Return Spawning/Rearing Habitat to Anadromous/Resident Fish within the Fishing Creek to Legendary Bear Creek Analysis Area Watersheds

Final Report
2002 - 2003

DOE/BP-00010372-1

March 2004

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Return Spawning/Rearing Habitat to Anadromous/Resident Fish within the Fishing (Squaw) Creek to Legendary Bear (Papoose) Creek Analysis Area Watersheds

Mountain Snake Province
Clearwater River Subbasin
High Priority Project
Project No. 2002-040
Contract No. 00010372

FINAL REPORT

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PREFACE

On November 13, 2000, the Northwest Power Planning Council and Bonneville Power Administration opened a "High Priority" solicitation to the region to identify immediate actions that will assist Endangered Species Act (ESA) listed anadromous fish in the Columbia Basin. This project, *Return Spawning/Rearing Habitat to Anadromous/Resident Fish within the Squaw Creek to Papoose Creek Analysis Area Watersheds,* sponsored by the Nez Perce Tribe's Department of Fisheries Resource Management (DFRM) Watershed Division was awarded for funding.

This final report has been prepared to describe the accomplishments associated with this high priority project, *Return Spawning/Rearing Habitat to Anadromous/Resident Fish within the Squaw Creek to Papoose Creek Analysis Area Watersheds*. As part of the Northwest Power Planning Council's Columbia Basin Fish and Wildlife Program (FWP), this project is one of Bonneville Power Administration's (BPA) many efforts at off-site mitigation for damage to salmon and steelhead runs, their migration, and wildlife habitat caused by the construction and operation of federal hydroelectric dams on the Columbia River and its tributaries.

The Nez Perce Tribes DFRM Watershed Division's vision focuses on protecting, restoring, and enhancing watersheds and treaty resources within the ceded territory of the Nez Perce Tribe under the Treaty of 1855 with the United States Federal Government. The program uses a holistic approach, which encompasses entire watersheds, ridge top to ridge top, emphasizing all cultural aspects. We strive toward maximizing historic ecosystem productive health, for the restoration of anadromous and resident fish populations.

The project's administrative and participant information is listed below:

BPA Project No: 2002-40
BPA Contract No.: 00010372
Performance Period: June 1, 2002 – September 30, 2003

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This final report begins with an introduction followed by the methods, accomplishments, costs and ending with a discussion. If more detailed information about this project is needed, contact the project leader or sponsor listed above.

EXECUTIVE SUMMARY

On November 13, 2000, the Northwest Power Planning Council and Bonneville Power Administration opened a "High Priority" solicitation to the region to identify immediate actions that will assist Endangered Species Act (ESA) listed anadromous fish in the Columbia Basin. This project, *Return Spawning/Rearing Habitat to Anadromous/Resident Fish within the Squaw Creek to Papoose Creek Analysis Area Watersheds,* sponsored by the Nez Perce Tribe's Department of Fisheries Resource Management (DFRM) – Watershed Division was awarded for funding.

The original boundaries of the project are in the Fishing Creek to Legendary Bear Creek Watersheds Analysis Area. Funding for this project allowed expansion into Pete King Creek and Cabin Creek. There were a total of 8 road crossings replaced with this project and 1 project designed (Cabin Creek). Cabin Creek could not be replaced because of budgetary constraints. The 8 replacements returned a total of 25 miles of fish habitat. The total project cost was $687,074 with $410,261 (60%) coming from the Nez Perce Tribe through BPA and $267,813 (40%) coming from the Clearwater National Forest as a cost-share. The Tribes contribution came from this projects funds ($385,000) and from the on-going *Protecting and Restoring the Fishing to Legendary Bear Creek Analysis Area Watersheds* BPA project ($25,261) as also a cost-share.

INTRODUCTION

Project Overview

This project is a critical component of currently on-going watershed restoration effort in the Lochsa River Drainage, including the Fishing (Squaw) Creek to Legendary Bear (Papoose) Creek[1] Watersheds Analysis Area. In addition, funding for this project allowed expansion of the project into Pete King Creek and Cabin Creek. The goal of this project is working towards the re-establishment of healthy self-sustaining populations of key fisheries species (spring Chinook salmon, steelhead, bull trout, and westslope cutthroat trout) through returning historic habitat in all life stages (spawning, rearing, migration, and over-wintering). This was accomplished by replacing fish barrier road crossing culverts with structures that pass fish and accommodate site conditions.

Site Description

The Fishing Creek to Legendary Bear Creek Watersheds Analysis Area is located in the Upper Lochsa River basin within the ceded territory of the Nez Perce Tribe (NPT) and the Clearwater National Forest (CNF). The streams within the analysis area include Fishing Creek with two major tributaries, Doe Creek and West Fork of Fishing Creek, Legendary Bear Creek with a major tributary Parachute Creek, Badger Creek, and Wendover Creek (Figure 1). These streams drain into the Upper Lochsa River, which

[1] Squaw Creek and Papoose Creek names have been changed to Fishing Creek and Legendary Bear Creek. These will be interchanged throughout this document.

flows into the Clearwater River, and into the Snake River. The total acreage for each streams watershed is listed in table 1.

Table 1: Acreage for each watershed within the analysis area.

Watershed	Acreage
Doe (Squaw tributary) Creek	6,183
Fishing Creek	10,812
Wendover/Badger Creeks	7,890
Legendary Bear Creek	7,415
Parachute (Legendary Bear tributary)	6,938
Entire Analysis Area	39,238

In addition, work on the project was completed outside of this analysis area but within the Lochsa River basin that include the Pete King Creek and Cabin Creek (Figure 1).

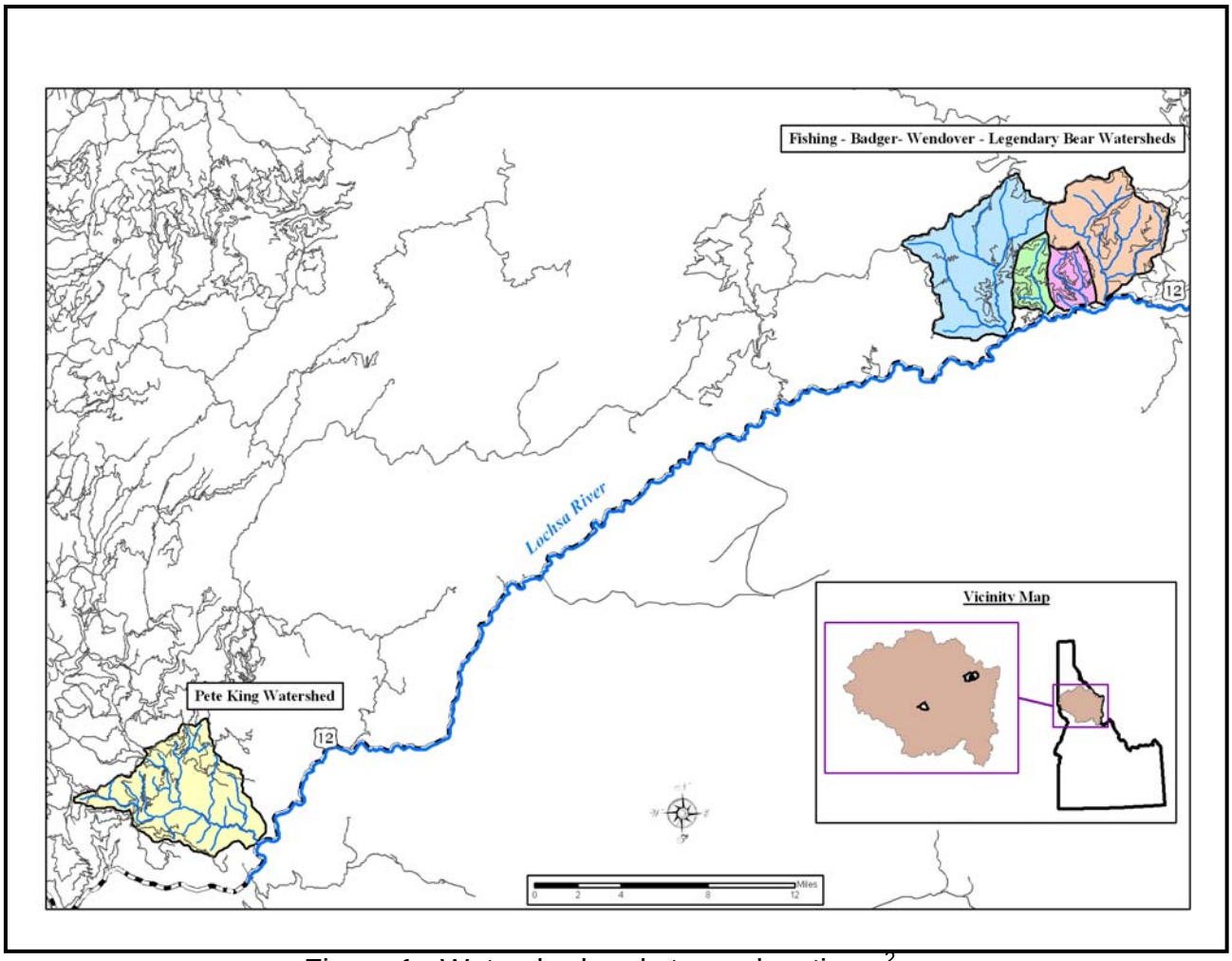

Figure 1: Watershed and stream locations.[2]

Fish

Within the streams listed above Steelhead, Spring Chinook Salmon, Cutthroat Trout and Bull Trout are found (see table 2).

The project watersheds and streams are high priority for several reasons, including the presence of at risk species, available spawning, rearing, migration, and over-wintering habitat, and the number or restoration projects in the area. The analysis area streams provide habitat for a variety of anadromous and resident fish, and for this reason addresses multiple species. The anadromous stocks include spring Chinook salmon and steelhead. Resident fish include westslope cutthroat and bull trout, as well as dace and sculpin species (CNF and NPT, 1998). The CNF rates Fishing and Legendary Bear Creeks as second and third for fisheries values through their prioritization for EAWS (Ecosystem Analysis at the Watershed Scale) scheduling. Fishing Creek is rated as stronghold for bull trout, the only one within the Lochsa River drainage and only one of thirteen within the four hundred and twenty-two sub-watersheds (6th field HUC's) of the Clearwater Sub-basin. All streams within the analysis area are rated as strongholds for

[2] Cabin Creek is not shown on this map because this site was designed but not replaced.

westslope cutthroat. Spring Chinook salmon and steelhead are listed as depressed throughout the analysis area.

Steelhead and bull trout populations are currently listed as "Threatened" under the Endangered Species Act (ESA), and westslope cutthroat trout has been petitioned for listing. Spring Chinook salmon and westslope cutthroat trout are currently on the Regional Forester's Sensitive Species list. The National Marine Fisheries Service, in addition, has petitioned to put spring Chinook salmon on the listing as an endangered species (CNF and NPT, 1998). Protection and restoration of these watersheds is critical to expanding and converting streams to strongholds for the restoration of key species within the Lochsa River drainage and the Clearwater River Sub-basin.

Table 2: Fish species within the project streams.

Stream	Area	* Species
Doe Creek	Fishing to Bear	SH / WCT / BT
Parachute Creek	Fishing to Bear	SH / WCT / BT
Wendover Creek	Fishing to Bear	SH / WCT / BT
EF Leg Bear Bridge	Fishing to Bear	SH / WCT / BT
Pete King	Lochsa	SH / WCT / SCS
Cabin Cr	Lochsa	SH / WCT / BT
* BT = bull trout; WCT = westslope cutthroat; ST = steelhead; SCS = spring/summer chinook salmon		

Problem

Due to the analysis area's road network, many streams are crossed multiple times by roads. The permanent system roads of the analysis area greatly affect the quality and continuity of aquatic ecosystems by interrupting the flow of water and material throughout the length of the stream.

Streams within the analysis area boundaries depend on naturally occurring landslides for the recruitment of material such as wood and gravel. These materials are critical in creating spawning and rearing habitats for fish and other aquatic organisms. Roads and culverts act like dams that constrict stream flows through a single narrow area (an undersized culvert) often preventing the transportation of material downstream. These constriction points also cause gravel buildup (substrate deposition) and channel widening at the culvert inlet. Wide, shallow channels do not provide quality habitat for aquatic organisms. The channels below culvert outlets are typically down cut and scoured by the high velocity water caused by the constriction. These appear as small to large waterfalls at culvert outlets.

Roads and undersized culverts have been shown to function as barriers to the upstream movement of many fish and wildlife (amphibian, insect) species. Culvert outlets not in contact with stream bottoms (i.e. those with waterfalls) do not allow for access since many organisms have no jumping abilities or are too small to negotiate the height of the falls. Undersized culverts constrict flows and increase water speeds creating high

velocity barriers and eliminating substrate from culvert bottoms. Substrate, such as gravel and rocks, provide low velocity areas for organisms to rest on their upstream migration. The presence of barriers can isolate small populations, limiting or preventing genetic exchange between populations, and preventing the re-colonization of historic or recovering habitats.

Culverts also limit or prevent seasonal upstream movement by fish. Juvenile salmon and trout living in large rivers or streams often seek refuge in small tributary streams during high water events. Without access to refuge habitats, fish may be washed downstream into poor quality or overcrowded habitats. This could reduce the chances for survival for both individuals and for populations, including those already on the Endangered Species list.

In addition to biological concerns, many culverts are in need of replacement to reduce the risk of road fill failure and subsequent addition of sediment into streams. Historically, most culverts were sized to pass 25 to 50 year storm events. In many cases, this sizing is not adequate to handle water and wood movement during large flood events. Culverts sized for a 100-year storm event are the same width as the stream channel and are able to easily pass the water and most debris associated with a large event.

METHODS

Site Selection

All culverts within the Fishing Creek to Legendary Bear Creek Watersheds Analysis Area were surveyed by the Nez Perce Tribe and the Clearwater National Forest in the summer of 2000. The rest of the Lochsa River Drainage culverts were surveyed in the summer of 2001. Using this data road crossing culverts were selected for priority replacement based on the number of species present at the crossing and the amount of habitat above the crossing. Due to alternative funding and new cost estimates for replacements, the original replacements were reprioritized. Table 3 lists the original road crossings selected for replacement, the new replacements selected through this project and the amount of fish habitat above the crossing. Figure 2 and 3 show the locations of each new replacement by the numbers listed below. In addition, road crossings replaced in previous years with alternative funding are also shown with the letters A, B, C and D. The combination of these replacements with the replacements completed with this project finishes replacement of all high priority road crossings within the Fishing Creek to Legendary Bear Creek Watersheds Analysis Area.

Table 3: Culverts selected for replacement and the amount of habitat above.

#	Original Replacements	Habitat Opened (mi)	New Replacements	Habitat Opened (mi)
1	E. Fk. Legendary Bear Upper #1	1	* Doe Creek	4
2	E. Fk. Legendary Bear Upper #2	1	* Parachute Mouth	5
3	Upper Lochsa #1	1	* Parachute Upper	2
4	Wendover Lower	2	Same	2
5	Wendover Upper	1.5	Same	1.5
6	W. Fk. Wendover	1.5	Same	1.5
7	E. Fk. Legendary Bear Lower	4.5	Same	4.5
8	Upper Lochsa #2	1	* Pete King Creek	4.5
9	Upper Lochsa #3	1	** Cabin Creek	0
	TOTAL	**11.5**	**TOTAL**	**25**
* Replacement Crossings				
** Cabin Creek opens 1 mile but is not counted because it was designed but not replaced.				

The crossings replaced (E. Fk. Papoose Upper #1, E. Fk. Papoose Upper #2, Upper Lochsa #1, Upper Lochsa #2, Upper Lochsa #3) were done so because of the increased habitat gained through the new crossings (Doe Creek, Parachute Mouth, Parachute Upper, Pete King). This resulted in an additional 10.5 miles of habitat returned. Cabin Creek was designed but not replaced due to budgetary constraints. This site had the lowest amount of habitat returned (1 mile). Project sponsors will continue to look for alternative funding for this replacement.

Design

Design of each project location was completed in cooperation with the CNF. All project locations were designed using squash pipe except for the East Fork of Papoose Creek site. A bridge was selected for this location because of the location of the stream in relation to the road. All crossings were designed by the Clearwater National Forest with the interdisciplinary team oversight except for the East Fork of Papoose Creek and Pete King Creek locations. Due to the complexity of the bridge design this had to be contracted out as well as the Pete King Creek site because of the large amount of fill over it. Druyvestein, Johnson, & Anderson Consulting Engineers and Land Surveyors out of Missoula, Montana were selected to perform the designs.

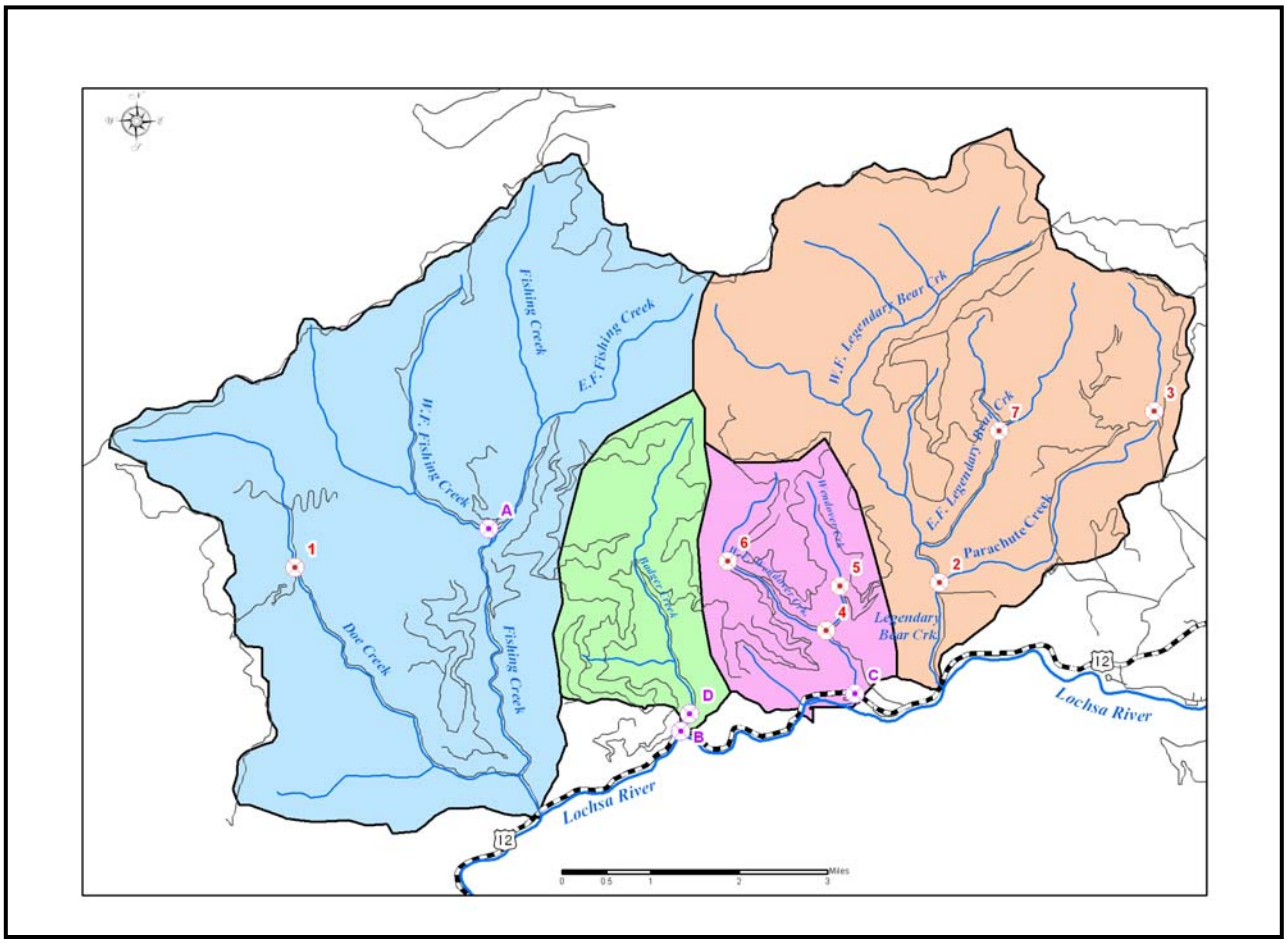

Figure 2: Replacement locations within the Squaw Creek to Papoose Creek Watersheds Analysis Areas.

For the squash pipe designs, an interdisciplinary team from the Nez Perce Tribe and Clearwater National Forest including biologists, hydrologists, and engineers was used. References used include the *Oregon Road/Stream Crossing Restoration Guide* (Allen, M., A. Mirati, and E.G. Robison, 1999), *Designing for Stream Simulation @ Road Crossing* (Porior, D., 2000), *Fish Passage Through Culverts* (Baker, C.O., and F.E. Votapka, 1990) and *Fish Passage Design at Road Culverts* (WDFW, 1999) documents.

Each culvert was sized first for the active stream channel and checked for the 100-yr. flood event, which are almost always very similar. When sizing the culvert, consideration was given to embedding the culvert and the substrate that will fill the bottom of the culvert. Each squash pipe was be retrofitted with an 8-inch high baffling system to aide in retaining substrate for natural channel simulation. This baffling system has been successfully used in the Coos Bay BLM area for retaining substrate within the culvert length. Culvert inlet and outlet invert elevations were embedded approximately 20% of the rise or 18 inches (below natural stream grade), which ever is greater, to allow for natural streambed simulation (Robison et al., 1999).

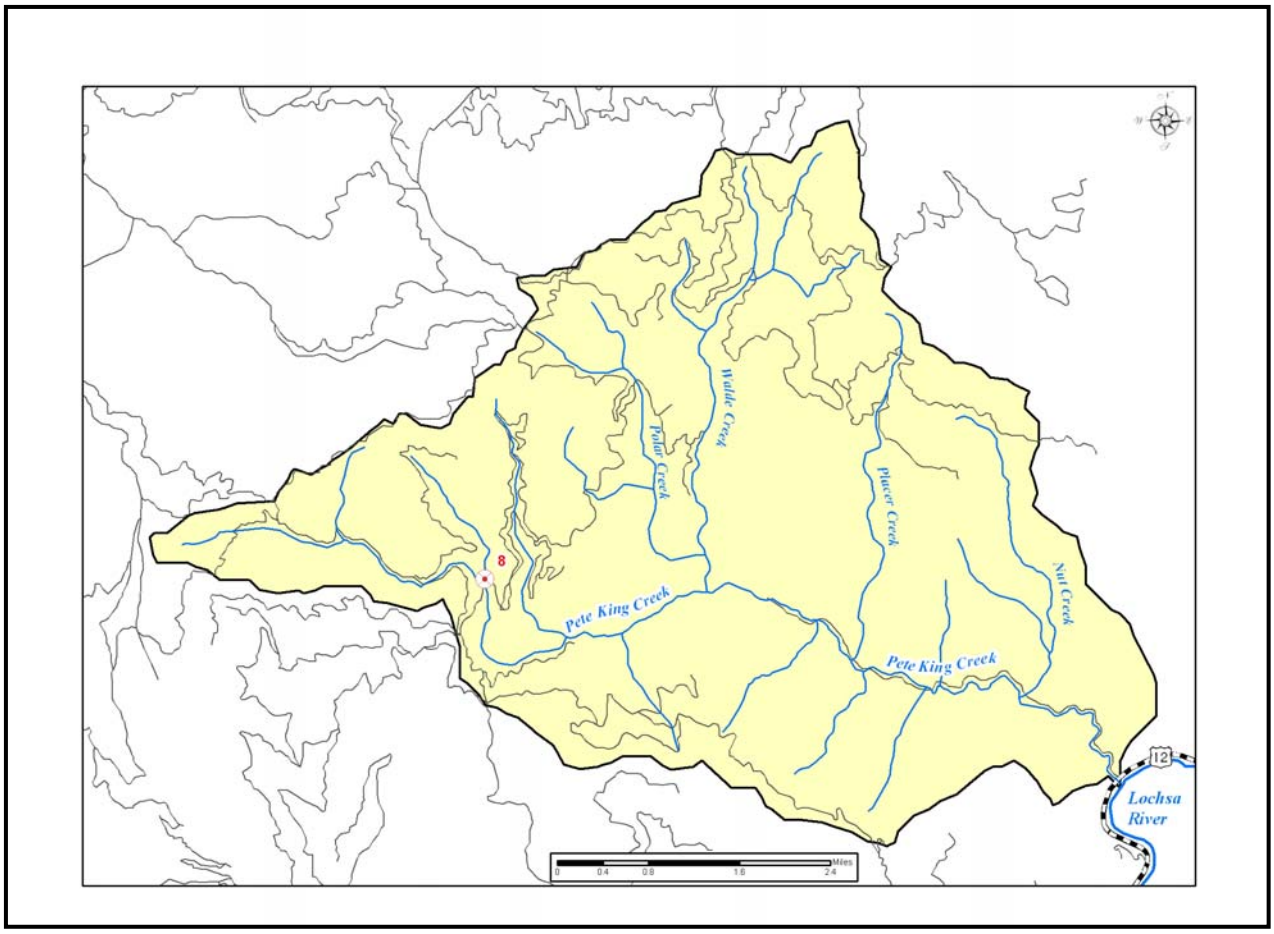

Figure 3: Replacement location on Pete King Creek.

ACCOMPLISHMENTS

The eight crossing replaced with this project returned a total of 25 miles of fish habitat to the Upper Lochsa River Drainage (Table 3).

Doe Creek Replacement (2002)

The original culvert was a 103”X71” pipe arch with two log structures below it to attempt in facilitating passage. The bankfull width (BFW) for this stream at this location is 168” and the new culvert is a 171”X110”X64’ pipe arch. The log structures were taken out during construction and the new pipe was embedded 18” below the estimated natural stream grade. This replacement crossing returned approximately 4 miles of fish habitat. Figures 4-10 show the site before construction, during construction and after construction.

Figure 4: Inlet before construction.

Figure 5: Outlet before construction.

Figure 6: Weirs below outlet.

Figure 7: During construction.

Figure 8: During Construction.

Figure 9: Outlet after construction.

Figure 10: Outlet after construction.

Parachute Creek Mouth Replacement (2002)

The original culvert was a 95”X65” pipe arch. At the outlet end of the culvert there was a series of stacked gabion baskets that were beginning to blow out. The BFW for this stream at this location is 120” and the new culvert is a 128”X83”X52’ pipe arch. The gabion baskets were removed and the new culvert is embedded 18” below the estimated natural stream grade. This replacement crossing returned approximately 5 miles of fish habitat. Figures 11-16 show the site before construction, during construction and after construction.

Figure 11: Outlet before construction.

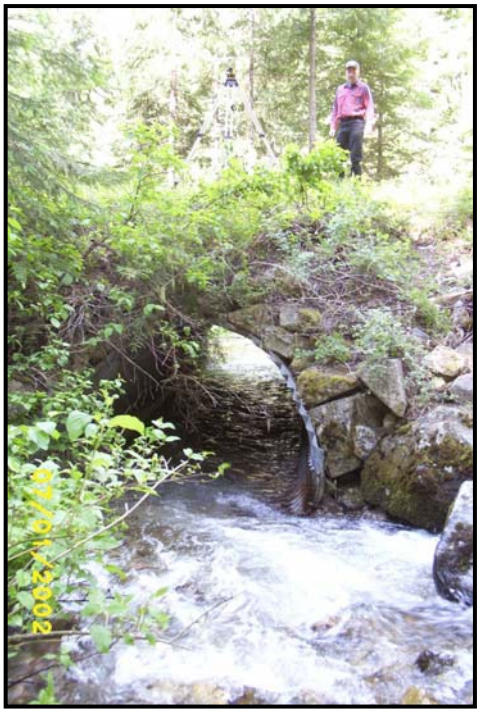

Figure12: Inlet before construction.

Figure 13: Gabions below outlet.

Figure 14: During construction

Figure 15: Inlet after construction.

Figure 16: Outlet after construction.

Parachute Creek Upper Replacement (2002)

The original culvert was a 54" round pipe. The BFW for this stream at this location is 96" and the new culvert is a 103"X71"X68' pipe arch embedded 18" below estimated natural stream grade. This replacement crossing returned approximately 2 miles of fish habitat. Figures 17-20 show the site before construction and after construction.

Figure 17: Inlet before construction.

Figure 18: Outlet before construction.

Figure 19: Inlet after construction

Figure 20: Outlet after construction.

Wendover Creek Lower Replacement (2002)

The previous culvert was a 48" round pipe. The BFW for this stream at this site was 96" and the new replacement culvert is a 103"X71"X74' pipe arch embedded 18" below estimated natural stream grade. This replacement crossing returned approximately 2 miles of fish habitat. Figures 11-16 show the site before construction, during construction and after construction.

Figure 21: Inlet before construction.

Figure 22: Outlet before construction.

Figure 23: During construction.

Figure 24: During construction.

Figure 25: Inlet after construction.

Figure 26: Outlet after construction.

Wendover Creek Upper Replacement (2002)

The previous culvert was a 48" round pipe. The BFW for this stream at this location is 96" and the new culvert is a 103"X71"X74' pipe arch embedded 18" below estimated natural stream grade. This replacement crossing returned approximately 1.5 miles of fish habitat. Figures 27-30 show the site before and after construction.

Figure 27: Inlet before construction.

Figure 28: Outlet before construction.

Figure 29: Inlet after construction.

Figure 30: Outlet after construction.

West Fork of Wendover Creek Replacement (2002)

The previous culvert was a 36" round pipe. The BFW for this stream at this location is 84" and the new culvert is an 87"X63"X50' pipe arch embedded 18" below estimated natural stream grade. This replacement crossing returned approximately 1.5 miles of fish habitat. Figures 31-35 show the site before construction, during construction and after construction.

Figure 31: Inlet before construction.

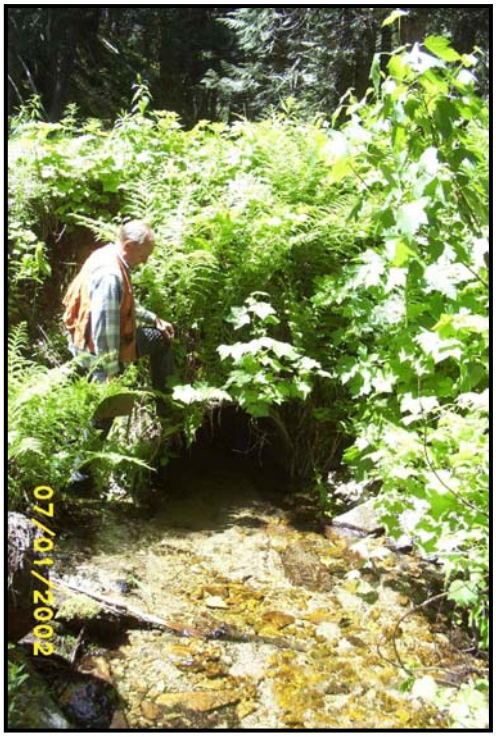

Figure 32: Outlet before construction.

Figure 33: During construction.

Figure 34: Inlet after construction.

Figure 35: Outlet after construction.

East Fork Legendary Bear Creek Replacement (2003)

The previous structure was a 114”X77” pipe arch. The first idea was to replace this structure with another pipe arch that was slightly larger in width than the bankfull width of the channel and embedded approximately 18” below estimated natural stream grade. Due to the complexity of the site, a field investigation was done with Mike Jenson with DJ&A consultants and engineering staff from the Clearwater National Forest (John Kasza, Dean Roach, and Monte Joersz). The site possessed very difficult alignment between the road, stream and the structure. A pipe arch and bottomless arch at this site was not feasible because they did not fit. The only other option was a bridge, which was decided to be the best solution for this site by the above mentioned personnel as well as the Nez Perce Tribe. The design of a bridge was not within the technical abilities of the interdisciplinary team used to design the pipe arches. For this reason, DJ&A consultants out of Missoula, Montana were contracted to provide this service. A copy of the design is with the file at the Nez Perce Tribe’s DFRM Watershed Division.

This replacement crossing returned approximately 4.5 miles of fish habitat. Figures 36-41 show the site before construction, during construction and after construction.

Figure 36: Inlet before construction.

Figure 37: Outlet before construction.

Figure 38: During construction.

Figure 39: During construction.

Figure 40: Inlet after construction.

Figure 41: Outlet after construction.

Pete King Creek Replacement (2003)
The original culvert was a 48”X172’ round pipe. The first design plan was to use the NPT/CNF interdisciplinary team to design a pipe arch for the site. The shear amount of fill over the structure complicated the design, and for this reason required it to be contracted out. It was contracted to the same firm as above, DJ&A consultants.

DJ&A designed a bottomless arch because the load from the fill would not allow a pipe arch structure. The contractor selected for structure installation was Debco Contractors. When Debco saw the design, they thought they could put in a structural round pipe that could hold the fill pressure, be more cost-effective and achieve the goal of natural stream simulation. The BFW for this stream at the replacement location is 11 feet and Debco proposed a 13 foot round structural pipe. This was approved by both the NPT and the Clearwater National Forest interdisciplinary team and approximately $24,000 was saved by going with this option. The round pipe was embedded 50% to allow for maximum channel adjustment. A copy of the design is with the file at the Nez Perce Tribe’s DFRM Watershed Division. This replacement crossing returned approximately 4.5 miles of fish habitat. Figures 42-48 show the site before construction, during construction and after construction.

Figure 42: Inlet before construction.

Figure 43: Outlet before construction.

Figure 44: During construction.

Figure 45: During construction.

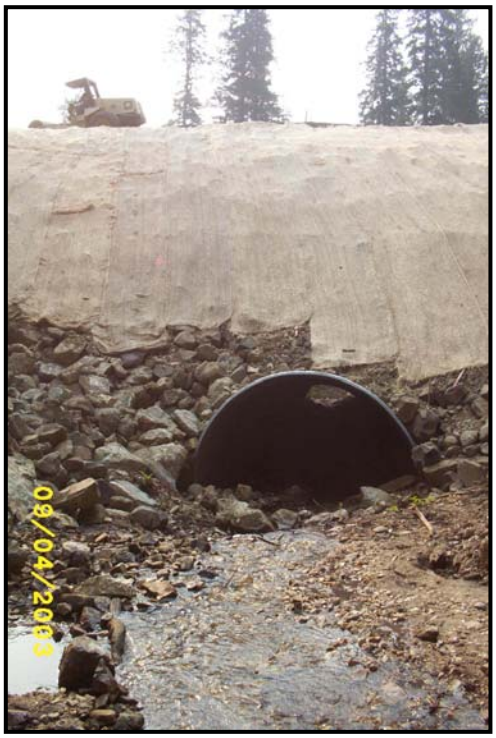

Figure 46: Inlet after construction.

Figure 47: Outlet after construction.

Figure 48: Inside new culvert.

COSTS

The costs associated with the culverts replaced under this project are presented below in Table 4. The table shows all cost including the cost-share with the Clearwater National Forest and the BPA project, *Protecting and Restoring the Fishing to Legendary Bear Creek Analysis Area Watersheds* (BPA project number 199607709).

Table 4: Breakdown of costs associated with the culvert replacements.

		Forest Service		NPT thru BPA			
		contract	* other		contract	survey/design	total
#	culverts	costs	costs	funding	costs	contract costs	cost
1	Doe	$ 41,168	$ 9,000	N/A	$ -	$ -	$ 50,168
2	Parachute Mouth	$ 24,272	$ 9,000	N/A	$ -	$ -	$ 33,272
3	Parachute Upper	$ 25,488	$ 9,000	N/A	$ -	$ -	$ 34,488
4	Wendover Lower	$ -	$ 9,000	high priority	$ 28,415	$ -	$ 37,415
5	Wendover Upper	$ -	$ 9,000	high priority	$ 26,300	$ -	$ 35,300
6	WF of Wendover	$ -	$ 9,000	high priority	$ 14,500	$ -	$ 23,500
7	EF Leg Bear Bridge	$ 98,485	$ 20,000	** F to LB	$ 2,200	$ 23,061	$ 143,746
8	Pete King	$ 3,500	$ 6,000	high priority	$ 304,585	$ 5,600	$ 319,685
9	Cabin Cr	$ 2,900	$ 1,000	high priority	$ -	$ 5,600	$ 9,500
		$ 195,813	**$ 81,000**		**$ 376,000**	**$ 34,261**	**$ 687,074**
	Total by funding agency		**$ 276,813**			**$ 410,261**	
	% funding agency		40%			60%	
					high priority	$ 385,000	
					** F to LB	$ 25,261	
* includes NEPA, survey, design, construction, construction admin, and monitoring							
** Fishing to Legendary Bear BPA contract							

There is one cost associated with the Tribe's contribution that is not within this table. These costs are associated with on-the-ground contract administration of the culvert installations. The tribal engineer and project leader, Emmit E. Taylor Jr., spent time working with the Clearwater National Forest engineers and the contractors on the installations at approximately 40 hours.

Total cost for the project was $687,074 with 40% of the project coming from the Clearwater National Forest ($267,813) and 60% from the NPT through BPA ($410,261).

The tribal contribution came primarily from this contract ($385,000). The rest came from the on-going *Protecting and Restoring the Fishing to Legendary Bear Creek Analysis Area Watersheds* BPA project ($25,261).

DISSCUSSION

Each of the culvert replacements were successful in their design requirements during installation. It will be a matter of time, depending on high flow events, before substrate begins to move into the culverts, the stream channels begin to re-grade themselves, and success can be fully determined. Monitoring will take place on the replacements (except for the bridge) in two ways, aquatic organism passage and physical condition surveys.

Aquatic organism passage will be evaluated for the two years following installation. Spawning surveys for bull trout, steelhead trout and Chinook salmon will be used for evaluation, as the redds (egg deposit sites) are easy to detect. The total number of redds will be counted 3 times during the spawning season for each species present. Success criteria will be the documentation of at least one redd in returned habitats.

For all culverts, and in streams where adult fish currently have passage but a barrier exists for juvenile fish, physical condition surveys will be documented. These will be completed one year after installation to allow for gravel movement into the culvert. Conditions noted will include whether or not the culvert outlet is in contact with the stream bottom and the percentage of the interior culvert bottom with substrate in it. If stream bottom contact exists and substrate occurs throughout the culvert, stream channel conditions will have been mimicked with the re-establishment of natural hydraulic and biotic connections. It is assumed that if this mimicking and reconnection is achieved, passage will be possible for all aquatic organisms.

As with any stream system, the movement of larger sediments such as gravel and cobble are directly dependent on large precipitation events that increase water velocities throughout a system. Large sediments may move only feet downstream during drought years but potentially hundreds of feet or more during flood events. It could therefore take several years for gravels to settle inside the culverts once they are replaced. This is an expected and acceptable process.

If the structures are not successful in achieving the goals of aquatic passage at each road crossing within three years, recommendations will be made as to what modifications need to be made in order for goals to be met. An interdisciplinary team from the Nez Perce Tribe DFRM Watershed Division and the Clearwater National Forest consisting of biologists, engineers, and hydrologists will provide the recommendations. Possible recommendations include substrate seeding, construction of weirs, or re-design and construction of the road crossing. This monitoring and evaluation plan is to act as a feed back loop into future design strategies. Any part of the project that is deemed not successful will get a full review from the interdisciplinary

team. Lessons learned will be applied to future projects to increase the overall success of aquatic passage at road crossings.

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