Bonneville Power Administration
Fish and Wildlife Program FY99 Proposal

Section 1. General administrative information

Stabilizing Stream Channels In The Cabin Creek Watershed

Bonneville project number, if an ongoing project 9114

Business name of agency, institution or organization requesting funding
US Forest Service, Wenatchee National Forest, Cle Elum Ranger District

Business acronym (if appropriate) USFS

Proposal contact person or principal investigator:

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Subcontractors.

Organization	Mailing Address	City, ST Zip	Contact Name
Helicopter services contractor	N/A	N/A	N/A
Self-Loader, dump truck and excavator services contractor	N/A	N/A	N/A
Sawyer contractor	N/A	N/A	N/A

NPPC Program Measure Number(s) which this project addresses.
7.6

NMFS Biological Opinion Number(s) which this project addresses.

Other planning document references.

Wy-Kan-Ush-Mi-Wa-Kish-Wit (5B-10 and Table 5B.2); Return to the River: Restoration of Salmonid Fishes in the Columbia River Ecosystem, 1996 (Northwest Power Planning Council, p. 160); Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the range of the Northern Spotted Owl, 1994 (FEMAT, Appendix B6); Snoqualmie Pass Adaptive Management Area Plan, 1997 (USFS, USFWS, 4-59); Yakima Watershed Analysis, 1997 (USFS, 5-12); 20/20 Vision for a viable future of the water resource of the Yakima River Basin, 1997 (Draft, Yakima River Watershed Council, pp. 62-64); Yakama Indian Nation (Memorandum of Understanding for coordinated management of anadromous fish habitat, signed Dec 27, 1993); Policy of Washington Department of Fish and Wildlife and Western Washington Treaty Concerning Wild Salmonids, 1997 (WDFW, habitat action strategies); Yakima Fisheries Project FEIS, 1996 (BPA, 1/7)

Subbasin.
Upper Yakima subbasin (above Roza Dam) in the mid-Columbia basin

Short description.
Restore channel conditions and enegy balance in headwater streams in the Cabin Creek Watershed by dissipating flow energy, increasing sediment storage, and stabilizing streambed and banks, benefitting downstream anadromous habitat.

Section 2. Key words

Mark	Programmatic Categories	Mark	Activities	Mark	Project Types
X	Anadromous fish		Construction	X	Watershed
+	Resident fish		O & M		Biodiversity/genetics
	Wildlife		Production		Population dynamics
	Oceans/estuaries		Research	+	Ecosystems
	Climate	+	Monitoring/eval.	+	Flow/survival
	Other	X	Resource mgmt		Fish disease
			Planning/admin.		Supplementation
			Enforcement		Wildlife habitat en-
			Acquisitions		hancement/restoration

Other keywords.
channel function and restoration

Section 3. Relationships to other Bonneville projects

Project #	Project title/description	Nature of relationship
9801005	Yakima Fisheries Project/acclimation and release facility	Improving strongholds for wild salmon reproduction and rearing

Section 4. Objectives, tasks and schedules

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Determining Channel Needs	a	Finalize areas to restore, design site specific plans
2	Restoring Channel Function	b	Implement in-channel and bank structures in phases
3	Monitoring Channel Function	c	Establish sample streambed profiles that study and evaluate sediment accumulation, scour and channel movement

Objective schedules and costs

Objective #	Start Date mm/yyyy	End Date mm/yyyy	Cost %
1	6/1999	8/2001	7.00%
2	8/1999	9/2001	59.00%
3	7/1999	9/2006	34.00%
			TOTAL 100.00%

Schedule constraints.
Project is three-phase, attacking high priority reaches in first year. After monitoring spring run-off interaction with structures, we will develop a schedule to implement phase II based on those findings. Similar scheduling will be done for phase III.

Completion date.
2006

Section 5. Budget

FY99 budget by line item

Item	Note	FY99
Personnel	3 specialists, six-person field crew, site surveys, aviation safety manager	$32,000
Fringe benefits		$ 0
Supplies, materials, non-expendable property	laser level, tripod, misc. tools	$2,000
Operations & maintenance		$ 0

Capital acquisitions or improvements (e.g. land, buildings, major equip.)		$ 0
PIT tags	# of tags:	$ 0
Travel		$2,000
Indirect costs		$ 0
Subcontracts	Helicopter services, self-loader operations, sawyer work	$50,000
Other		$ 0
TOTAL		$86,000

Outyear costs

Outyear costs	**FY2000**	**FY01**	**FY02**	**FY03**
Total budget	$60,000	$50,000	$15,000	$15,000
O&M as % of total	0.00%	0.00%	0.00%	0.00%

Section 6. Abstract

Over seventy percent of the forest structure in the Cabin Creek Watershed has been harvested in the last four decades. Subsequently, riparian canopy was removed and stream channels were cleaned of woody debris. These conditions have resulted in a network of steep gradient, high energy non-fish bearing streams with little roughness to dissipate erosive energies prior to reaching downstream fisheries habitat. Downstream effects include increased channel instability and critically low fisheries production. This project will design and implement large-scale wood structures in headwater non-fish bearing streams to provide bank and riparian stability, dissipate flow energy, create substrate deposition zones and subsequently retain downstream structure for salmon spawning and rearing habitat in the lower reaches of Cabin Creek. This will assist with the success of the Yakima Fisheries Project and spring chinook supplementation program. Log structures will be placed by helicopter to minimize human impact and sediment source delivery. Each phase will be designed based on ecological need and approachability; thus, specific site locations will be established on an annual basis. Over those three years, we will review structure effectiveness and channel response to peak flow events. Monitoring will entail profiling channel cross-sections, measuring substrate accumulation, bed scour and channel movement. In its completion in 2001, nearly eight miles of stream length will be restored. At that time, a five-year monitoring and evaluation program will be implemented to make appropriate future recommendations for potential restoration efforts in downstream reaches.

Section 7. Project description

a. Technical and/or scientific background.

Cabin Creek Watershed (16,000 acres) is a large tributary to the Yakima River above Roza Dam and Lake Easton. Cabin Creek is located upstream of the BPA funded Cle Elum Supplementation and Research Facility which has an acclimation pond two miles downstream from the mouth. The watershed is the only undammed, free flowing system of this size upstream of the facility and potentially the most available habitat of any tributary above Lake Easton for anadromous spawning and rearing.

Management of this area is complicated by checkerboard ownership. Primary owners are the USDA Forest Service and Plum Creek Timber Company. The watershed has been continuously hit hard by logging activity since 1958. Over 70 percent of the watershed has been harvested since that time with road densities exceeding 5 miles per square mile (USFS Cle Elum Ranger District 1993). Additional harvest activity entailed clearing riparian areas of larger trees and removing wood from the stream channels. Harvest, stream cleanouts and road density are the primary reasons for channel and floodplain habitat degradation.

Seasonal water temperature fluctuations are dynamic with summer temperatures exceeding water quality standards in hotter years (USFS Cle Elum Ranger District 1997). This effect is accentuated by the lack of closed canopy (only 12% of the stream length). Large woody debris numbers are well below Forest Service recommended numbers (80 pieces or more) in the main stem of Cabin Creek. Less than 17 pieces of wood (>12" in diameter, >35' in length) per mile over a 12-mile stretch were observed in a stream inventory (USFS Cle Elum Ranger District 1991).

Prior to timber-guided management, Cabin Creek provided quality anadromous and fluvial salmonid spawning, rearing and foraging habitat for upwards to five miles of stream length. Steelhead, chinook, coho and sockeye salmon as well as bull trout have been historically noted utilizing the lower reaches. Native westslope cutthroat trout dominated the upper reaches, extending into several tributaries. Currently, populations of chinook and bull trout still persist along with remnant steelhead in the Upper Yakima Watershed, but due to degraded habitat conditions, fish productivity has been depleted to a critical level. Spawning habitat has been destroyed by the high rate of bed movement, simplistic channel formation, and distribution of larger substrate into the lower reaches. In confined areas, the channel is scoured, and, in depositional areas, the bankfull continues to expand. Riparian areas have not been able to function nor recover due to accelerated peak flow energies which have eroded banks and ripped away fresh vegetation.

In order to improve these conditions, Yakama Indian Nation (YIN), U.S. Forest Service (USFS), Plum Creek Timber Company (PC) and Washington Department of Fish and Wildlife (WDFW) recognize that in-place and in-kind restoration efforts must begin in headwater tributaries (1st and 2nd order, Type 4/5 channels) of the watershed. In-channel work in 3rd and 4th order portions of the watershed by Plum Creek and the Forest Service in the early 90's were unsuccessful due to the high energy flows that flush through the

valley. By starting restoration efforts in the smaller headwater tributaries, large wood structures will be able to hold during peak flow events and create a roughness that will allow channel complexity to develop. Substrate and organic debris will distribute and hold instead of blasting down the system. In downstream areas, the dissipation of energy will allow the riparian to recover and for diverse depositional areas to develop. (Swanston 1991; Gordon et al. 1992; MacDonald and Keller 1987) Long-term recruitment of wood is likely throughout, more so as the project proceeds further down the drainage and as the riparian recovers.

The preferred form of restoration is passive restoration in which managers avoid further ground and vegetation disturbance activities and allow nature to recover on its own. (Hunter 1991; Kauffman et al. 1997) Recovery time in Cabin Creek Watershed would likely proceed below the needs of the ecosystem due to the lack of necessary riparian components and unstable channel dynamics. Although preferred in most cases, a passive restoration approach would be too slow in relation to salmon recovery. Simply, that is not acceptable. Forest management practices have been altered and a plan to obliterate logging roads will be completed and implemented over the next decade. In order to accelerate recovery of the floodplain, riparian and channel function, approximately 270 structures will be placed over nearly eight miles of channel length.

These work efforts complement the needs and recommendations of the Northwest Power Planning Council's (NPPC) Fish and Wildlife Program (see section 7.c) The Columbia River Anadromous Fish Plan of the Nez Perce, Umatilla, Warm Springs and Yakama Tribes (1997), Return to the River (1996), and the Yakima Fisheries Project (1996) are related documents to the FWP. These documents identify the technological need and scientific background for this type of work (see section 7.c)

The Cabin Creek Watershed is part of the Snoqualmie Pass Adaptive Management Area (AMA) which is mandated to "implement a scientifically credible comprehensive plan for providing late-successional forest." (USDA Forest Service et al. 1997) All research and projects developed within the AMA must be approved by a scientific panel led by the Pacific Northwest Research Station and the US Fish and Wildlife Service.

YIN and USFS are currently developing and implementing projects that are linked to all accessible waters above Lake Easton, including Cabin Creek, to improve stream and lake habitat for anadromous, fluvial and resident salmonids. This is in addition to the recent establishment of the previously discussed BPA-funded (Yakima Fisheries Project) supplementation facility for spring chinook salmon located in Cle Elum and an acclimation pond located two miles below the mouth of Cabin Creek. The Yakima River Watershed Council is also developing a long-term watershed scale plan to restore salmon and trout habitat using ecologically based means and not mechanical or artificial techniques.

Besides extensive experience throughout the Yakima Watershed, team members have had successful headwater structure projects in the Clackamas, Hood and Middle Fork

Willamette systems in Oregon and the South Fork Trinity system in California through the guidance of the Pacific Northwest Forest Plan and the Aquatic Conservation Strategy Objectives.

b. Proposal objectives.

The re-introduction of large woody material into first and second order tributaries in the Cabin Creek Watershed will:

1. Dissipate peak flow energies
2. Decrease channel scour
3. Provide bank and riparian stability
4. Create substrate deposition zones longitudinally throughout the watershed
5. Over time, stabilize and retain downstream structure
6. Minimize aggradation and frequency of channel changes in spawning reaches closer to its historic level
7. Build spawning, rearing and foraging habitat in fish-bearing areas
8. Provide refugia for aquatic species

The Cabin Creek Project will focus on ecologically-based restoration and not tackle this problem as if it can be healed through mechanical and artificial means. The project is expected to provide benefits to the FWP by "improving the quality of degraded habitat" so as to "increase the productivity" of spring chinook and bull trout by meeting habitat objectives (7.6D).

In the first three years, 270 structures will be placed over an eight-mile length of channel, nearly 13% of the 1st and 2nd order channel length in the watershed. The project and post-project monitoring data will be evaluated and interpretations will be provided by the Snoqualmie Pass AMA scientific panel as geared by the Pacific Northwest Research Station. Annual progress reports will be delivered to the NPPC, YIN, the Yakima River Watershed Council and the Regional Forest Service office. The final report and recommendation will be made available to the previously mentioned parties as well as regional land offices, large timber companies, local universities and other interested salmon restoration entities in spring 2007.

c. Rationale and significance to Regional Programs.

The placement of large wood structures in the headwater tributaries of the Cabin Creek Watershed are designed to achieve the objectives and goals of many regional restoration planning documents.

The Cabin Creek Project complements the recommendations and goals of the NPPC's Fish and Wildlife Program to "improve the productivity of salmon and steelhead habitat

critical to recovery of weak stocks." (NPPC 1994) In the last fifteen years, the average annual escapement of Upper Yakima spring chinook salmon is less than 720 adults per year. Habitat objectives as stated by the FWP include "improving stream morphology" and "retaining large woody debris in stream channels (including waters where salmon are not produced) to protect the sediment and nutrient storage and processing function of stream ecosystems supporting salmon." Other objectives met by this project include reducing embeddedness, restoring riparian vegetation, improving bank stability, and decreasing stream temperatures closer to historic levels.

This work is a desire presented by the Independent Science Group as stated in their review of the FWP in their document Return to the River (1996): "Plans for...stabilization and normalization of degraded habits are needed for every tributary in the Columbia Basin." They further qualified this by recommending that "it may be prudent to focus actions on those tributaries that have the greatest likelihood of playing a key role in salmonid recovery." The report further specified that these actions should take place in "currently functional habitats that are producing salmonids such as the Yakama."

The Columbia River Anadromous Fish Plan of the Nez Perce, Umatilla, Warm Springs and Yakama Tribes (1997) directs efforts in areas where "habitat degradation in salmon-bearing stream systems, originating in headwaters, tends to progressively reduce the production capability and eliminate the potential for supporting the historical diversity of life history forms of (salmon)." Furthermore, the plan recommends "implementing active restoration" to re-establish natural LWD levels, reduce sediment delivery, improve water temperature conditions, and improve bank stability. Work should only be performed if causes of degradation "have been adequately addressed and where ecologically appropriate." A thorough investigation by PC in 1987 followed by the USFS in 1993 and a watershed analysis in 1997 made determinations that timber and road management has directly effected the function of the watershed. Management of the watershed has shifted over the last decade. The last planned timber sale (Windy) on public land was completed in 1989 followed by a salvage sale (Shack) in 1992. Recent adoption of the watershed into the Snoqualmie Pass AMA has limited harvesting and suppressed roadbuilding. Recently, five miles of road have been obliterated or decommissioned. PC, Boise-Cascade, and the State of Washington continue to log on their parcels but with more updated forest practices and stronger protection of the riparian and channel habitats (as guided by watershed analysis and the Endangered Species Act).

The recent opening of the Cle Elum Supplementation and Research Facility emphasizes the need to improve the wild spring chinook stock productivity. The facility is guided by the Yakima Fisheries Project. (BPA 1996) The Project supports "habitat improvement" as a "valid alternative for increasing numbers of fish in the Yakima River Basin" and as a means to optimize and maintain natural production levels.

The State of Washington recently released an adopted policy to rebuild salmonid stocks. The policy includes habitat action strategies "because habitat is essential to wild salmonid protection." (WFWC 1997) The strategies are designed to "(m)aintain or increase the

quality and quantity of habitat necessary to sustain and restore salmonid populations" which include "promot(ing) sediment control measures that protect all waters, including small non-fish bearing streams especially in areas with...unstable slopes, and high mass wasting potential likely to result in sedimentation and pool filling, and to protect the integrity of downstream salmonid-bearing waters."

Guidance under the Snoqualmie Pass AMA lends toward watershed scale restoration projects which when "implemented in both fish-bearing and non-fish-bearing streams will promote faster recovery of habitat that is currently below existing standards." (USDA Forest Service et al. 1997) The AMA is supported by a regional and local document. The Pacific Northwest FEIS on Management of Habitat for Late Successional and Old-Growth Forest Related Species with the Range of the Northern Spotted Owl (FEMAT 1994) established guidelines for riparian protection and aquatic productivity. The nine Aquatic Conservation Strategy Objectives apply to this project but most specifically ask managers to "restore the physical integrity of the aquatic system" and "the sediment regime under which aquatic systems evolved." FEMAT stated that a watershed analysis must be performed before any further management activity is to take place in a watershed. Cabin Creek was studied in the Yakima Watershed Analysis (USFS Cle Elum Ranger District 1997) and recommendations were made to "improve stream channel conditions" so that they will "maintain the natural historic distribution and structure of floodplains and/or riparian vegetation for the purpose of...site productivity and floodplain function including coarse woody debris recruitment and retention."

The Yakama Indian Nation (YIN) and the Wenatchee National Forest (USFS) have a signed agreement which states that each entity is "sensitive to the responsibilities and interests of each party with respect to anadromous fisheries and associated habitat." (MOU 1993) The Cabin Creek Project complements other work taking place in the Upper Yakima sub-basin. YIN is currently planning and designing habitat improvement projects in the main stem Yakima below the mouth of Cabin Creek. They are also funded by the BPA to perform juvenile habitat surveys in the upper Yakima River around Cabin Creek in order to determine what other improvements need to be made to restore off channel rearing. YIN will cooperatively help the USFS develop design plans for the Cabin Creek Watershed Project.

Recovery of salmon in the Yakima sub-basin is a direct need as seen by the development of the Cle Elum supplementation facility, proposed actions by YIN, and as discussed by the Independent Scientific Group in Return to the River. This project has been discussed as a need by the Forest Service Regional Office during a site visit in 1990 and has been an on-going discussion point between the USFS, YIN, PC and WDFW. The Cabin Creek Project's objectives and scientific background are clearly supported by the documents stated above.

The uniqueness of this project is that the work will take place upstream of the targeted recovery area and will try to take an ecological approach of restoring the channel and riparian by slowly and methodically working from the top of the watershed down. Due to

annual budget and time constraints, the Forest Service is typically hampered by limiting restoration work and project scope to one field season. In these cases, we have in the past looked directly at an impacted area or stream segment of limited length and not considered upstream and downstream effects or benefits. In some low impact areas, this approach has succeeded, but in most cases, projects have failed. Being able to restore an area and monitor recovery in sequences over a period of a decade allows us to facilitate a project based on science and ecological need and not with an engineered band-aid. It is our hope that this project can be used as a model for other managers to restore similar areas at a watershed scale.

d. Project history

Conceptually, the Cabin Creek Watershed Project is not a new project. It has been discussed since 1990 and was recommended and proposed in 1993 by the USFS Cle Elum Ranger District after components of the watershed were analyzed. This was a transition time for the Forest Service with the release of the Pacific Northwest Forest Plan (FEMAT) which impeded any further activity in a given watershed until a formal watershed analysis was performed. Cabin Creek (located in the Yakima Watershed) did not have a completed analysis until January 1997, stalled by the development of the Snoqualmie Pass Adaptive Management Area Plan. With the watershed analysis and the AMA completed, the Forest Service can now move forward with the project. Perennial channels in the watershed have been dissected into habitat units and each unit has been rated for stability. This process has targeted and mapped restoration areas. Over the next year, NEPA will be completed to allow the agency to move forward with project implementation. Future funding through grants, partners and challenge cost share awards will allow the Forest Service and partners to establish site specific designs and begin implementation of the first restoration sequence and associated monitoring.

e. Methods.

Cabin Creek Watershed is divided into 15 subwatersheds. Each subwatershed has had perennial channels surveyed to the end of fish presence or to its source or both. This 1991 survey mapped habitat units. Through this process, each unit was rated for stability. From this information, each subwatershed was rated as currently stable, moderately stable and unstable by measuring the percentage of stream channel length that is unstable. Focus can then be placed on a specific subwatershed that is highly aggraded and unable to recover given the lack of riparian vegetation and unstable slopes. Within the subwatershed, red flag areas are also mapped. Together, the information allows the team to determine which upstream reaches need to be targeted for restoration to provide increased channel stability downstream. Target areas will be rated for priority and field verified.

A target area is likely to be a longitudinal length of stream channel in 1st or 2nd order stream with a gradient of 25-50% where past management activities have removed the wood component. In identified target areas, large pieces of woody debris no less than 20”

in diameter (length will be at least 1½ to 2 times greater than bankfull width) will be placed individually in 100 to 150' spacing to establish the lost roughness element. This spacing is modeled after reference 1st and 2nd order tributaries with equivalent channel types and gradients that are located in unmanaged sections of the Cabin Creek Watershed. The logs will **not** be cabled. The average size of wood will be 28-32 inches in diameter and 35 feet in length. Placement will vary where pieces either interact during bankfull events, five to ten-year floods, or during late summer low flows. In order to minimize impacts and to eliminate risk to various species, each piece of wood will be placed by a helicopter. An aviation safety plan will be designed by the USFS and shared with the helicopter contractor. Follow-up site review may determine that manual winching is needed to yield a better functioning structure. Large wood pieces will be collected from blowdown pockets in the Upper Yakima Watershed and moved to already established logging decks in strategic locations via self-loader and dump truck. Plum Creek will provide some of the structural materials and allow access to their logging decks as needed.

The highest priority areas will be targeted in FY99. In that first year, approximately 130 structures will be implemented over a 3.7 mile length of stream channel. The second year (FY2000) is slated for approximately 80 structures over a 2.3 mile stream length. The final installation (FY01) will add 60 structures down 1.7 miles of stream channel. The first sequence of restoration will be completed in 2001, totaling around 270 structures in 7.7 miles of stream channel.

The simple task of placing large wood structures will tackle all the stated objectives (1-8), acting as a function of the floodplain and stream channel, restoring the immediate area and over time improving downstream function. The critical assumption on public land is that current guidelines for the AMA will remain intact which would imply no foreseeable timber harvest. This assumption also includes that the Forest Service will be budgeted and complete an access and travel management plan for the Cabin Creek Watershed and begin obliterating roads. The critical assumption on private land is that current levels of harvest activities and types of forest practices will not exacerbate impacts. These assumptions imply that management activities will continue to be altered or maintained at a low level to allow the watershed to restore without further human impacts.

Although it has been discussed in previous sections, at this time we would like to expand on the justification of the project incorporating the size and scope. This discussion will encompass the three alternatives looked at by district and other agency specialists.

To review, timber harvesting has removed both the riparian forest canopy and in-channel wood. This forty-year activity has altered the present structural component within streams and the recruitment potential for large wood throughout the watershed. Due to the intensity and distribution of timber harvest units, 1st and 2nd order stream channels throughout the watershed have been degraded. Three various restoration approaches have been considered:

1. *Passive Restoration*—leave basin alone to allow recovery on its own
2. *Light Active Restoration*—restore stream channel wood in selected short stream reaches and treat actively degrading channels lower in the watershed
3. *Aggressive Active Restoration*—approach on a watershed scale by targeting high and moderate priority headwater steep (>25% gradient) stream segments throughout the watershed and working methodically from the top down

Passive restoration, although preferred in most cases, would allow stream banks to continue to unravel and the riparian structure to recover at a pace below ecosystem needs. Until the riparian recovers, there will be little if any large wood recruitment. The extensive area of hydrologically immature stands of trees in both upland and riparian areas increases the susceptibility of the watershed to rain-on-snow peak flood events. These frequent events (five to seven year interval), combined with channel susceptibility to increased scour and downstream deposition, will make natural recovery prolonged. The lower five miles of anadromous habitat will be the recipient of the slowest recovery rate of any component in the watershed. Projected recovery would not be defined in years, but in decades, or some have speculated a century. In any case, this will be much too late to assist with the recovery of salmon and bull trout.

Light active restoration would be limited in scale and scope, considering treatment only in selected stream reaches. This approach would fall short of achieving recovery objectives due to the watershed size problem. Any one tributary contributes such a relatively small percentage to the overall peak flow in the 3rd and 4th order portions of the watershed that the benefits of energy dissipation and sediment retention from treating an individual reach would be insignificant. With the hydrologic instability of the watershed, any direct treatment in lower 3rd and 4th order fish-bearing waters would be severely at risk of failure.

Aggressive active restoration is the proposed preferred alternative. This approach will restore watershed function at a watershed scale. Placement of large wood will take place across the watershed in steep headwater channels, treating over 10% of the watershed's channel length. Nearly half of all 1st and 2nd order tributaries in excess of 25% gradient will be treated. Not only is this expected to drastically shorten up the recovery period by decades, it will immediately place structural components in the floodplain and stream channel. Large wood structures will retain sediment and bedload higher in the watershed, improve and stabilize channel structure and character as well as accelerate the rate of recovery for riparian and aquatic habitat, including downstream reaches. The immediate and long-term product will counter the effects of the previously discussed frequent rain-on-snow events by allowing the floodplain and stream channel to function at a closer to normal hydrological level. This is possible because the susceptibility of channel scour and bedload movement will be reduced by the introduced wood component.

In order to analyze and evaluate the project, the target areas will be divided into channel types as defined by the Rosgen Stream Classification Method (Rosgen 1996). Each channel type will be monitored and evaluated as subsets by looking at ten percent of the

treated area. For example, if a B4 channel type has forty structures, four sample areas will be chosen for the monitoring study. There will be a pair of data sets for each sample area. Monumented cross sections (quantitative) and photo points (qualitative) will be established at a site specific structure and at a point downstream in the anticipated fish-bearing response reach.

At each monumented cross section, measurements will be made annually during late summer/low flow to determine changes in bankfull width and depth and map stream bed profile using standard transect techniques. Bankfull velocity flow changes will be monitored using a salinity profile technique as established by NCASI. In addition, over the long term, canopy closure widths will be measured at each paired data set. In the response reach data points, pool filling and scouring will be measured using scour chains and stream profiles. USFS will continue and expand on their water temperature monitoring as well as McNeil sampling for particle size distribution.

In addition, biological surveys will be performed in established transects in the lower five miles of Cabin Creek and the lower mile of Log Creek to measure changes in fish productivity (i.e. distribution, habitat utilization, species presence). These transects will be visited annually in July (resident) and September (anadromous/fluvial). We do not expect immediate results to macrobiotic production in the response reach, but by establishing and implementing the survey we can adequately measure recovery and monitor changes in productivity.

In order to insure that all contributing problems are addressed for improving project effectiveness, the hydrologic function of roads in the riparian reserves will be surveyed. Routing of sediment and water from roads into these headwater channels will be examined and recommendations for corrective actions will be documented.

Data will be collected pre and post-project until 2006 at which time the project will be re-evaluated and future data collection needs will be determined. Comparative statistical analyses may be performed on pre and post-project data using non-parametric techniques.

The re-introduction and strategic placement of large wood in the floodplain and stream channel is expected to decrease stream flow velocity, trap sediment and organic debris, causing localized aggradation of the streambed in the headwaters. The expected long-term and downstream effect of the project will be to dissipate peak flow energy and provide diverse channel morphology while allowing the riparian to recover. With this improved channel condition, fish productivity should increase. Limitations to the success of the project may relate to the Cle Elum Supplementation Facility. If the supplementation process is unsuccessful, the likelihood of anadromous utilization of Cabin Creek becomes limited. Natural conditions may also limit the success. If the water temperature profile is unable to cool to historic levels due to the inability of riparian function to recover, bull trout will not reseed the Cabin Creek system.

f. Facilities and equipment.

The restoration portion of the Cabin Creek Watershed Project will entail using contracted services which will provide the large equipment (i.e. CH47 chinook "heavy" helicopter, self-loader, excavator and dump truck). The equipment contracted will meet the specs of the desired need in order to move the large pieces of wood.

Monitoring and evaluation will entail a large portion of work in the field collecting data on stream profiles using traditional surveying equipment, scour chains, McNeil sampler, camera, and Stow-Away temperature monitors. Data analysis, mapping and report writing will use Arcview and associated Microsoft programs on IBM type PC's and laptops provided by USFS Cle Elum Ranger District.

A laser level and tripod would be purchased with this funding. As opposed to a regular transit, the laser level would save money over time by minimizing the field crew size to two people. It would also save field time by doubling the amount of ground covered.

g. References.

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Washington Fish and Wildlife Commission. 1997. Policy of Washington Department of Fish and Wildlife and Western Washington Treaty Tribes Concerning Wild Salmonids. Olympia, Washington.

Section 8. Relationships to other projects

The Cabin Creek Watershed Restoration Project will work cohesively with two other BPA-funded projects in the Upper Yakima sub-basin. The Cle Elum Supplementation and Research Facility is actively pressing forward to improve natural and wild spring chinook productivity in the Yakima and Teanaway rivers. With an acclimation facility two miles downstream from the mouth of Cabin Creek, the desire is to expand the productive levels above Lake Easton to accommodate the expected escapement and recruitment numbers of wild salmon. In order for the supplementation process to be successful, spawning and rearing habitat need to be intact, available and in optimum condition. Improvements to bedload formation and decreased sediment delivery in Cabin Creek and below the mouth will allow this spawning corridor to recover and provide, over time, six additional miles of spawning and rearing habitat. In conjunction with the supplementation work, the Yakama Indian Nation is currently planning to survey for juvenile distribution in the Yakima River between Lake Easton and Keechelus Lake, which includes influence from Cabin Creek. The study will allow YIN, Bureau of Reclamation and the USFS to make appropriate decisions to improve, restore or create sections of off-channel rearing habitat.

The Yakima River Watershed Council, which consists of public agencies, timber companies, irrigation districts as well as individual farmers and landowners, is developing a comprehensive plan to actively and passively restore the Yakima Watershed as a whole. The Cabin Creek Project is an active part of that plan.

With Cabin Creek falling within the boundaries of the Snoqualmie Pass Adaptive Management Area, the desire of the overseeing scientific panel through the guidance of the AMA plan is to develop long-term studies and recovery projects so as to monitor the successes and failures of restoration and best management practices. The Cabin Creek Project is desirable because of the methodical and long-term approach to recovery.

Currently, plans are underway to cross the Cascade crest with a fuel pipeline from the Puget Sound to the Tri-Cities, which would cross Cabin Creek. In the analysis, the weakest points to the success of the pipeline is the potential for failure at the Cabin Creek crossing. Current conditions of the watershed produce destructive debris and bedload torrents that are magnified in the response reach near the mouth. The proposed crossing would likely be scoured, exposing the pipeline to the pounding forces of large debris. It is possible that this section could be an annual spill disaster site unless measures are taken to improve watershed conditions. In time, the Cabin Creek Project would dissipate these energies and limit bedload movement and scouring. Once the project is approved, the USFS will move forward to acquire the Pipeline Company as a cost-share partner on the Cabin Creek Project.

This project is a piece of a larger scope and on-going effort of the USFS Cle Elum Ranger District to develop connected corridors for salmon and bull trout to assist with the recovery of species in their current and historic habitats.

Section 9. Key personnel

- **Bill Ehinger**, Project Manager and Designer, USFS District Hydrologist
  Bill's familiarity with the Cabin Creek Watershed and his expertise with floodplain and watershed hydrologic function are complementary to his task as the Project Manager and Designer. Bill will function as the lead scientist with assistance from key personnel as well as the Science Panel from the Snoqualmie Pass AMA. His duties will include championing project design, monitoring data collection and analysis.
- **Sean Ferrell**, Project Coordinator and Field Advisor, USFS Fisheries Biologist
  Sean's vast field experience and established communication skills will complement his given tasks. Sean will be the project field assistant and will coordinate all related project duties as specified by the Project Manager. He will also be lead writer and editor for documents associated with the project, including progress reports, grants, contract and budget reports.
- **Tina Mayo**, Consulting Specialist, USFS District Fisheries Program Leader
  Tina's elaborate restoration experience and familiarity with the Cabin Creek Watershed will be utilized during project design and evaluation. Tina will also assist with field data collection and provide input on anadromous and resident salmonid functioning needs for rearing, spawning and foraging.

Bill Ehinger
District Hydrologist
Wenatchee National Forest
Cle Elum Ranger District

CAREER SUMMARY

Performed watershed-scale assessments to develop restoration programs across two states; provided advice and guidance to program managers and team leaders to perform best management practices; and developed monitoring tools that characterize the given conditions of the landscape which initiated new programs of work that restore ecological processes

CURRENT RESPONSIBILITIES

- Interdisciplinary team member for watershed-related resources (i.e. hydrology, water quality and soils)
- Interagency Team member for Snoqualmie Pass Adaptive Management Area and Plum Creek road access EIS
- Providing expertise on hydrologic function for district program of work
- Watershed restoration design and implementation
- Conduct watershed analysis for evaluating ecological processes associated with soil and water
- Team leader for watershed restoration projects
- Collection and analysis of hydrology data in relation to monitoring

PROFESSIONAL EXPERIENCE

District Hydrologist 1990 - 1998
Wenatchee National Forest, Cle Elum Ranger District
Wenatchee National Forest, Naches Ranger District

Watershed Specialist Contractor 1990
Montana Water Quality Bureau/Bureau of Land Management, Missoula, Montana

Forest Practice Research Assistant 1988 - 1990
University of Montana, Missoula, Montana

Forest Practice Assessment Coordinator 1988
Montana Environmental Quality Council, Helena, Montana

RELATED ACCOMPLISHMENTS

- Crow Creek Stream Channel Rehabilitation Project entailed increasing large wood component to dissipate energy for fisheries habitat (15 structures)
- Multiple riparian and wet meadow restoration and revegetation projects (regional *Caring for the Land* award)
- Stream channel stability assessments on watershed scale in Yakima and Blackfoot systems
- Extensive road obliteration design and implementation in riparian reserves and at stream crossings (20+ miles)
- Union Creek Stream Channel and Hydrologic Assessment for the State of Montana

EDUCATION

National Hydrology Workshop, Pagosa Springs, Colorado May 1992
Rosgen's stream classification, fluvial geomorphology, sediment modeling, riparian ecosystems and wetlands

M.S., University of Montana, Missoula, Montana May 1990
Major: Forestry. Concentration: Forest Hydrology and Soils

B.G.S., University of Kansas, Lawrence, Kansas May 1979
Major: Communication. Concentration: Business Management

Sean A. Ferrell
Fisheries Biologist
Wenatchee National Forest
Cle Elum Ranger District

CAREER SUMMARY

Coordinated interagency and partnership restoration efforts to re-establish salmon and native trout species, authored project grants (awarded in excess of 2 million dollars) and implemented successful recovery projects for bull trout (pending, on-going), redband trout as well as chum, sockeye and coho salmon

CURRENT RESPONSIBILITIES

- Lead writer/editor and coordinator for projects, grants, reports and interpretive program
- Supervisor for field data collection
- Interdisciplinary Team member for timber sales and watershed analysis
- Interagency Team member for Snoqualmie Pass Ski Area Master Plan and Olympic Pipeline Project
- Program building which includes watershed restoration and species recovery
- Forest coordinator for *Respect the River* education campaign

PROFESSIONAL EXPERIENCE

Fisheries Biologist 1993 - 1998
Wenatchee National Forest, Cle Elum Ranger District
Willamette National Forest, Rigdon Ranger District
Okanogan National Forest, Winthrop Ranger District

Experimental Fisheries Biologist 1992 - 1993
Oregon Department of Fish and Wildlife, Central Point, Oregon

Biological Technician 1989 - 1992
Colville National Forest, Kettle Falls Ranger District
San Juan National Forest, Supervisor's Office
Tongass National Forest, Misty Fiords National Monument

RELATED ACCOMPLISHMENTS

- Middle Fork Willamette Headwater Restoration Project (60 structures)
- Bull Trout re-introduction study which led to *Homes for Lost Natives*, an in-stream restoration program
- Seasonal habitat utilization study on various salmonid age classes in relation to natural and artificial structures
- Created, designed and implemented award-winning Chewuch River Riparian Restoration Project
- Proposed and established financing for a five-year watershed study in Elk Creek (Oregon) to determine adult and juvenile salmon survival

EDUCATION

B.S., Fort Lewis College, Durango, Colorado May 1992
Major: Forest Biology. Concentration: Forest Resource Management
Minor: Botany and written/oral communications

Tina Mayo
Fisheries Program Manager
Wenatchee National Forest
Cle Elum Ranger District

CAREER SUMMARY

As fisheries program manager, I have built young programs in two Regions, developing strong databases, implementing watershed restoration programs and altering management practices to allow areas to recover while creating projects that have improved water quality, fish habitat, riparian structure, and overall watershed productivity

CURRENT RESPONSIBILITIES

- Interdisciplinary Team member on most district management activities
- NEPA document writer and consultant
- Watershed restoration program designer
- Interagency Team member for Snoqualmie Pass Adaptive Management Area and Plum Creek road access EIS
- Supervise, build and implement fisheries program
- Manage six major anadromous watersheds in the mid-Columbia Basin and Yakima sub-basin

PROFESSIONAL EXPERIENCE

Fisheries Program Manager 1990 - 1998
Wenatchee National Forest, Cle Elum Ranger District
Shasta-Trinity National Forest, Hayfork Ranger District

Fisheries Biologist 1989 - 1990
Mount Hood National Forest, Hood River Ranger District

Forestry Technician 1988 - 1989
Mount Hood National Forest, Estacada Ranger District

Writer and Database Development 1987 - 1988
California Department of Fish and Game, Sacramento, California

Fisheries Technician 1987
California Department of Fish and Game, Sacramento, California

RELATED ACCOMPLISHMENTS

- Habitat and off-channel structure placement for coho and steelhead in the Clackamas Watershed (200+ structures)
- Habitat structure placement for steelhead in the West Hood Watershed (20 structures)
- Habitat and channel stabilization structure placement in the South Trinity Watershed (200+ structures)
- Intermittent and ephemeral channel stabilization in Rock and China Fire recovery areas (100 structures)
- Multiple riparian revegetation and restoration projects (Regional *Caring for the Land* Award) altering use patterns and planting with native vegetation (South Fork Trinity, Upper Yakima watersheds)

EDUCATION

National Hydrology Workshop, Bend, Oregon June 1993
Rosgen's stream classification, fluvial geomorphology, sediment modeling, riparian ecosystems and wetlands

B.S., California State University, Sacramento, California January 1988
Major: Biological Conservation. Concentration: Fish and Wildlife Biology and Management

Section 10. Information/technology transfer

The hope of the project writer and editor is to create annual documents and a final report that will show the progressive nature of assisted recovery in the Cabin Creek Watershed. A highlight of the document will be the established photo points that will be used as a visual and physical tool to represent rate of recovery. The document will note successes and failures and try to provide a guide for future watershed restoration planners. It will **not** promote that this project can be successful in all basins and will state that this project is unique due to the impeded natural recovery rate.

Annual progress reports will be provided to the NPPC as well as to the Yakama Indian Nation, the Yakima River Watershed Council and the Regional Forest Service office. The final report and recommendation will be made available to the previously mentioned parties as well as regional land offices, large timber companies, local universities and other interested salmon restoration entities in spring 2007. The Pacific Northwest Research Station will provide backing to support publication of this document as a learning tool.

Through the assistance of the USFS Public Affairs Office, we will promote this project to the local and regional public through the newspaper and television media. The hopeful package is that we could incorporate the work of the Cle Elum Research and Supplementation Facility as well as restoration efforts by the Yakama Indian Nation.