9
Meacham Creek (RM 2.0)	47	106	0	70	0	35	0	0
Meacham Creek (RM 5.25)	28	102	0	68	0	31	0	0

Mission Creek and the upper Umatilla River (RM 81.7) 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 the mean salmonid density in Mission Creek to be 0.0931 fish/m^2 (Contor et al., 1996). The upper Umatilla River, however, maintains flows year round and surveyors found a moderate number of fish (0.45 salmonids/m^2) between RM 81.8 and RM 89.6 (Contor et al., 1996). Based on salmonids densities and low summer instream temperatures, this section of the Umatilla River appears to be an important rearing area for salmonids. Stream temperatures were highest, exceeding 85 F on several days, at RM 56 Umatilla River.

The CTUIR Habitat Enhancement Project has monitored temperatures in the Wildhorse Creek Project Area (RM 9.5) site since the summer of 1995. Over time there appears to be a decreasing trend in the maximum weekly average temperature and in the average diurnal (daily) flux. The trend is not seen at thermograph locations upstream (RM 26.0) and downstream (RM 0.0) of the project area. It is unknown whether CTUIR's habitat improvements have resulted in cooler, more consistent temperatures at this site; however, this trend seems consistent with the improved riparian vegetation and width to depth ratios observed at the project site over time. Continued out-year monitoring at this location will determine whether this trend is statistically significant.

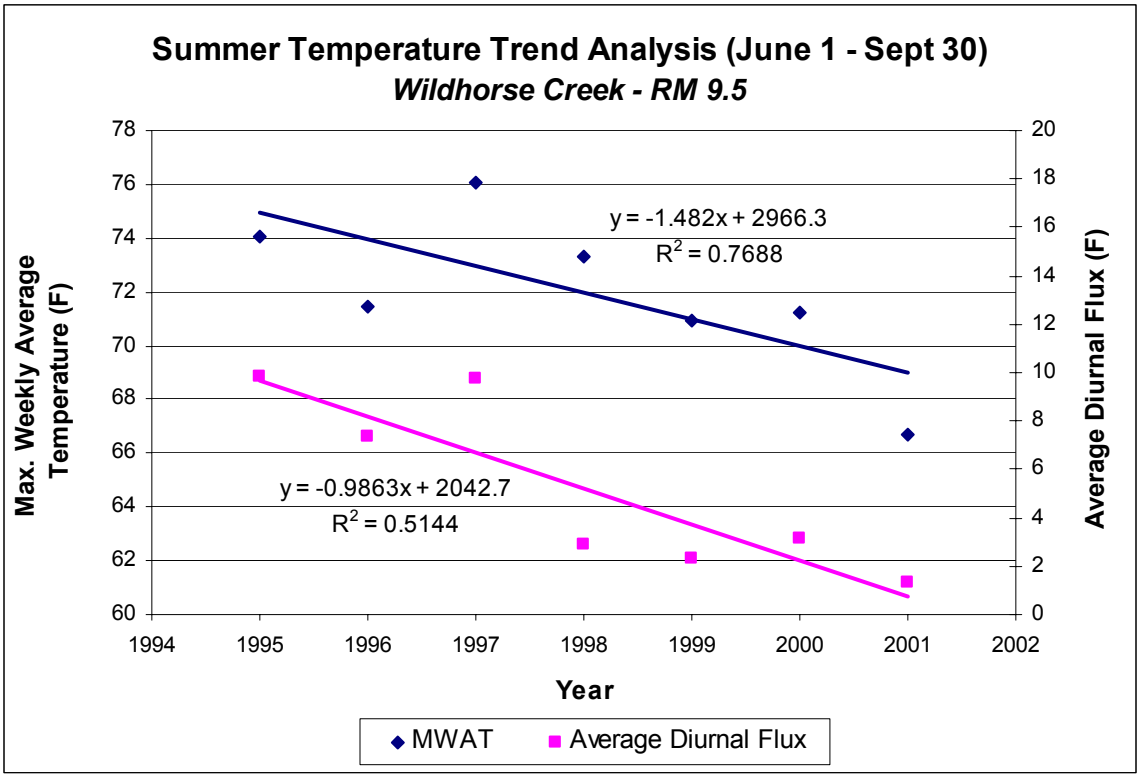


Figure 3 - Changes in maximum weekly average temperatures and average diurnal flux in Wildhorse Creek project area (RM 9.5) over time.

6. Suspended Sediment Monitoring:

CTUIR EP/RP 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 C. Tabular daily sediment yield data and stream discharge data is currently maintained at the CTUIR Habitat Enhancement Project Office.

A thorough analysis of sediment monitoring data for 2001 has been completed by the Umatilla County Soil and Water Conservation District in the Total Maximum Daily Load (TMDL) 2000-2001 Sediment Monitoring Report for The Umatilla Basin (King, 2002). The following data summary has been taken from this document. Analysis of sediment data has been completed based on the water year cycle, not the BPA contract fiscal year.

Graphs of mean discharge and turbidity for these sites indicate that as expected, when flow levels increased due to seasonal rain and snowmelt, the turbidity values generally increased as well. As with the previous monitoring year, most of the higher TSS and turbidity readings occurred between January and late April. And as in past years, the upper watershed did not appear to have much of an impact on sediment delivery to the Umatilla River. The Meacham Creek site near the east end of the reservation was used as an indicator of background sediment levels in the system. During this season's sampling period, this site never exceeded the basin's turbidity guidance standard of 30 NTU (turbidity >30 NTU for a period of 48 hours) (ODEQ et al., 2001).

As with the previous monitoring year, most of the higher TSS and turbidity readings occurred between January and late April. Graphs in Appendix C show TSS versus turbidity correlation coefficients (R^2 values) during the sampling period, for all three sites. Linear regression analysis of TSS and turbidity indicates a strong statistical relationship in all but one site: Umatilla River RM 81.7 (R^2 = 0.4749). Results show that this site has never exhibited a strong relationship between TSS and turbidity during the past three monitoring seasons (see

Table 5). While the Umatilla River RM 56.0 site has displayed a strong trend over the three years, Meacham Creek shows the most year-to-year variability.

Table 5 - TSS vs. turbidity linear regression analysis results.

Sample Sites	WY1999 R^2	WY2000 R^2	WY2001 R^2
Umatilla (RM 56.0)	0.85	0.86	0.93
Umatilla (RM 81.7)	0.57	0.67	0.47
Meacham (RM 2.0)	0.66	0.26	0.71

The first sampling site funded by this project was located on the Umatilla River (RM 81.7). For the purposes of this report, the sampling period looked at was November 1st, 2000 – June 5th, 2001 (a possible 217 sample days), which is the period during a water year that sediment loading tends to be a potential problem. This ISCO™ collected 142 days of water samples or 65% of possible sampling days. There was a 32-day period starting in mid-

November and a 20-day period starting in late February when no samples were taken. Overall, the maximum results were lower this season than during the 1999-2000 monitoring period. The high flow during WY2001 was 89% of the high flow recorded in WY2000. While the daily maximum turbidity was lower in WY2001 by 66%, turbidity levels were similar to the previous monitoring period, with two samples above 30 NTU and one period when 30 NTU was exceeded by two consecutive days. The total suspended sediment load for the sampling period was 741 tons with the average daily suspended load calculated at 5.2 tons/day, 25% lower than last year's value. The average daily suspended unit load was 0.04 tons/mi^2/day, also down slightly from last water year (0.05 tons/mi2/day). Both the highest daily flow and TSS values occurred on April 27th, while the maximum turbidity value was recorded in February 2001 (see Table 6).

Table 6 - Summary data for Umatilla River at RM 81.7 (east CTUIR reservation boundary)

	Turbidity (NTU)		TSS (mg/L)		Flow (cfs)		Susp. Sed. (tons/day)	
	1999-00	**2000-01**	**1999-00**	**2000-01**	**1999-00**	**2000-01**	**1999-00**	**2000-01**
Average	(5.4)	5.1	(7.0)	5.9	(338.1)	226.4	(7.2)	5.2
Minimum	(1.3)	1.4	(0.4)	1.2	(43.0)	79.0	(0.1)	0.3
Maximum	(50.8)	17.4	(161.5)	27.9	(953.0)	850.0	(164.7)	64.0
Date Maximum Value Occurred	11/25/99	02/05/01	11/25/99	04/27/01	11/26/99	04/27/01	11/26/99	04/27/01

The next station downstream is located at the west boundary of the CTUIR reservation (RM 56.0), approximately one river mile upstream from the mouth of Wildhorse Creek. This site is also operated by the CTUIR on a year-round basis. Out of a possible 217 sampling days (Nov 1st – June 5th), this ISCO™ collected samples 85% of the time, or 184 days. During the first nine consecutive days of the monitoring period (Nov. 1st - Nov. 9th), turbidity values exceeded 30 NTU, with the highest TSS and turbidity measurements occurring on Nov. 1, 2000. Lab records were reviewed for the previous sampling period (Oct. 8th – 31st) and out of an additional 24 days of samples, all but three days were above 30 NTU. The remaining sample period was below the standard, except for two days near the end of May. There was little change in turbidity levels:

Table 7 – Turbidity data summary for the Umatilla River at RM 56.0 (west CTUIR reservation boundary)

Turbidity Counts	1999-2000	2000-2001
# Composite Samples > 30 NTU	16	14
# Times 30 NTU exceeded by two consecutive samples	7	9
Maximum Turbidity Value (NTU)	140	100
# Samples >300 NTU (10X standard)	0	0

As with the first sample site, other overall maximum values were lower this year than last, including flow levels. The highest discharge rate occurred on April 28, 2001, one day after the highest recorded flow event upstream at RM 81.7 (see Table 8). Maximum flow at this site was less than the 1999-00 season by 24%. The total suspended load for the sampling period was 5144 tons, 44% lower than last year. The average daily suspended load was 28 tons/day. The OWRD and USGS have not determined the official drainage area for this

particular site; an estimated area of 455 square miles was obtained from ODEQ and used in the calculations. The estimated average daily-suspended unit load was 0.06 ton/mi2/day, 40% lower than last year's value (recalculated using the same estimated drainage value).

Table 8 - Summary data for Umatilla River at RM 56.0 (west CTUIR reservation boundary)

	Turbidity (NTU)		TSS (mg/L)		Flow (cfs)		Susp. Sed. (tons/day)	
	1999-00	**2000-01**	**1999-00**	**2000-01**	**1999-00**	**2000-01**	**1999-00**	**2000-01**
Average	(12.5)	12.6	(22.8)	25.0	(768.5)	531.5	(92.6)	28.0
Minimum	(2.0)	3.3	(5.3)	5.2	(62.0)	103.0	(0.3)	3.4
Maximum	(140.0)	100.0	(537.1)	214.3	(2180.0)	1650.0	(768.3)	194.9
Date Maximum Value Occurred	11/25/99	11/01/00	11/25/99	11/01/00	12/18/99	04/28/01	11/26/99	03/20/01

TSS values for the Meacham Creek was never higher than 90 mg/L and the maximum turbidity values were below 30 NTU. Meacham Creek attained a maximum flow level that was 46% lower than the 1999-2000 high flow value. Maximum sediment loads were 57% lower than the previous maximum value. The average daily suspended unit load was 0.02 tons/mi2/day, 33% lower than during the 2000 water year.

Table 9 - Summary data for Meacham Creek at RM 2.0

	Turbidity (NTU)		TSS (mg/L)		Flow (cfs)		Susp. Sed. (tons/day)	
	1999-00	**2000-01**	**1999-00**	**2000-01**	**1999-00**	**2000-01**	**1999-00**	**2000-01**
Average	(5.3)	6.3	(3.9)	7.5	(336.6)	33.0	(5.5)	4.2
Minimum	(1.4)	1.4	(0.3)	0.6	(15.0)	207.5	(0.03)	0.2
Maximum	(25.3)	29.8	(54.8)	66.4	(1230.0)	789.0	(119.2)	51.8
Date Maximum Value Occurred	11/26/99	12/24/00	11/26/99	12/24/00	04/05/00	03/25/01	04/05/00	03/25/01

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

1. Watershed Assessment:

The CTUIR extended the subcontract with Eco-Pacific to conduct and complete a watershed assessment of the Umatilla Subbasin by fiscal year 2002. Eco-Pacific Staff and CTUIR Habitat Enhancement Project Personnel held several coordination meetings to exchange ideas, obtain input, and update interested parties on progress.

The project provided $25,000 in BPA project cost-share for subcontracting Water Works Consulting, Duck Creek Associates and Ed Salminen Consulting for watershed assessment and restoration planning in the Meacham Creek Subwatershed. Project personnel also participated in subcontractor selection and at progress and coordination meetings. This assessment detailing current conditions in the Meacham Creek Subwatershed and necessary restoration actions will be available for review in early 2003.

Project staff participated in the development of the Draft Umatilla Subbasin/Willow Subbasin Summary (Subbasin Summary) by providing technical input and writing portions of that document. Goals of this project are consistent with the biological needs of salmonids as

identified in the Subbasin Summary, and the project will assist in fulfilling the strategies and associated actions outlined in the document.

2. Community Outreach Efforts:

The following public outreach efforts occurred during the 2001 project period:

- Participated and provided a display and educational literature to seventh and eight grade students at the Umatilla-Morrow County Education Service District (ESD) Career Showcase "2001".

- Coordinated with Stewards of the Umatilla River Environment (SURE) to recommend public-driven restoration measures for portions of the Umatilla River riparian corridor within the city of Pendleton.

- Provided the McKay Creek Project Area for ESD's 2001 Watershed Field Day and presented habitat restoration talks and native willow reestablishment training to participants.

- Provided a habitat talk and field instruction to Sunridge Middle School Students, including water quality, macroinvertebrate and stream habitat monitoring and stream bank revegetation, on lower Tutuilla Creek.

- Provided a presentation at the Eastern Oregon Salmon Ecology and Recovery Conference.

- Provided a presentation at the Native American Fish & Wildlife Society's 19th Annual Pacific Regional Conference.

- Mentored a Tribal Member under the U.S. Workforce Investment Act.

- Attended Umatilla Basin Watershed Council Meetings.

REFERENCES CITED

Adelman, Bob. January 11, 1996. Personal Comment stated at Mission Creek Watershed Coordination Meeting.

Alexander, C.W., R.L. Moffatt, P.R. Boucher, and M.L. Smith. 1987. Water Resources Data Oregon Water Year 1985. U.S. Geological Survey Water – Data Report OR-85-1. Portland, Oregon. 218 p.

Bauer, Stephen B. and Timothy A. Burton. 1993. Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams. EPA 910/R-93-017. U.S. Environmental Protection Agency – Surface Water Branch, Region 6, Seattle, Washington, 179 p and appendices.

Bell, M.C. 1984. Fisheries Handbook of Engineering Requirements and Biological Criteria. Fish Passage Development and Evaluation Program, U.S. Army Corps of Engineers, North Pacific Division. Portland, Oregon.

Campbell, I.C., K.R. James and R.T. Edwards. Farming and Streams - Impact, Research and Management. Proc. of the Conference, The State of Our Rivers, Australia Natural History, September 1990 (as cited by Gordon, N.D., T.A. McMahon and B.L. Finlayson, 1993).

Confederated Tribes of the Umatilla Indian Reservation. 1983. Land Development Code, Land Use Map of the Umatilla Indian Reservation Land Development Code. Pendleton, Oregon. 186 p.

Contor, Craig R., Eric Hoverson, Paul Kissner, and Jed Volkman. 1996. Umatilla Basin Natural Production Monitoring and Evaluation Annual Progress Report 1997. DOE/BP – 75349. BPA, Portland, Oregon, 33 p and appendices.

Contor, Craig R., Eric Hoverson, Paul Kissner, and Jed Volkman. 1997. Umatilla Basin Natural Production Monitoring and Evaluation Annual Progress Report 1995-1996. DOE/BP – 75349-2. BPA, Portland, Oregon, 51 p and appendices.

Cortes R.M.V. M.A.S. Graca and A. Monzon. 1994. Replacement of Alder by Eucalyptus along Two Streams with Different Characteristics: Differences on Decay Rates and Consequences to the System Functioning. Vern. Internat. Verin. Limnol. 25:1697-1702.

Elmore, W. and R.L. Beschta. 1987. Riparian Areas: Perceptions in Management. Rangelands 9(6) 260 - 265 (as cited by Bauer, S.B. and T.A. Burton).

Gonthier, J.B. and D.D. Harris. 1977. Water Resources of the Umatilla Indian Reservation, Oregon. USGS Water Resources Investigations 77-3. U.S. Geological Survey, Portland, Oregon. 112 p.

Gordon, N.D., T.A. Mcmahon and B.L. Finlayson. 1993. Stream Hydrology - An Introduction for Ecologists. John Wiley & Sons Ltd., New York, New York. 526 p.

Hiers, Becky. 1996. Water Conflict Resolved Cooperatively: The Umatilla Basin Project. Department of Natural Resources, Confederated Tribes of the Umatilla Indian Reservation. http://www.umatilla.nsn.us/basin.html [website]. Accessed on August 1, 2000.

Johnson, J.H. and N.H. Ringler. 1980. Diets of Juvenile Coho Salmon (*oncorhynchus kisutch*) and Steelhead Trout (*salmo gairdneri*) relative to prey availability. Can. J. Zool. 50:553-558.

Karr, J.R. 1991. Biological Integrity: A Long-neglected Aspect of Water Resource Management. Ecological Applications, 1 (1), 63-84 (as cited by Bauer, Stephen B. and Timothy A. Burton. 1993).

King, Marty. 2002. 2000-2001 Sediment Monitoring Report For The Umatilla Basin. Umatilla County Soil and Water Conservation District. 17 p.

Kerans, B.L., J.R. Karr, and S.A. Ahlstedt. 1992. Aquatic invertebrate assemblages: Spatial and temporal differences among sampling protocols. J.N. Am. Benthol. Soc., 11(4): 377-390 (as cited by Bauer, S.B. and T.A. Burton).

Lambert, S.M., A. Sassman and J. Rouse. 1995. Washington and Oregon Conservation Grasses, Wildflowers, Legumes, Trees, and Shrubs. Natural Resource Conservation Service. Spokane, Washington. 67 p.

Li, J.L. 1998. Strategies For Riparian Recovery: Plant Succession + Salmon, BPA Fiscal Year 2000 Proposal. Corvallis, Oregon. 26p.

Meyers, L.H. 1987. Montana BLM Riparian Inventory and Monitoring, Riparian Technical .....Bulletin No. 1., BLM-MT-PT-88-001-4410, Billings, MT (as cited by Bauer, S.B. and T.A. Burton).

Miller, Carey. L. 2001. A Cultural Resource Inventory of the Emma Stroud, David Richards and Bruce Carson Properties, Umatilla County, Oregon. Confederated Tribes of the Umatilla Indian reservation, Department of Natural Resources – Cultural Resources Protection Program. 10 p and Cultural Resources Isolated Find Report.

Oregon Department of Environmental Quality and others. 2001. Umatilla River Basin Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP), Vol. 1 & 2.

Oregon Department of Fish & Wildlife, United States Forest Service and Confederated Tribes of the Umatilla Indian Reservation. 1998. Umatilla Drainage Fish Habitat Improvement Implementation Plan.

Saul, Darin, Craig Rabe, Anne Davidson, Dora Rollins. 2001. Draft Umatilla Subbasin / Willow Creek Subbasin Summary. BPA, Portland, Oregon. 284 p and appendices.

Schoen, J. 1991. "Canaries of the Stream," The Volunteer Monitor. Vol 3, No. 1, page 1.

Shaw, R. Todd. 1996, 1997 and 1998. Macroinvertebrate Analysis Physical Habitat Data.

Shaw, R. Todd and Amy D. Sexton. 1999. Umatilla River Basin Anadromous Fish Habitat Enhancement Project 1998 Annual Report. BPA, Portland, Oregon, 31 p and appendices.

Trout Unlimited. 1994. The Invisible Menace - Agricultural Polluted Run-off in our Nation's Streams. 12 p.

U.S. Army Corps of Engineers, Walla Walla District. 1975. Floodplain Information, Umatilla River Cayuse - Gibbon, Oregon. 22 p.

U.S. Bureau of Reclamation. Accessed on August 3, 2000. Umatilla Basin Project Oregon. http://dataweb.usbr.gov/html/umatilla.html [website].

USDA, Forest Service - Intermountain Region Wildlife Management. 1985. Aquatic Ecosystem Inventory - Macroinvertebrate Analysis, Chapter 5 Aquatic Macroinvertebrate Surveys "from" Fisheries Habitat Surveys Handbook. R-4 FSH 2609.23. Provo, Utah. 38 p.

U.S. Forest Service Aquatic Ecosystem Lab. 1995. Wingnet-Modified Surber Net. Provo, Utah. 2 p.

USDA, Soil Conservation Service. 1988. Soil Survey of Umatilla County Area, Oregon. U.S. Gov. Printing Office 1988 0 - 183-557. 388 p.

USDA, Soil Conservation Service. 1991. Squaw Creek Watershed Area Interdisciplinary Planning Team Report. Baker City, Oregon. 8 p.

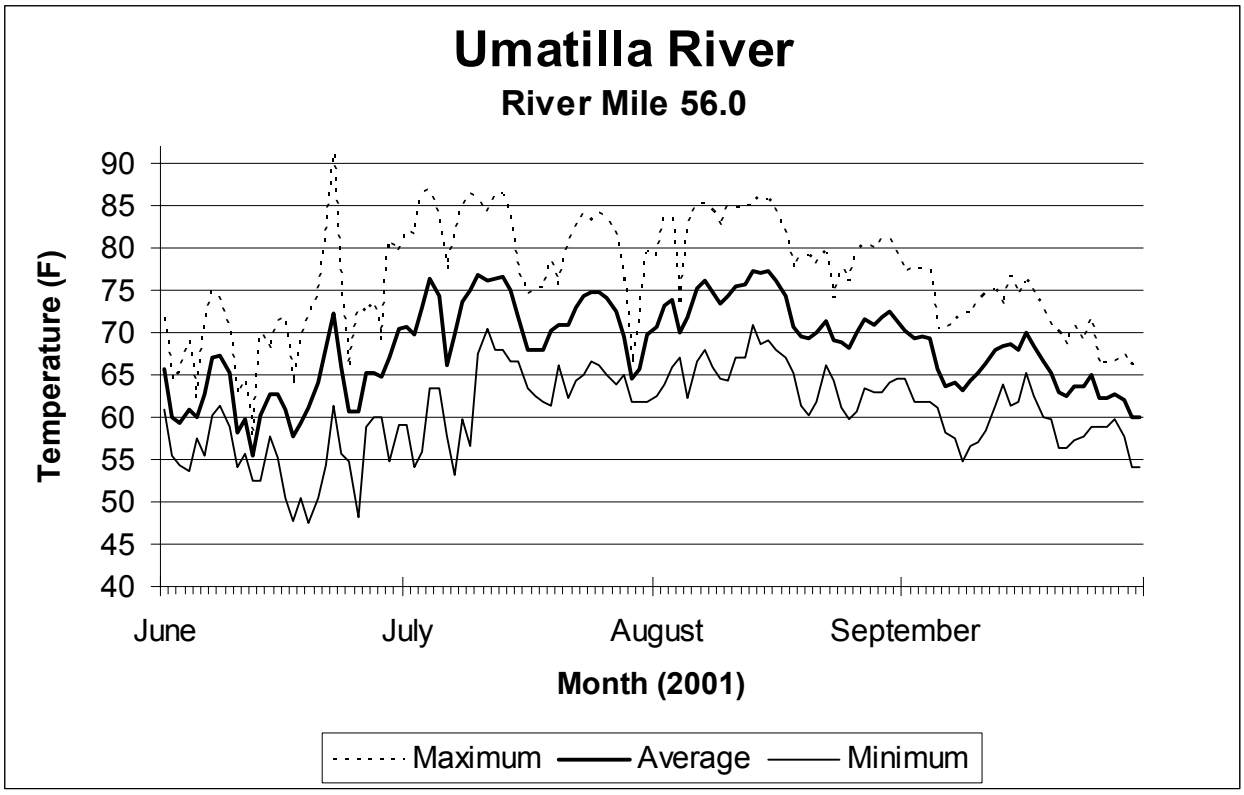
U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1981. Eastern Oregon Anadromous Fish Habitat Restoration Project. Portland, Oregon.

Wilson, Ray. June 26, 1996. Personal Comment from phone conversation.

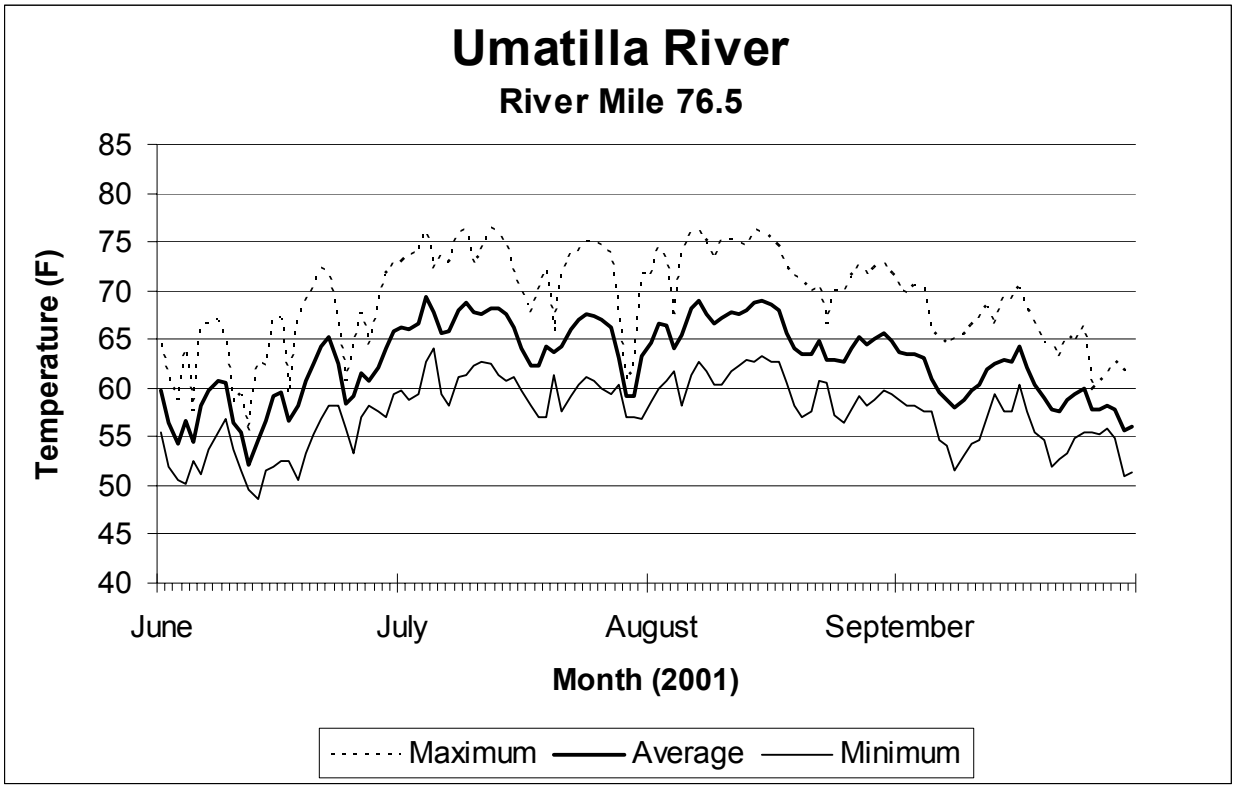
Zimmerman, B.C. and B.B. Duke. 1996. Trapping and Transportation of Adult and Juvenile Salmon in the Lower Umatilla River in Northeast Oregon. 1995-1996. Project No. 88-022, Contract No. DE-B179-89BP98636. Bonneville Power Administration, Portland, Oregon.

Appendix A

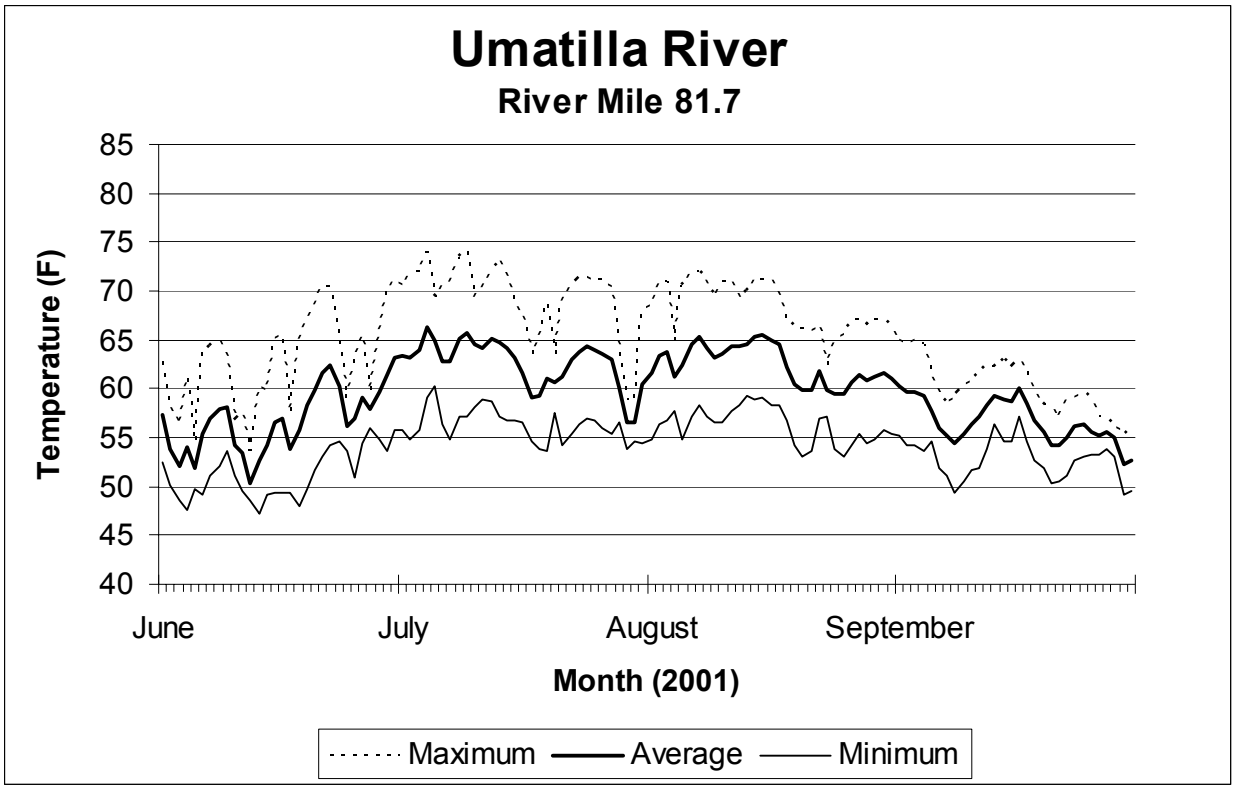
Water Temperature Graphs



File Name: Umatilla (RM 56) – 2001.xls



File Name: Umatilla (RM 76.5) – 2001.xls



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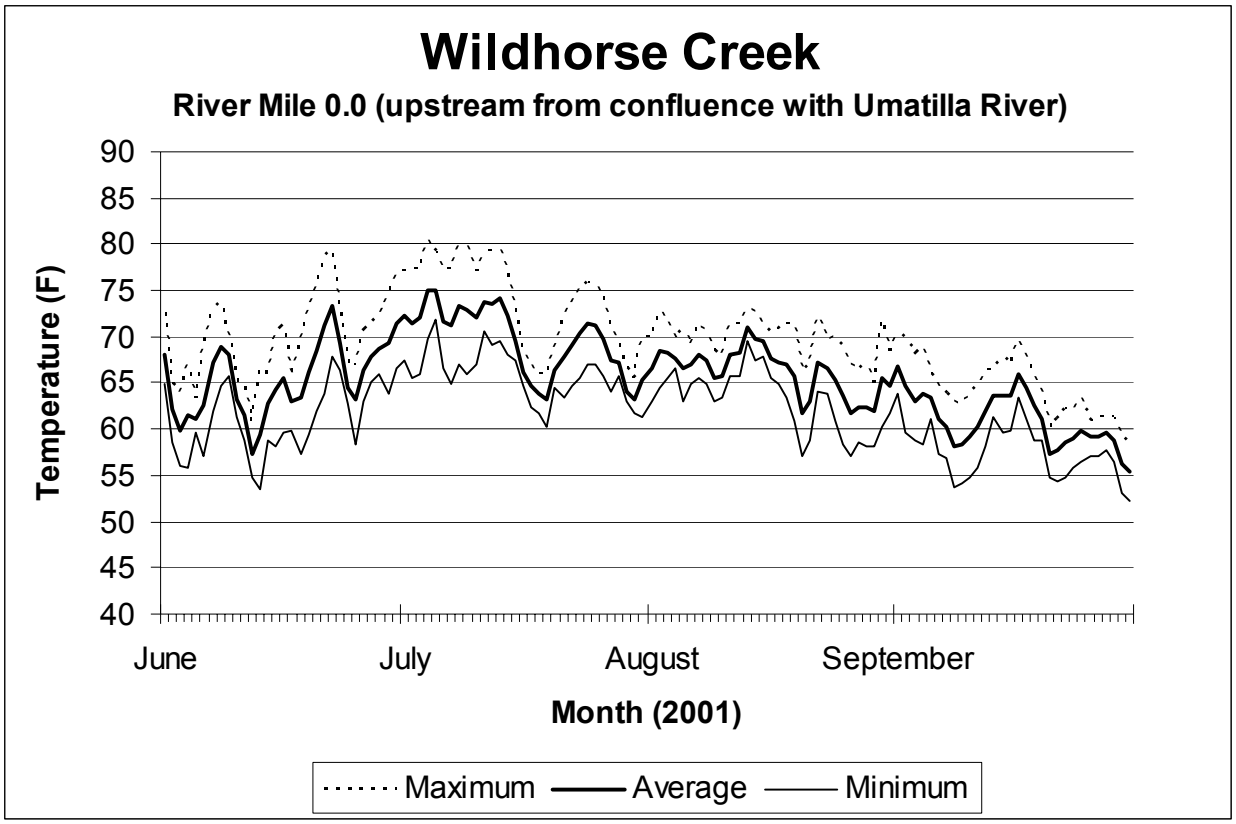

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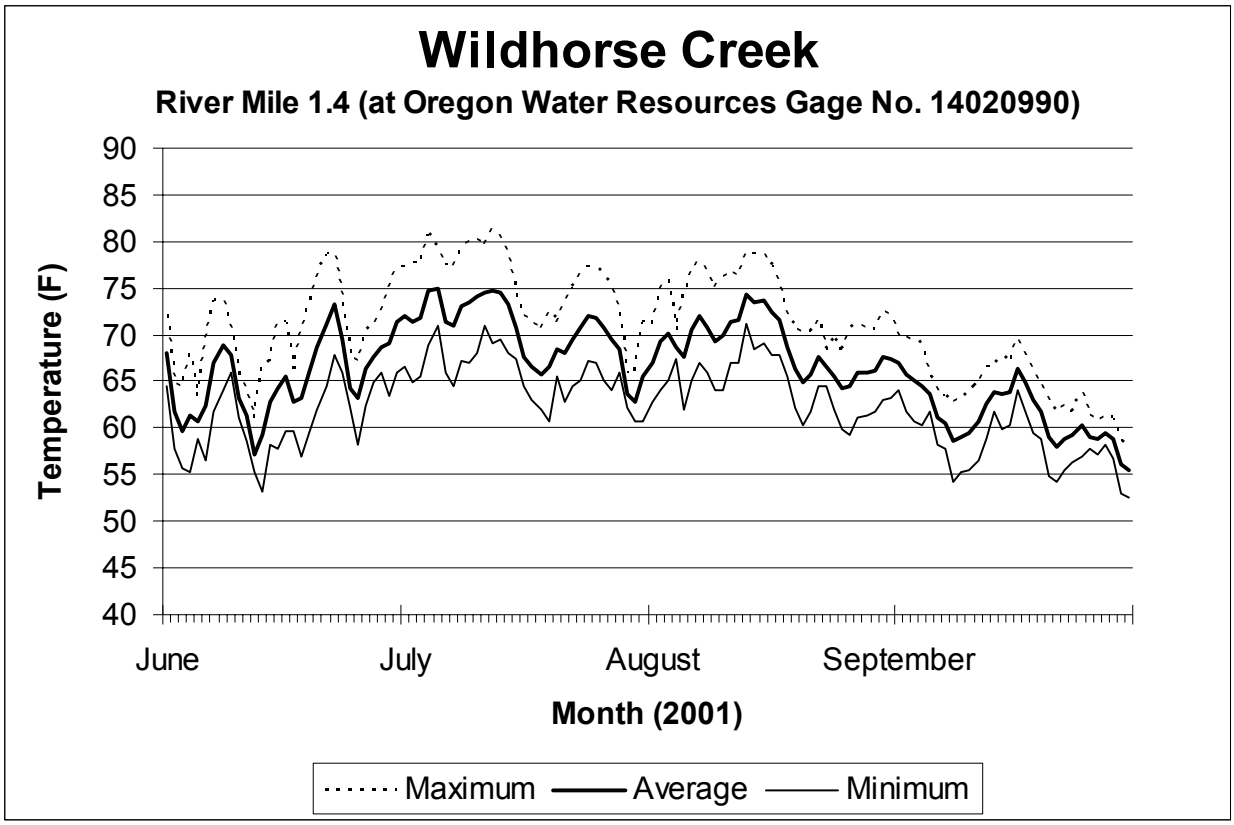

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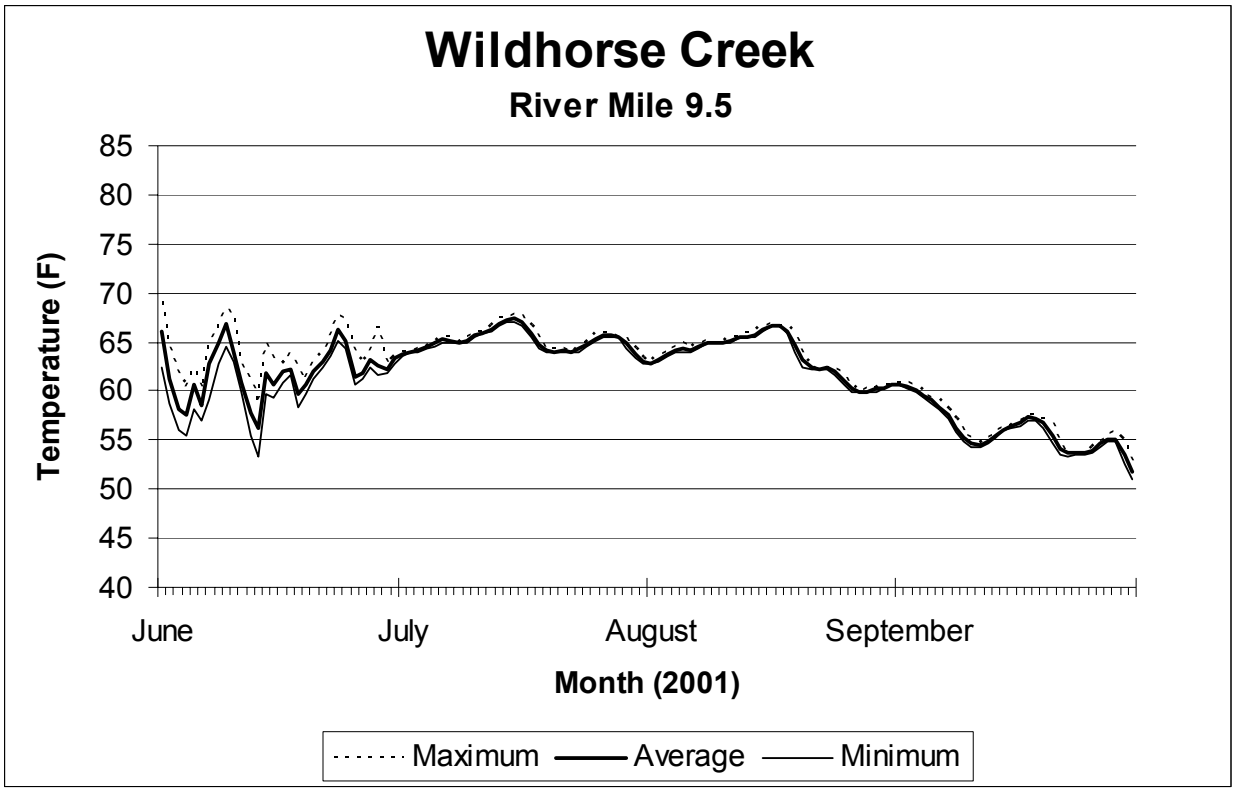

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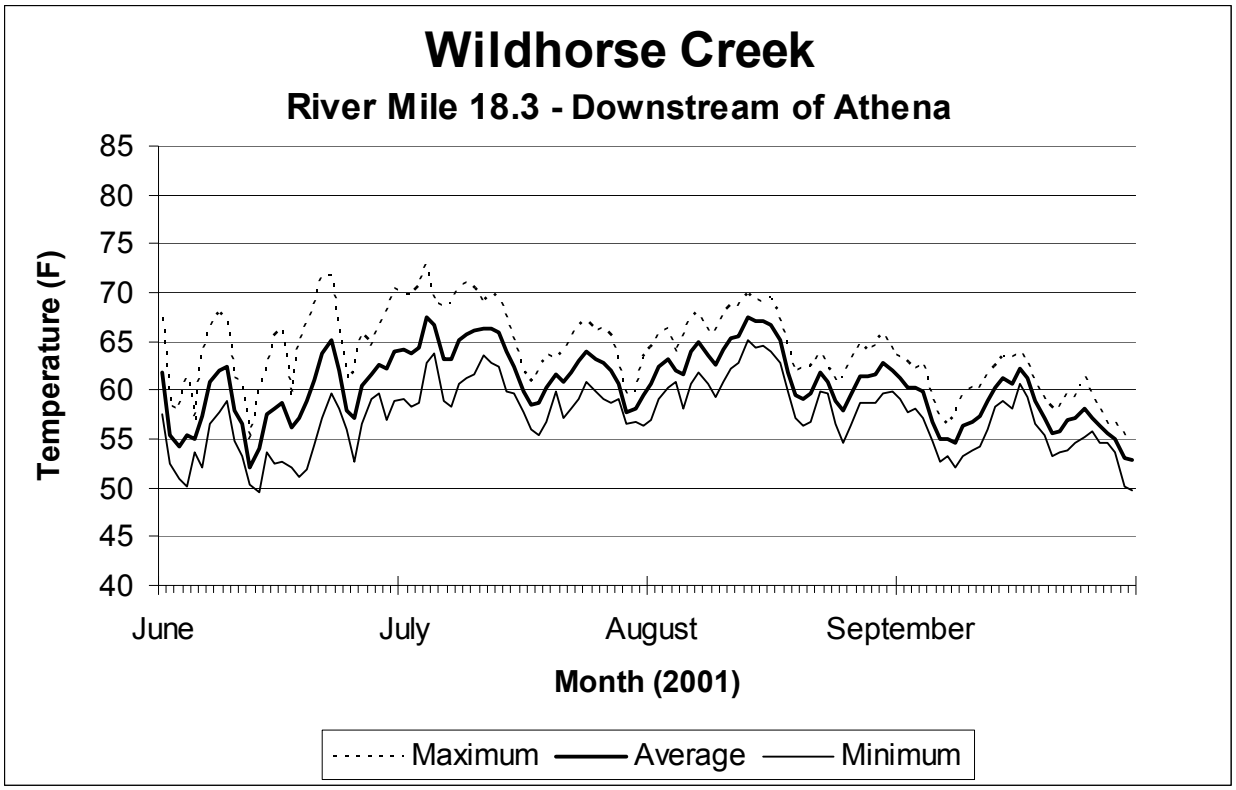

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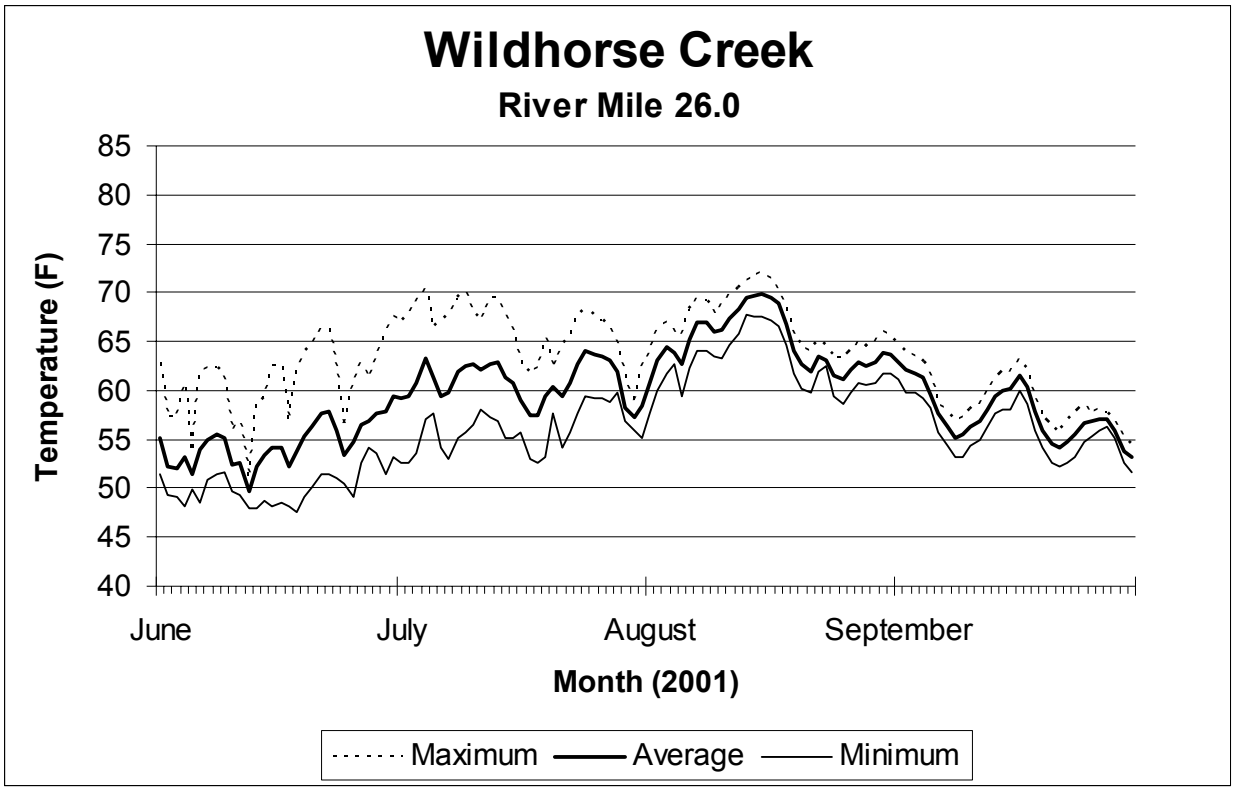

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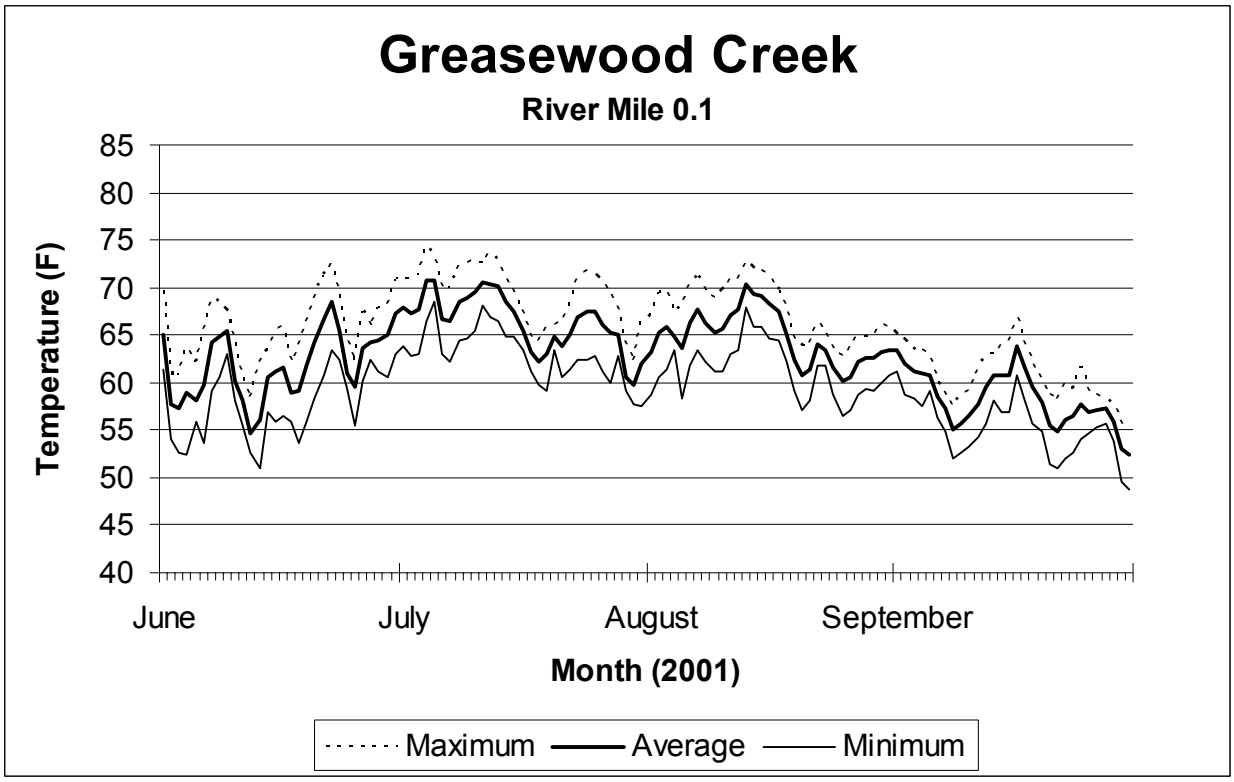

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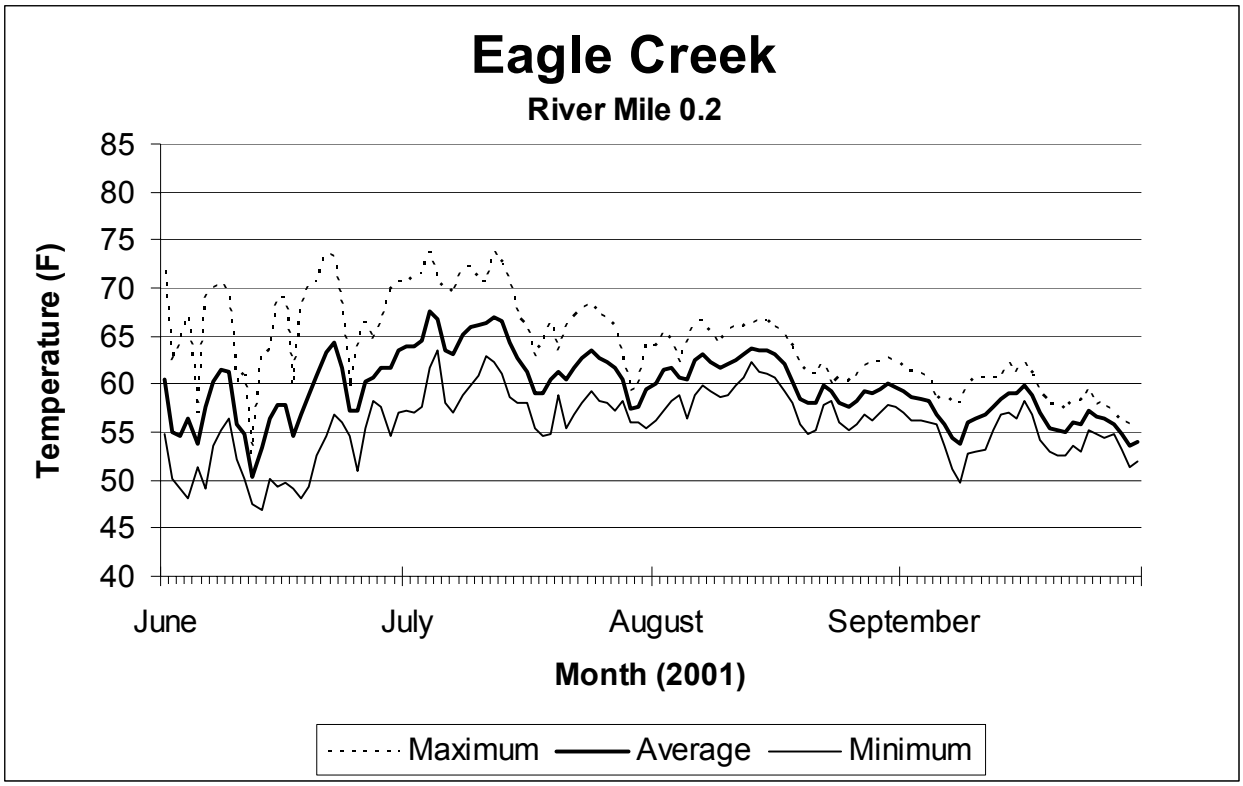

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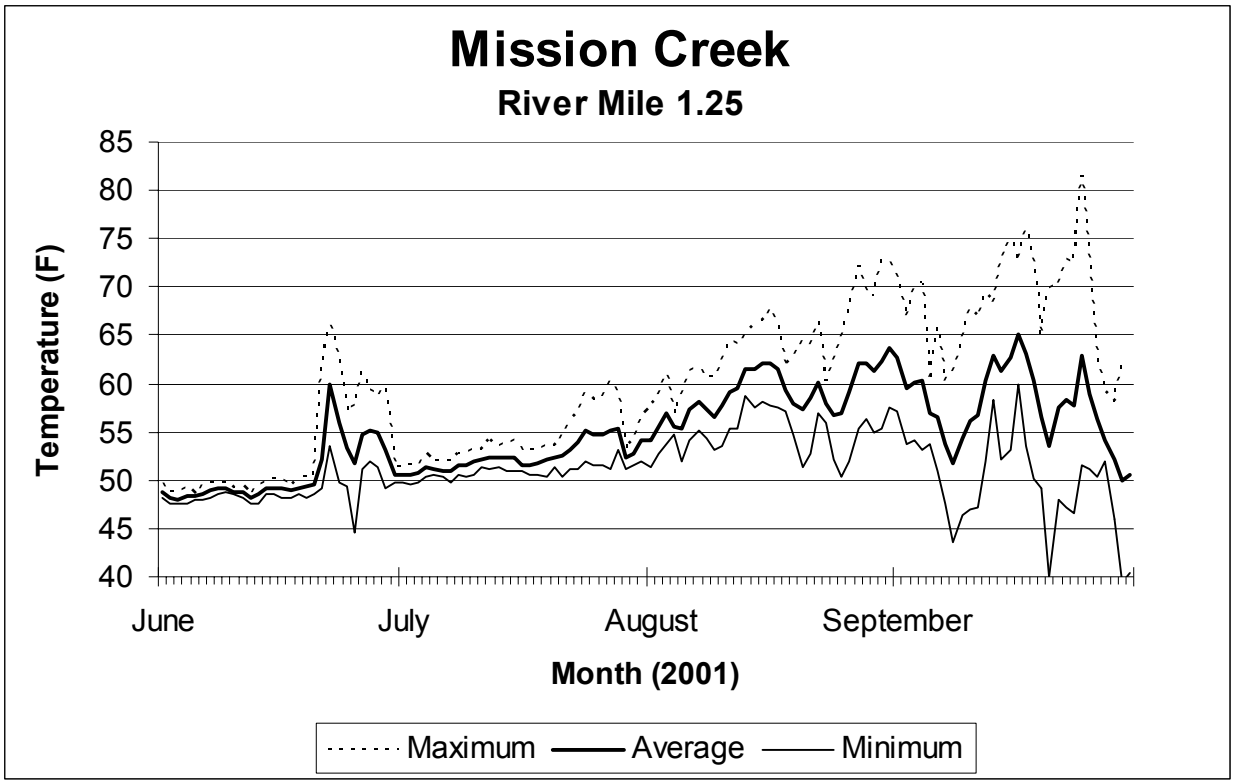
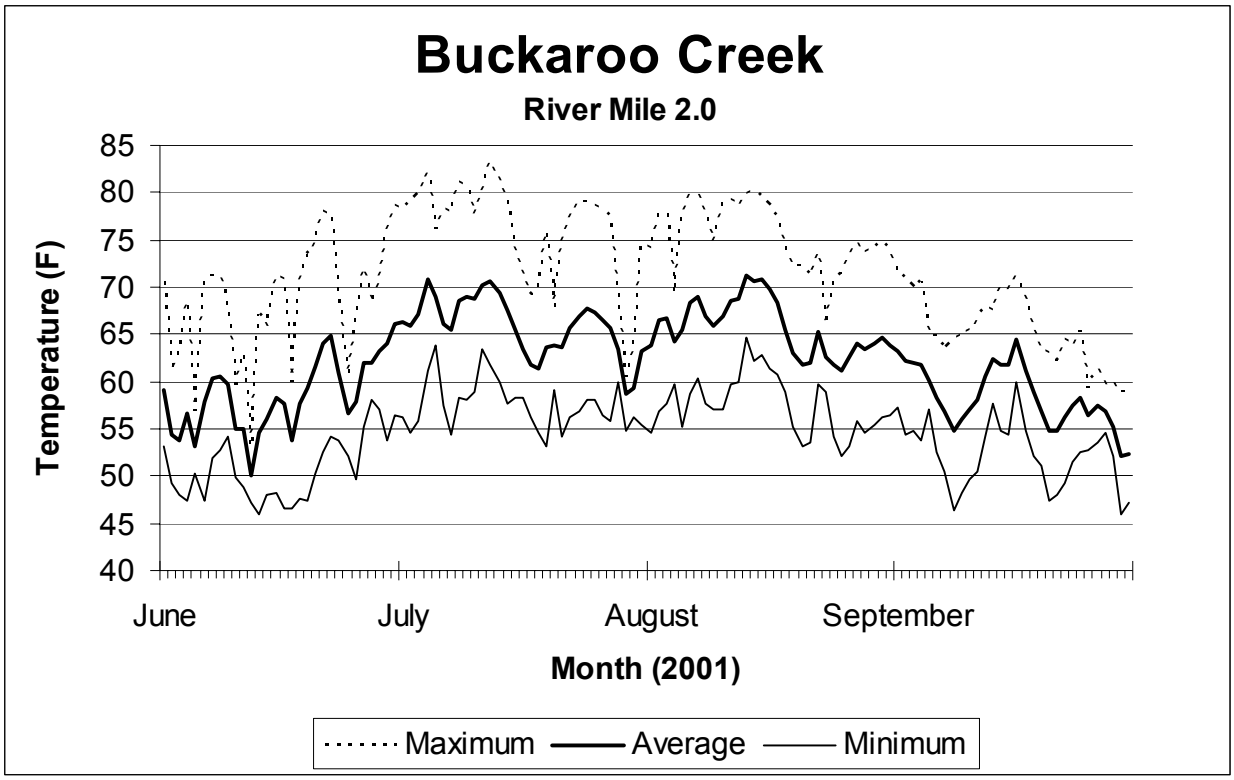


File Name: Mission (RM 1.25) – 2001.xls



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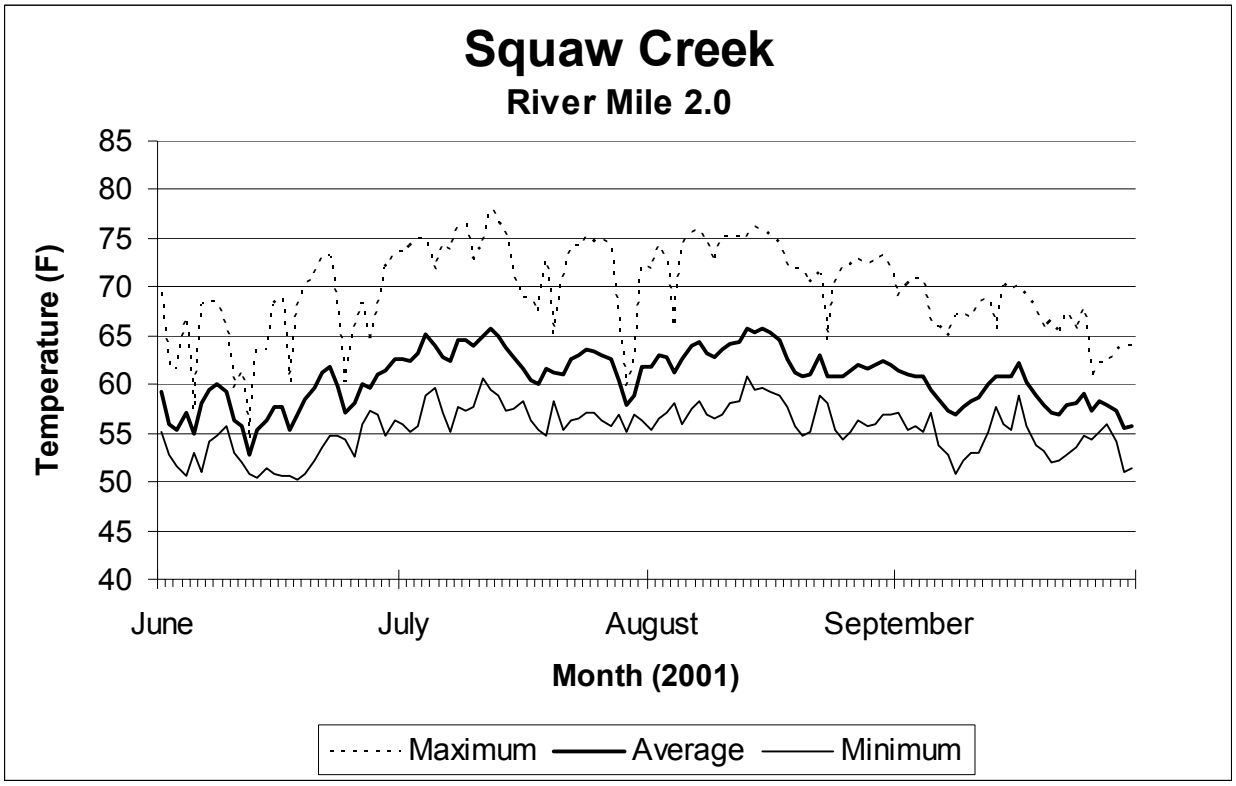

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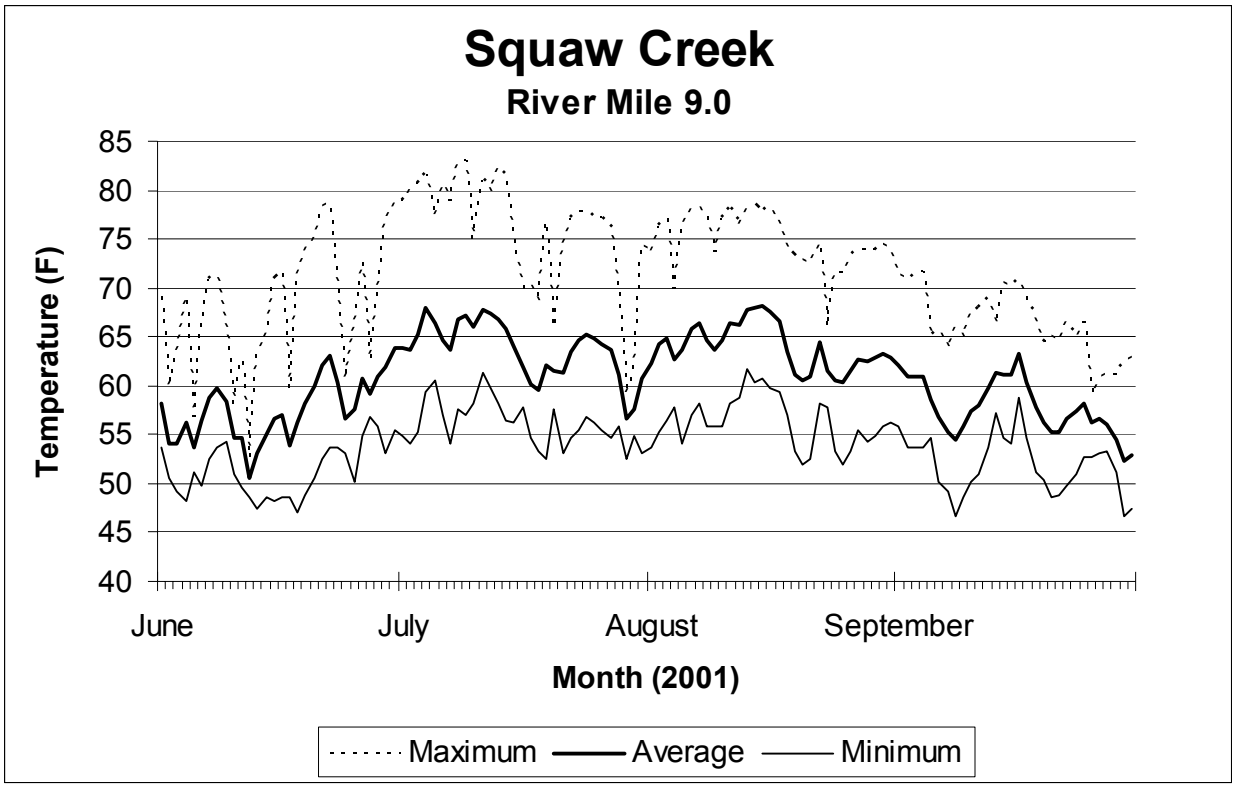

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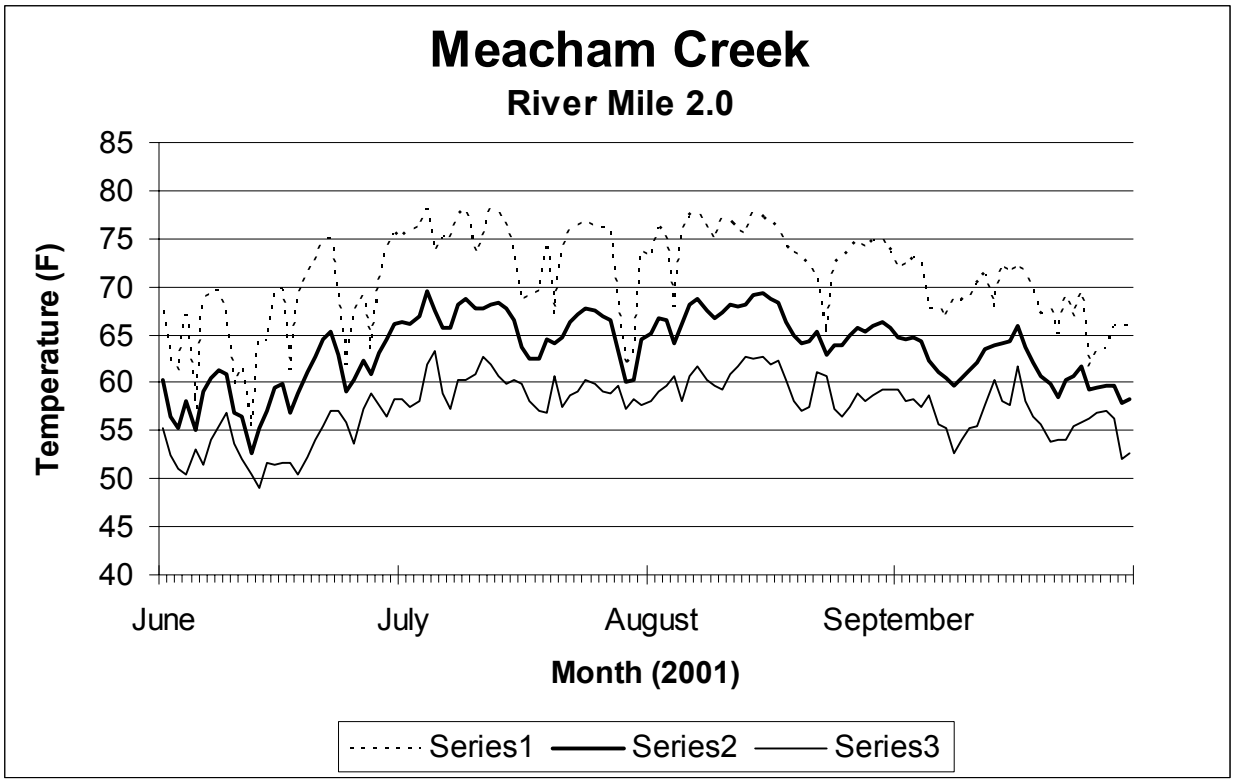
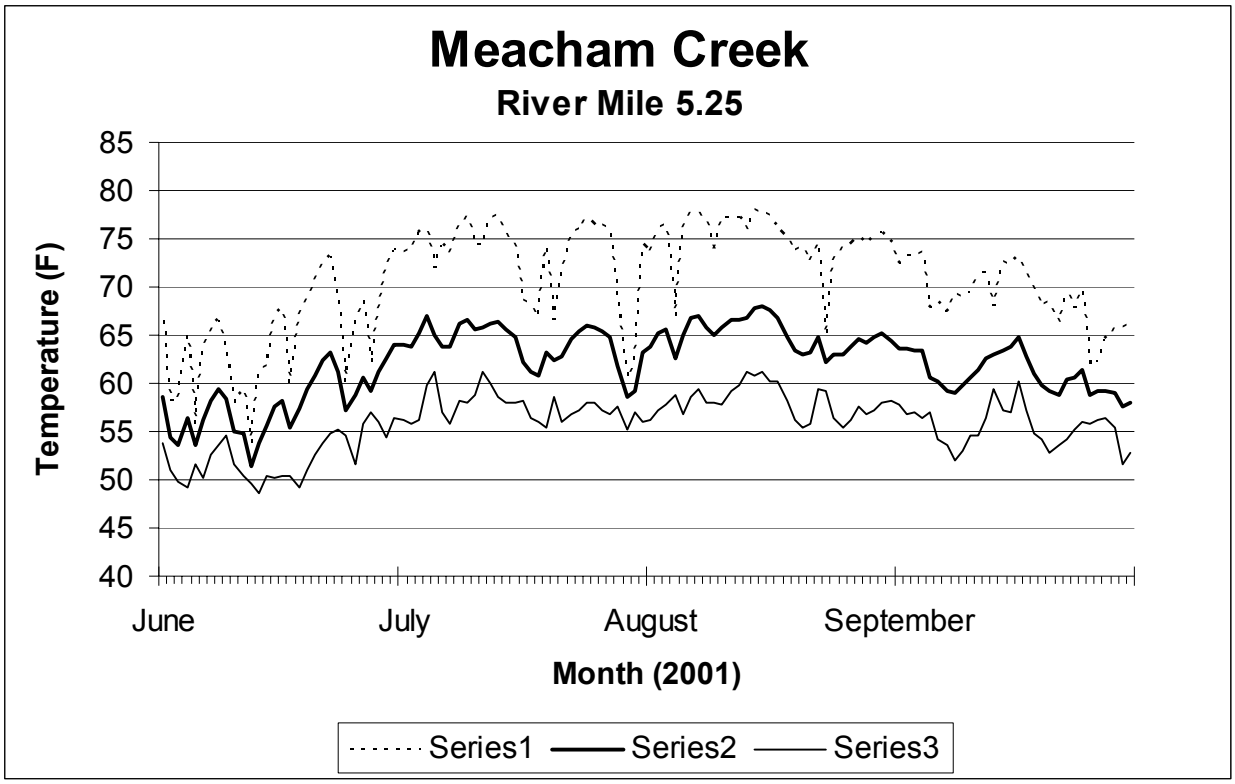


File Name: Meacham (RM 2) – 2001.xls



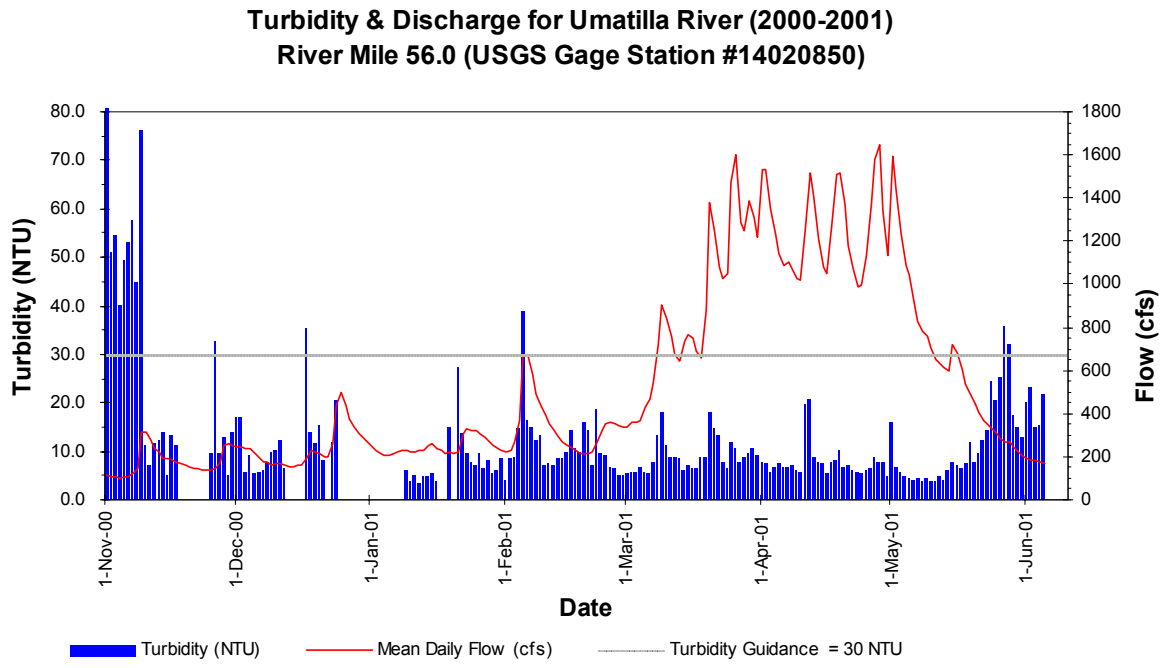
File Name: Meacham (RM 5.25) – 2001.xls

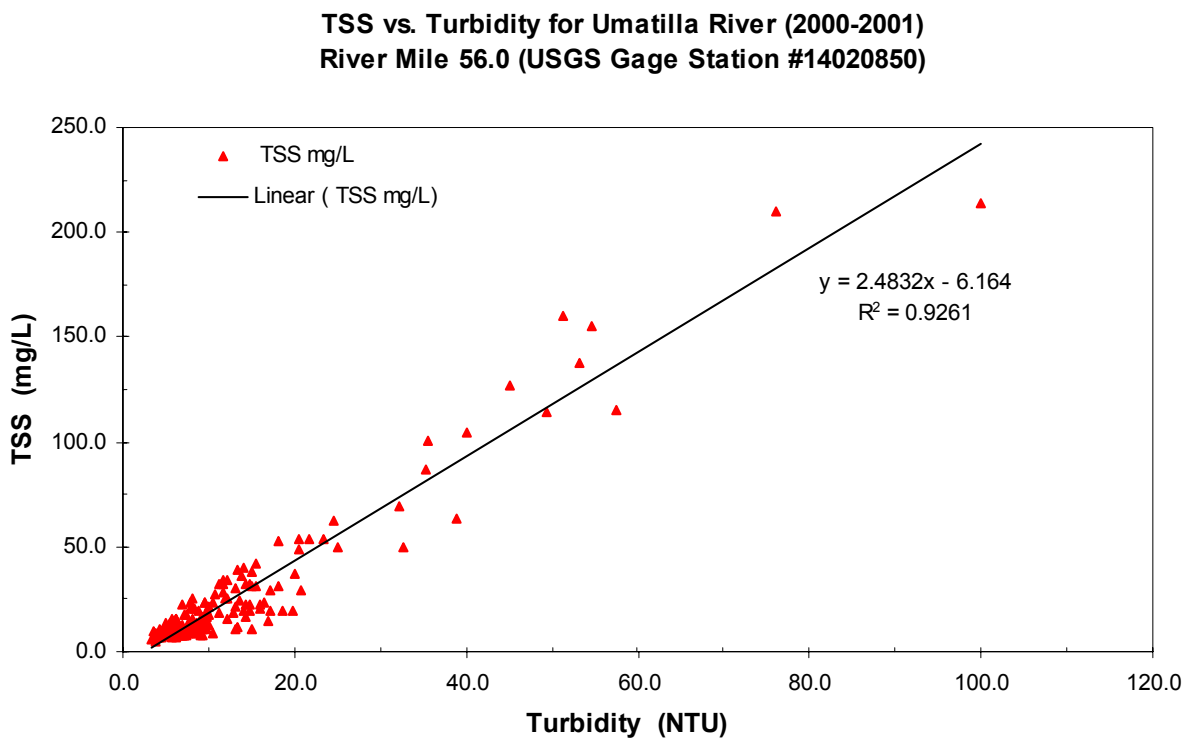
Appendix B

Suspended Sediment Graphs

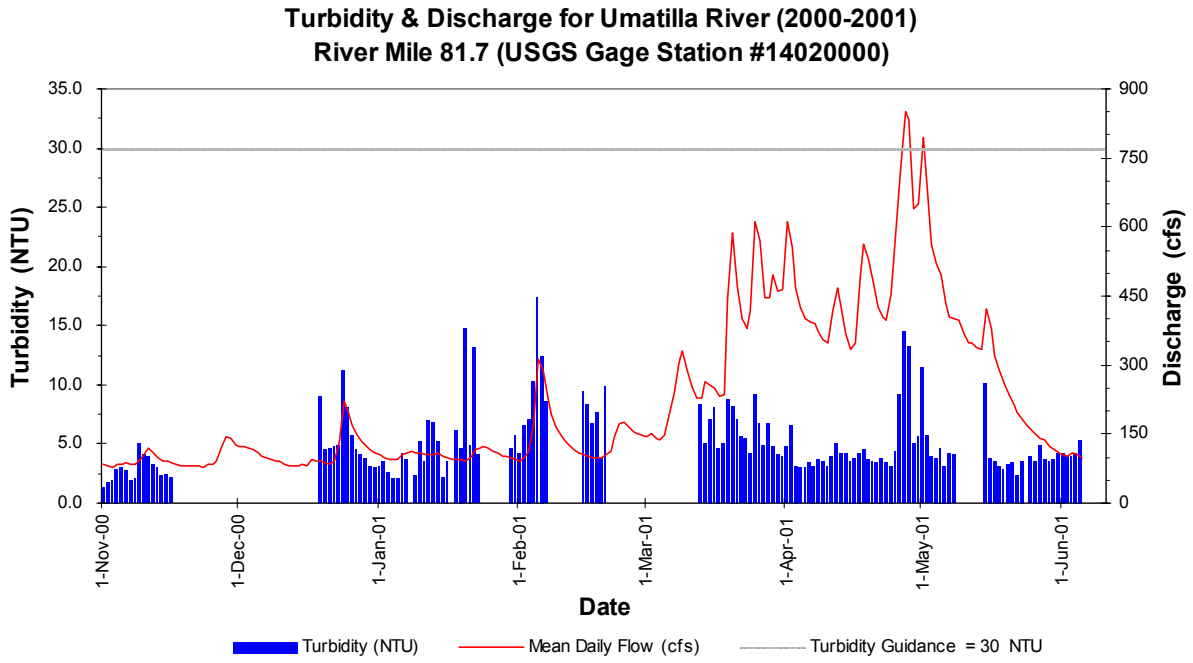
(File Name: WinterISCO analysis_1999-2001.xls)

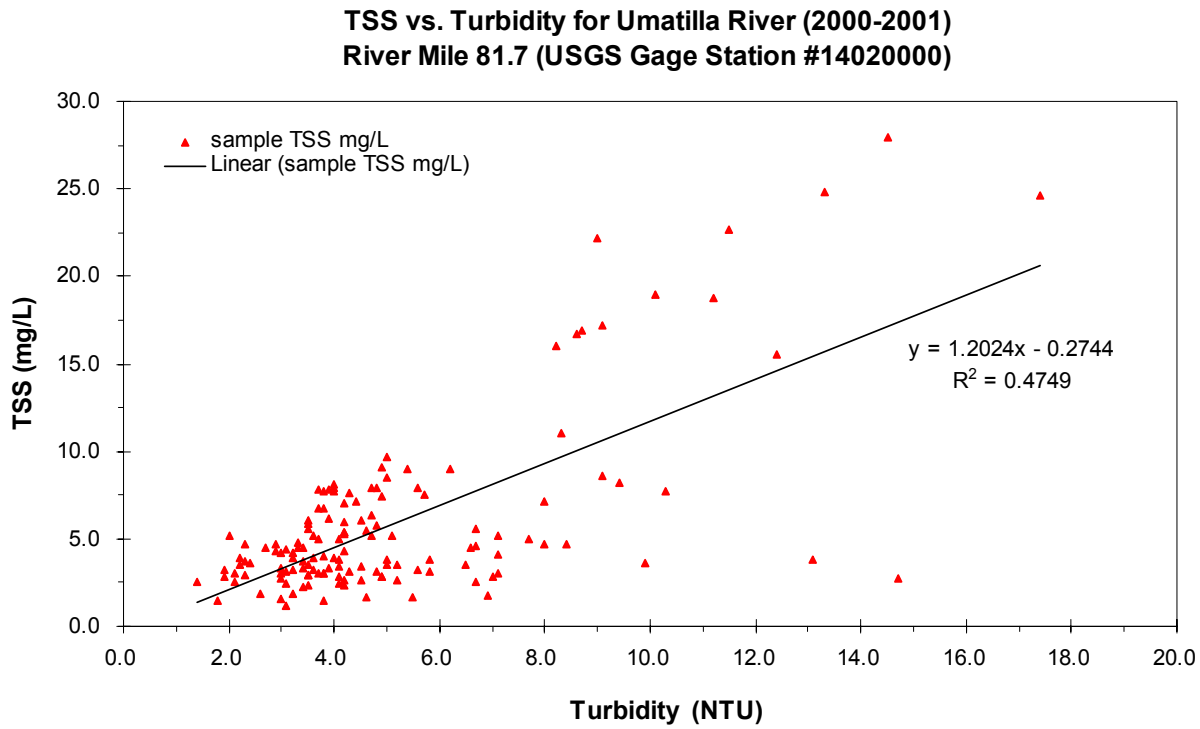
B-1. Sediment Graphs for the Umatilla River (RM 56.0)



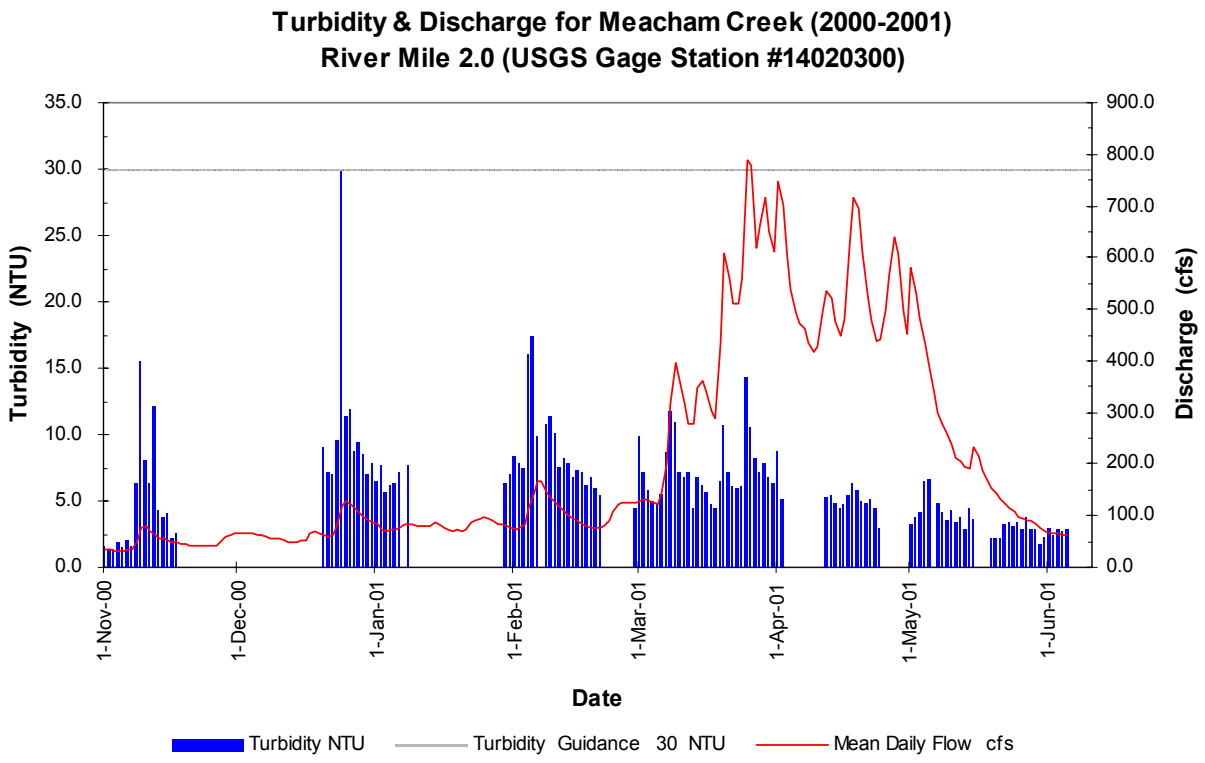


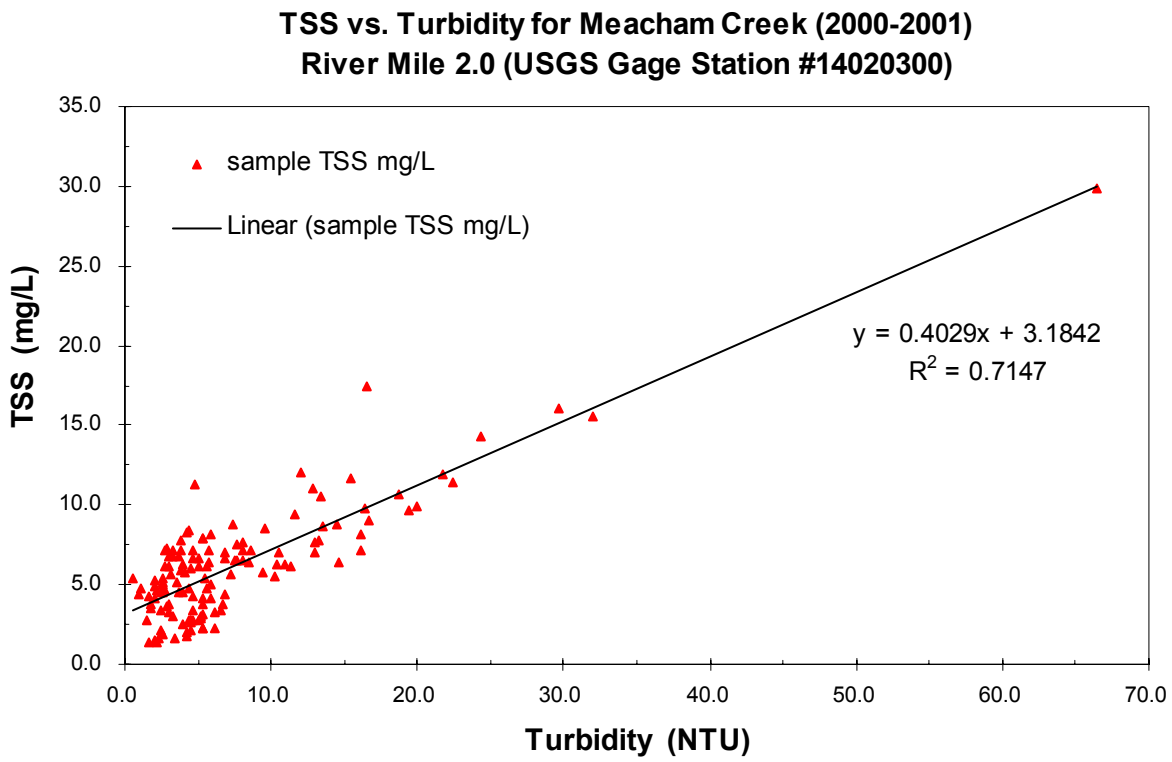
B-2. Sediment Graphs for the Umatilla River (RM 81.7)





B-3. Sediment Graphs for Meacham Creek (RM 2.0)





Appendix C

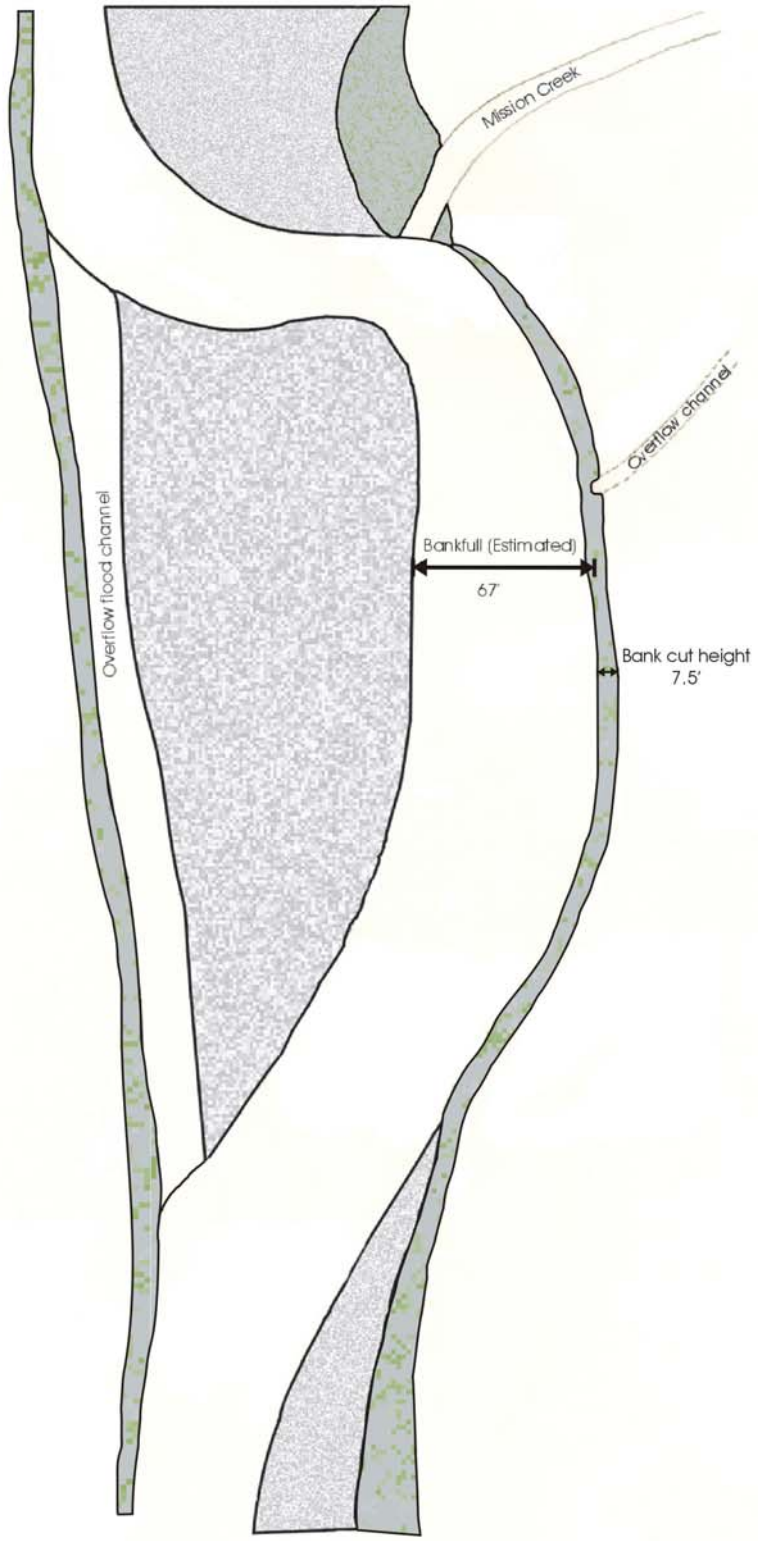
Design Specifications for Umatilla Instream Project (RM 63.5)

Umatilla River near Mission Creek

Stroud Property

Existing Condition

July 20, 2000



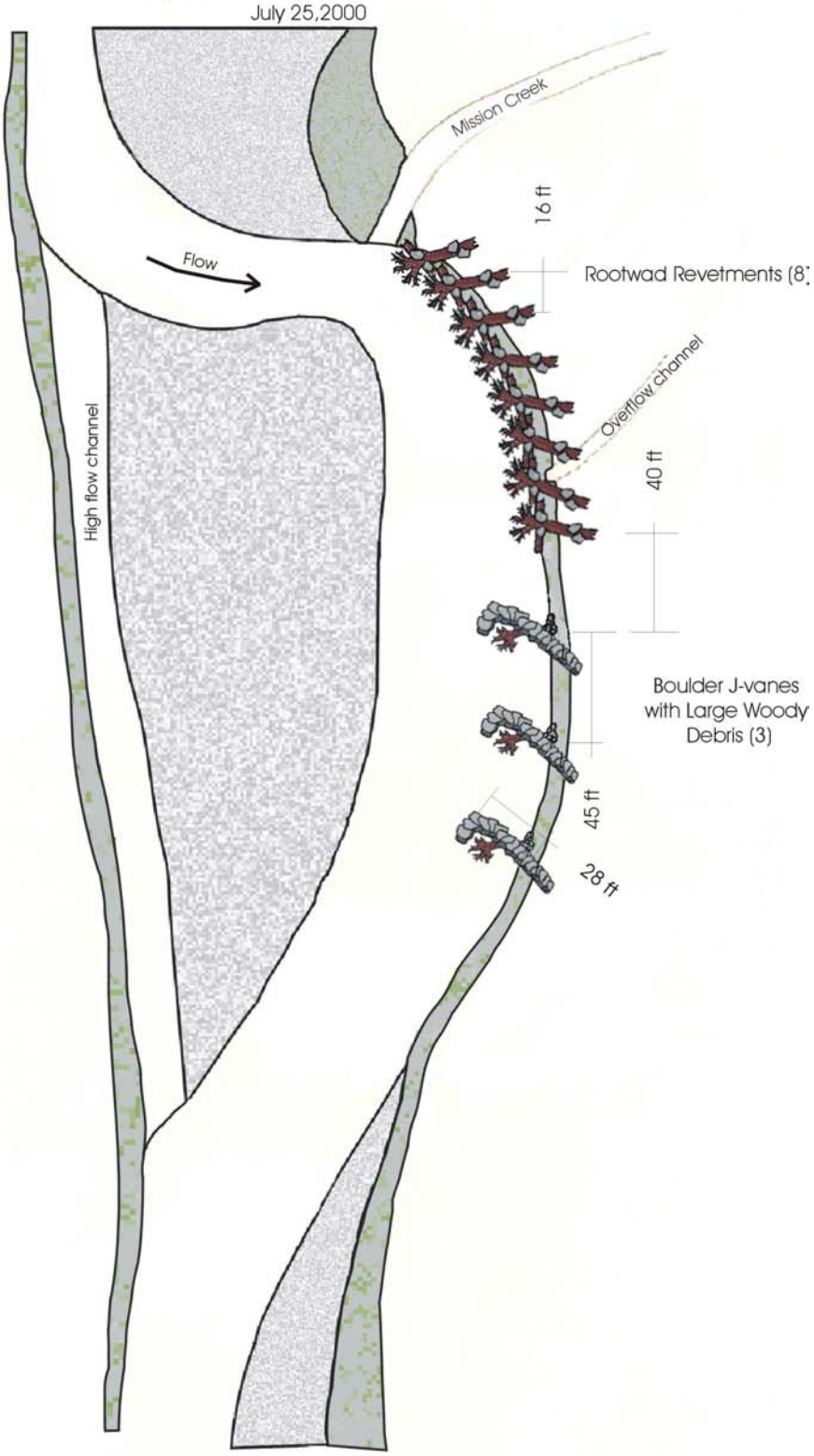
Scale 50

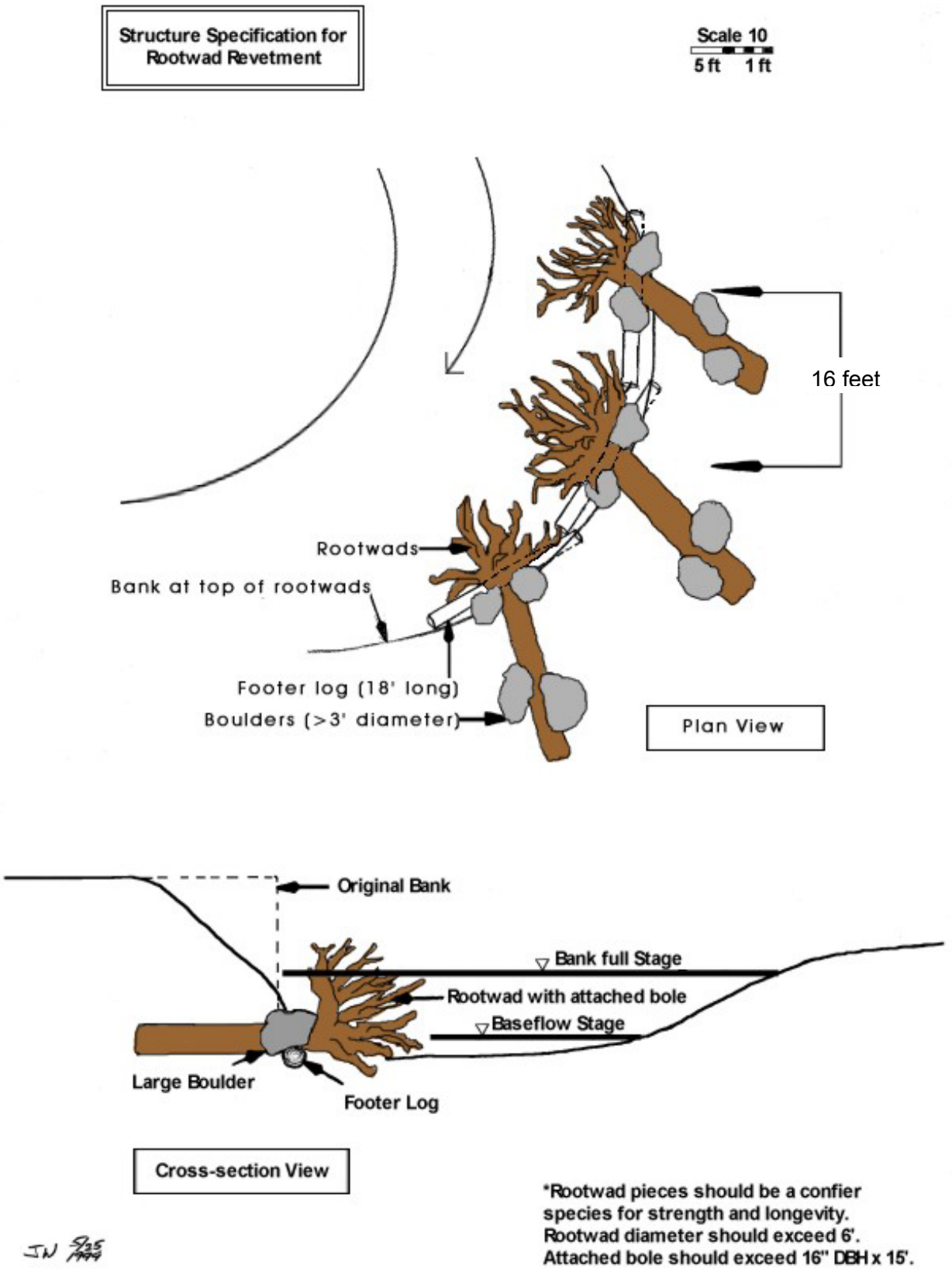
Umatilla River near Mission Creek

Stroud Property

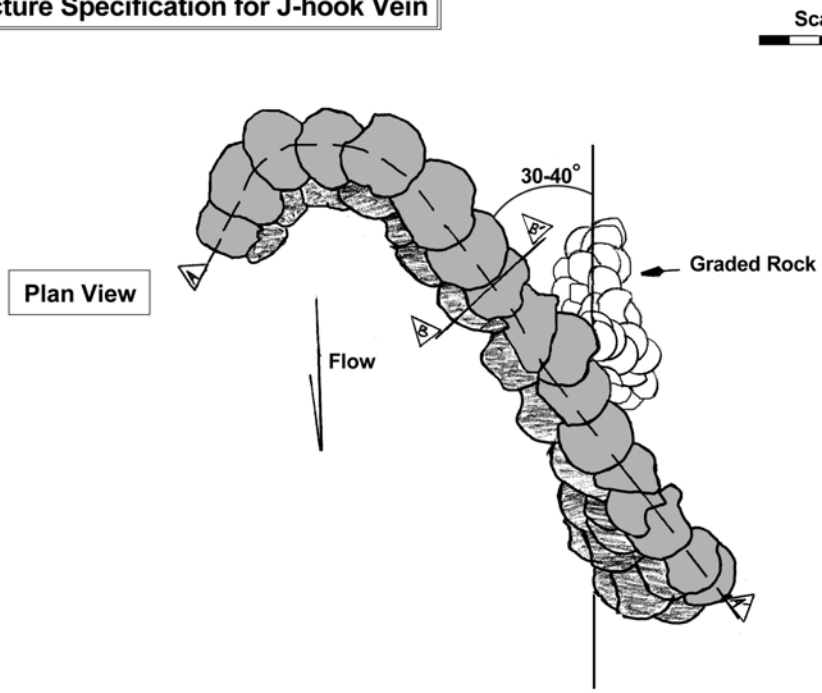
Proposed Bank Stabilization

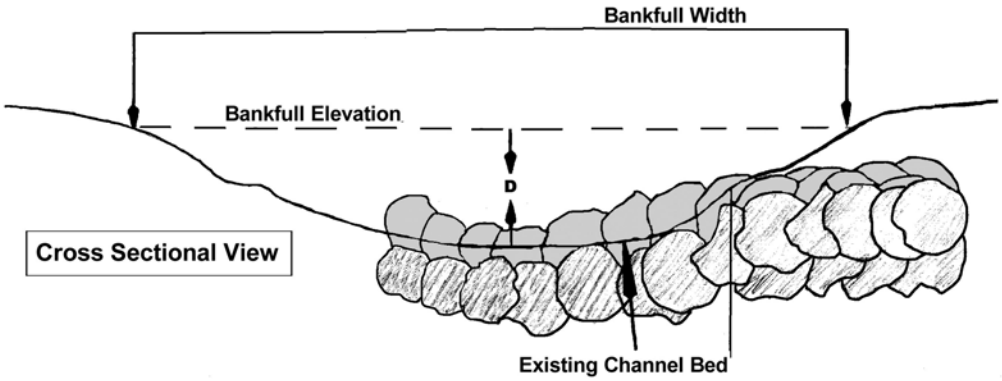
July 25,2000

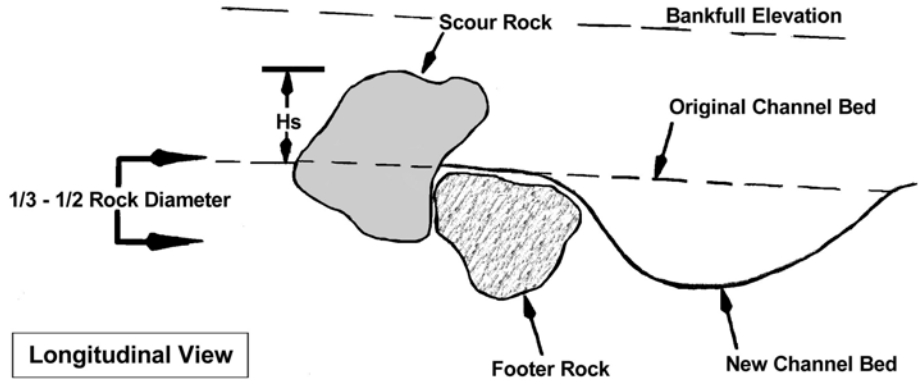



Structure Specification for Rootwad Revetment
Scale 10
5 ft 1 ft
16 feet
Rootwads
Bank at top of rootwads
Footer log (18' long)
Boulders (>3' diameter)
Plan View
Original Bank
Bank full Stage
Rootwad with attached bole
Baseflow Stage
Large Boulder
Footer Log
Cross-section View
*Rootwad pieces should be a confier species for strength and longevity. Rootwad diameter should exceed 6'. Attached bole should exceed 16" DBH x 15'.

Structure Specification for J-hook Vein

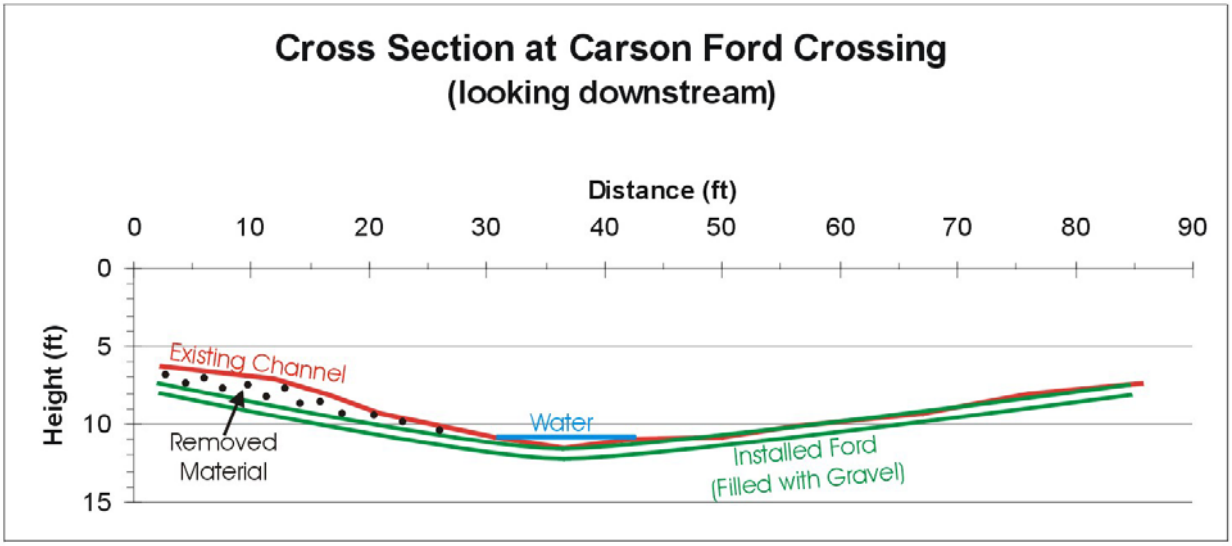






Appendix D

Design Specifications for Geoweb Stream Ford Crossing



Channel cross-section of ford installation.

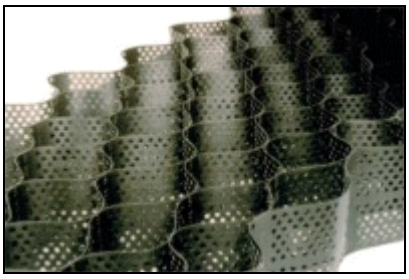
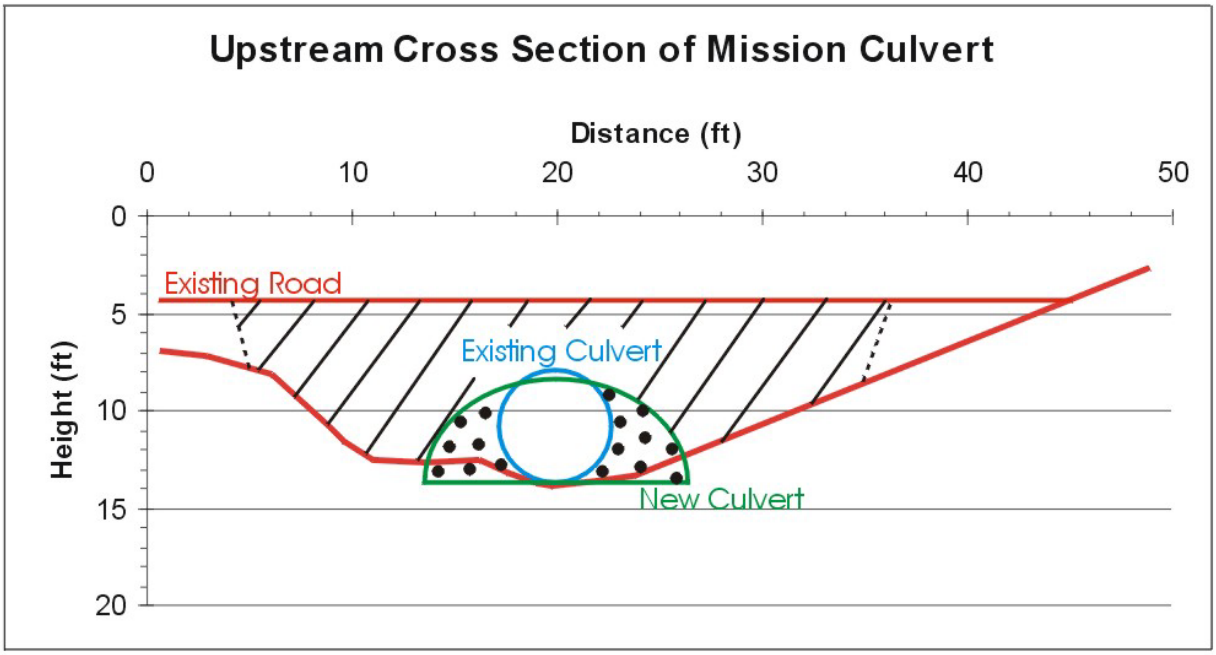
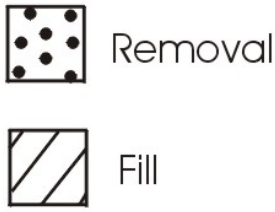


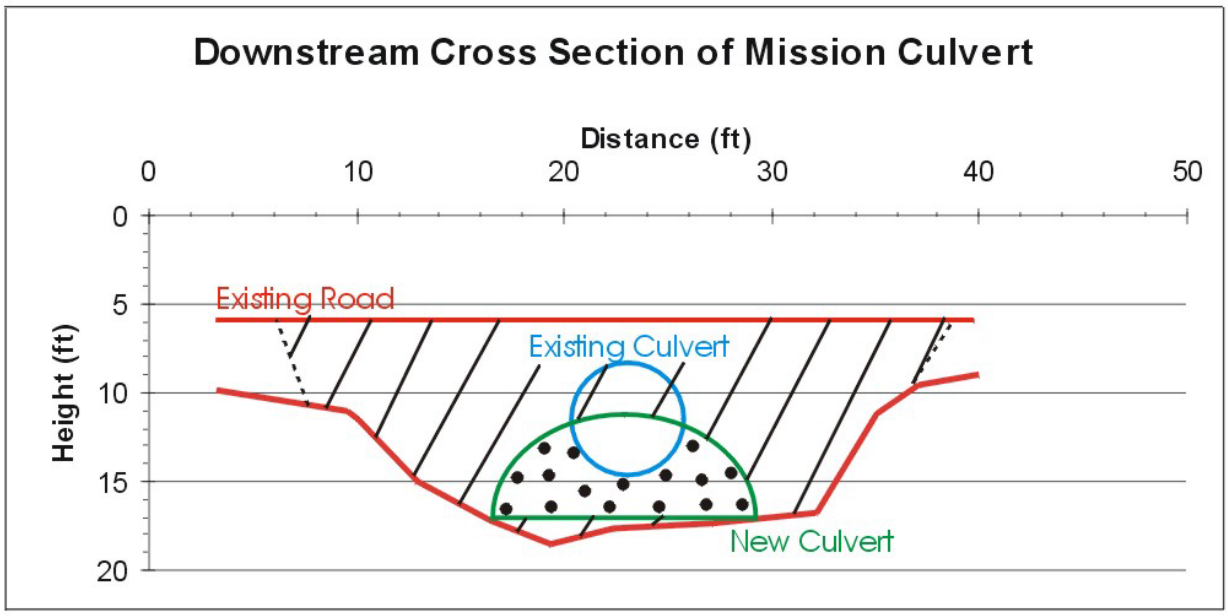
Photo of Geoweb grid system.

Appendix E

Cross Sectional Data for Culvert Replacement on Mission Creek


Upstream Cross Section of Mission Culvert
Distance (ft)
0
10
20
30
40
50
Height (ft)
0
5
10
15
20
Existing Road
Existing Culvert
New Culvert


Removal
Fill


Downstream Cross Section of Mission Culvert
Distance (ft)
0
10
20
30
40
50
Height (ft)
0
5
10
15
20
Existing Road
Existing Culvert
New Culvert

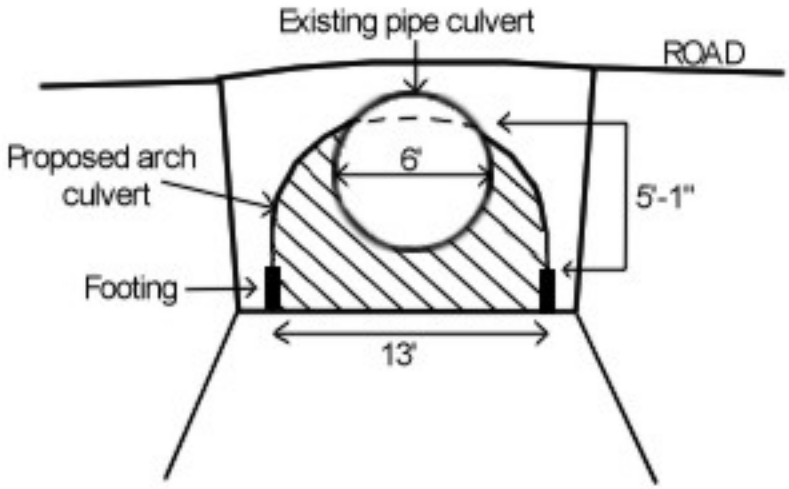


Figure 1. Downstream (North) Cross Section

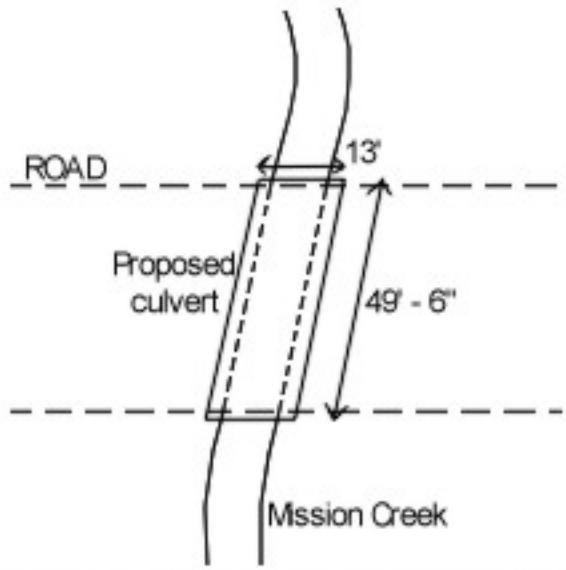
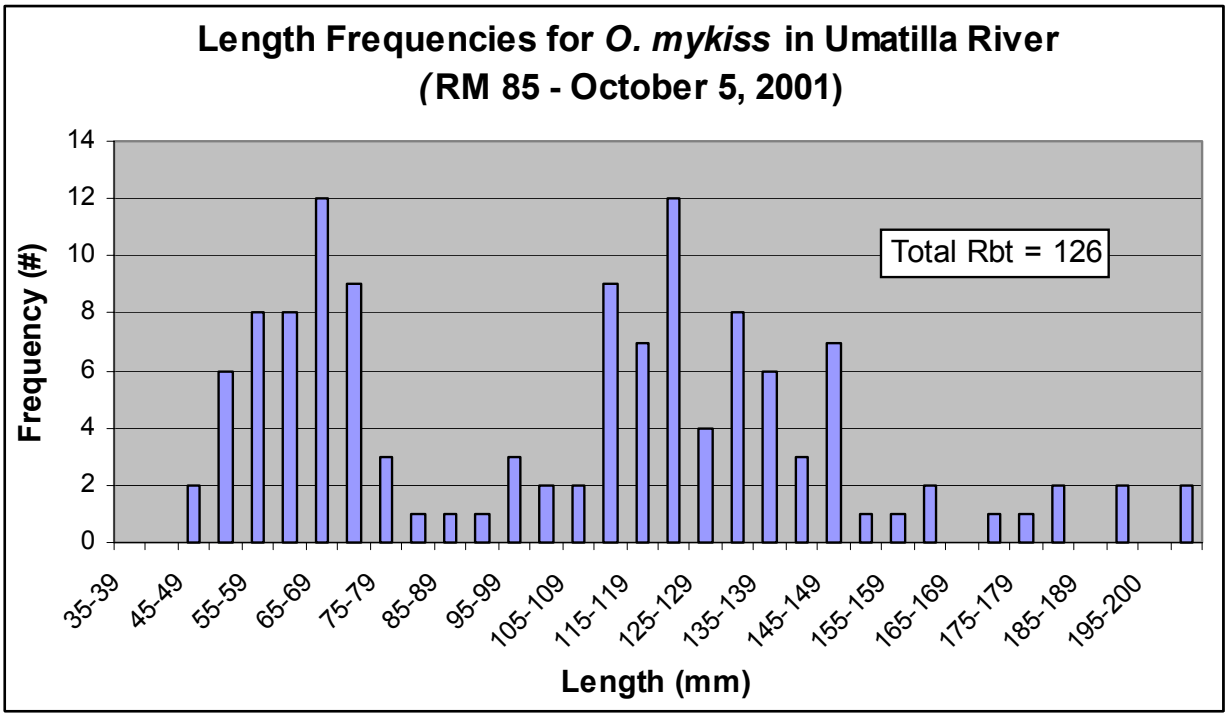


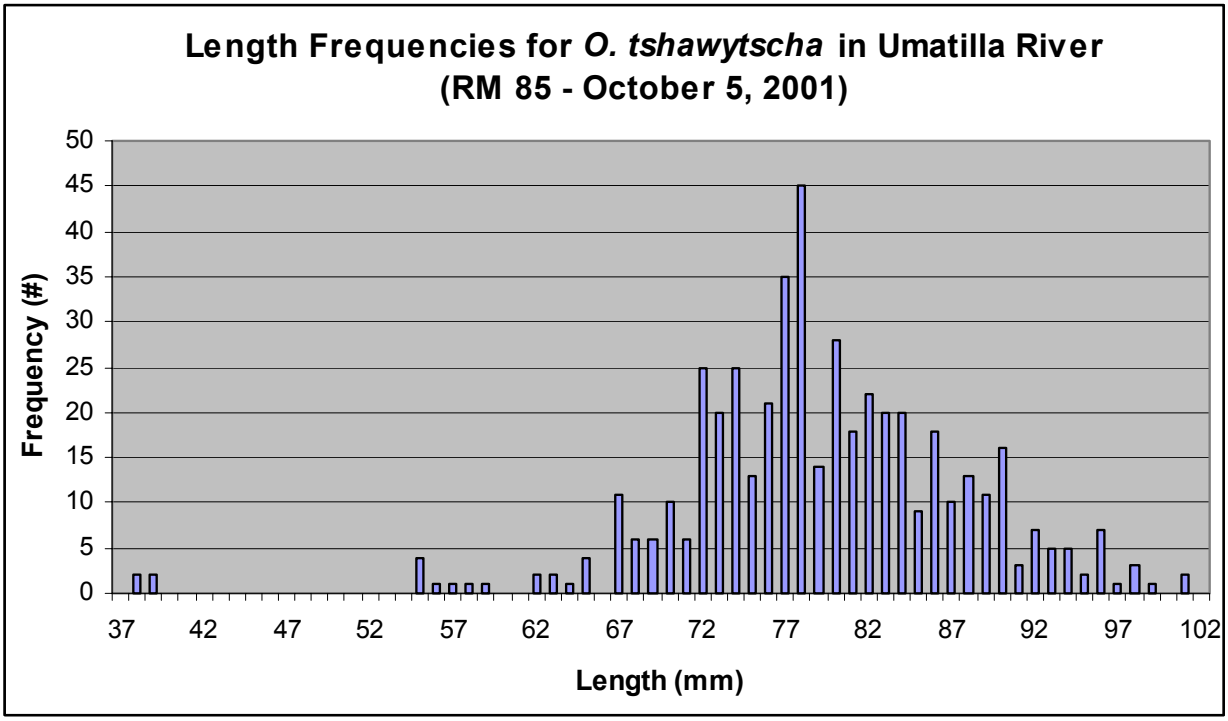
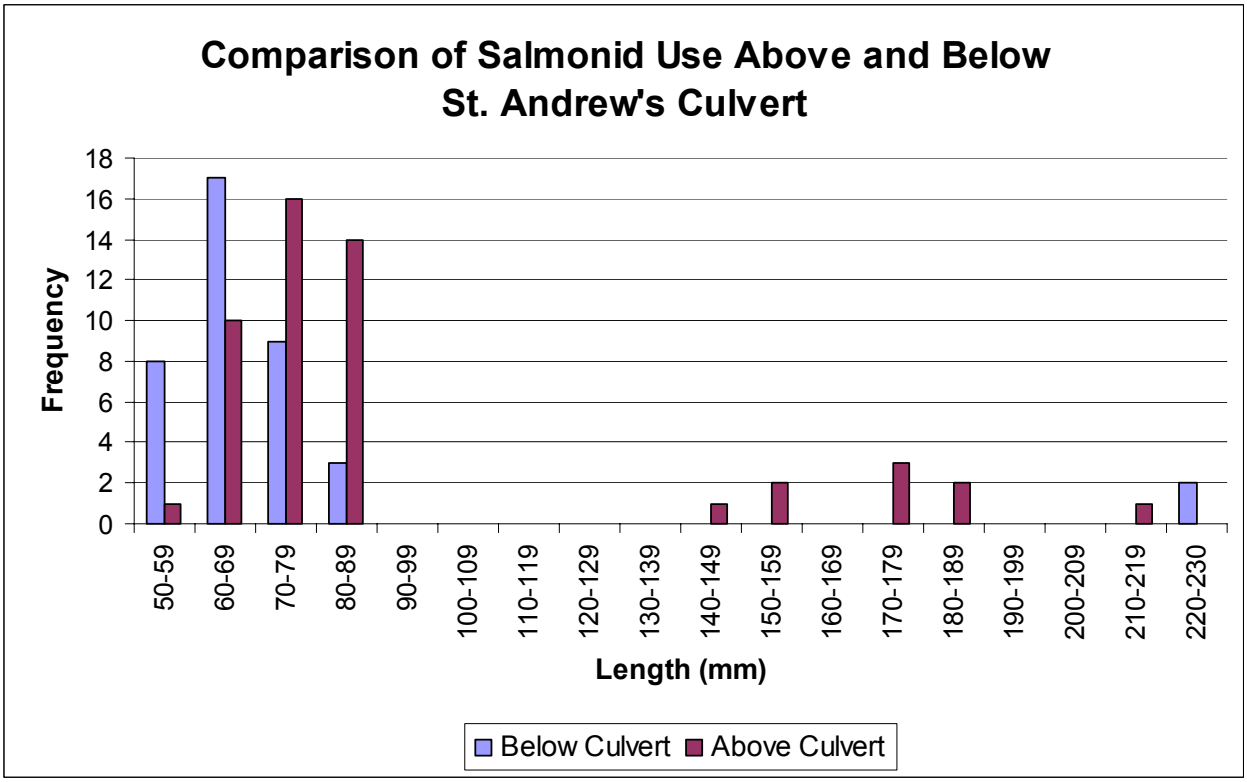
Figure 2. Topographic View of Proposed Arch Culvert

Appendix F

Summarized Data from Biological Inventories

Length frequency data for salmonids sampled within project site on the Umatilla River (RM 85).





Length frequency data for biological surveys conducted above and below culvert replacement project on Mission Creek.