A BIOLOGICAL AND PHYSICAL INVENTORY OF THE STREAMS WITHIN THE NEZ PERCE RESERVATION

SYNOPSIS OF THREE YEARS OF STREAM INVENTORY ON THE NEZ PERCE RESERVATION

FINAL REPORT

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ABSTRACT

This report provides a synopsis for three years of inventory work on the streamsin the Lower Clearwater Basin, Idaho. The main emphasis of the study was to document which streams presently support anadromous salmonids, the extent of production in those streams and the identifination of those streams which may best respond to enhancement restoration activities. Rainbow-Steelhead trout (Salmo gairdneri) were the most abundant anadromous salmonid found. Chinook salmon (Oncorhynchus tshawytscha) were found rarely except in the Lolo Creek Drainage. The main environmental problem affecting these streams was the extreme flow variations which commonly occur. This is due primarily to poor land management practices. Enhancementrecommendations are suggested for these streams which include passage around barriers, barrier' removal, riparian enhancement, instream habitat improvement, and better land use practices.

INTRODUCTION

Historically, many of the tributaries of the lower Clearwater River sup-ported substantial populations of anadromous salmonids, primarily steelhead rainbow trout (Salmo gairdneri) and, to a lesser extent, chinook salmon (Oncorhynchus tshawytscha). Presently, anadromous salmonid populations are well below historical levels. This decline is primarily attributed to hydroelectric power development which has inundated large areas of habitat and has increased the difficulty of both upstream adult migration and downstream smolt migration. In addition, timber harvesting, cattle grazing, and intensive agriculture have had direct impacts on most of the lower Clearwater River tributaries, reducing the amount of habitat available to anadromous salmonid populations for spawning and rearing.

Most of the tributaries in the lower Clearwater River, below Kooskia, Idaho, flow at least in part through the Nez Perce Indian Reservation (Figure 1). Historically, fishing was important to the Nez Perce Tribe for subsistence and salmon and Steelhead play an integral role in tribal cultural/religious heritage. Therefore, the Nez Perce Tribe is concerned with the continuing decline of anadromus salmonids within their reservation and have identified the need for remedial action. Data on the present condition of these populations and the habitat on which they depend are very limited. In order to recover these populations to a more acceptable numeric level, data needed to be accumulated which would characterize the present disposition of anadromous salmonid populations and their habitat in the lower Clearwater River tributaries.

The Tribe received funding in 1982 from the Bonneville Power Administration (BPA) to survey the streams within the reservation in order to establish the enhancement, management, or restoration of anadromous salmonids in the lower Clearwater drainage. The 1982 inventory surveyed only those stream reaches which flowed within the reservation boundaries. In 1983, the inventory was continued to include the stream reaches outside the reservation boundaries. The 1984 inventory focused on the total drainages of three of the largest, but little-studied tributaries of the lower Clearwater River; Potlatch River, Orofino Creek, and Clear Creek. This report summarizes the three year stream inventory effort into a single concise report to enhance the availability and usefulness of the data. Supporting physical and biological information are contained in three separate BPA reports, Kucera et al. (1983), Fuller et al. (1984) and Johnson (1985).

The objective of the biological and physical inventory was to collect the biological and hydrological information needed to assess the stream and habitat conditions such that recommendations for enhancement of the anadromous fish resources can be made. This was accomplished by: 1) utilizing fish collection or observation techniques to identify major fish species present and to estimate existing densities and standing crops of anadromous salmonids; 2) quantifying existing habitat parameters associated with representative reaches of the inventory streams; 3) identifying hydrological or physical limitations to production of anadromous salmonids; and 4) recommending specific enhancement measures which would result in either creating additional anadromous salmonid habitat or protecting the existing habitat.

Although specific enhancement measures are provided it was beyond the scope of this tudy, as defined by study objectives, to present specific estimates of increased smolt yield expected per enhancement measure. All of the streams inventoried over the three year study period were prioritized and those with the best enhancement potential are identified in the Enhancement Activities section.

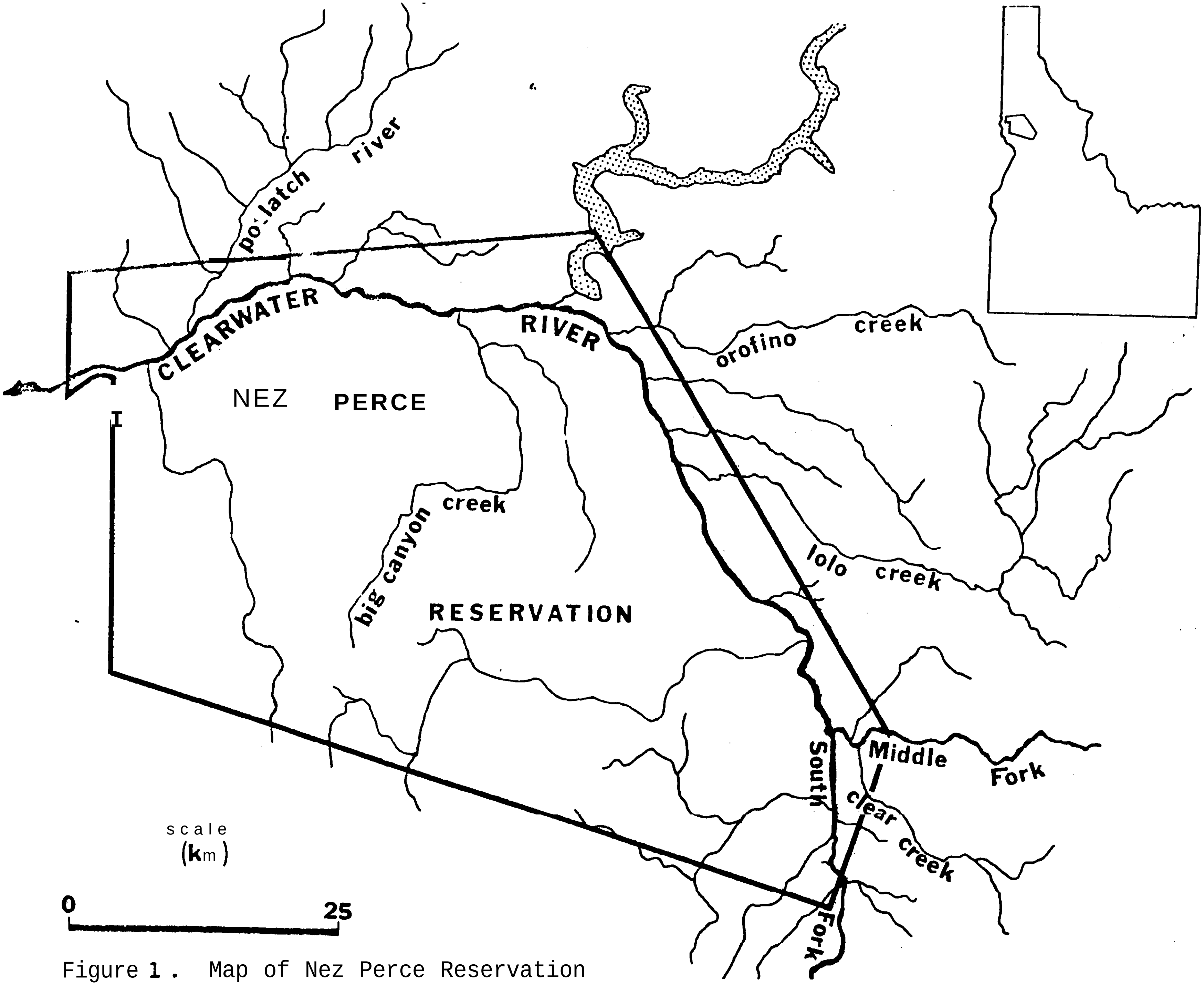

Figure 1. Map of Nez Perce Reservation

S Y N O P S I S

This chapter is a synopsis of three years of inventory work in the Lower Clearwater Basin. As the major objectives were to identify the extent of anadromous fish production and enhancement potential, this chapter will be divided likewise.

Anadromous Fish Production

Rainbow-Steelhead trout were found in most streams surveyed during the three year period. Those streams not identified with production (Cottonwood Creek S.F. Tributary) had water quality problems.

The five highest densities of overyearling rainbow-Steelhead were found in Little Canyon, Cottonwood, Big Canyon, Middle Fork Potlatch, Little Boulder, Big Canyon, and Jacks Creeks. The five highest densities of Subyearling rainbow-Steelhead were found in Tom Taha, Six Mile, Bedrock, Pine and Big Canyon Creeks. Chinook salmon were found in great numbers only in Lolo Creek. (Juveniles were found occasionally at stream mouths throughout the Lower Clearwater Basin).

ENHANCEMENT ACTIVITIES

The major problem in all the lower Clear-water River Basin watersheds is the extreme annual variation in streamflow. All the watersheds investigated were characterized by excessively high flows of short duration during spring runoff and intensive precipitation periods and by very low stream flows during the dry summer and fall periods. Excessively high flows over short time periods have caused flooding and high rates of channel re-structuring to accomodate large volumes of high velocity runoff. Rates of scouring and deposition are relatively high and stream banks are relatively unstable.

The major component of stream flow which is related to stream degradation is energy. A given amount of precipitation in a watershed provides a given amount of potential stream flow energy available in the watershed. The rate at which this energy is released from the watershed is directly related to the condition of that watershed. A pristine watershed releases its stream flow energy in a more or less uniform manner over time. This enables a small stream with flow obstructions to convey this water from the watershed without excessive scouring. As a watersheds capability to reservoir precipitation is decreased, stream flow energy is released over a shorter time period. To accomodate these higher short term releases, stream channels must enlarge to reach a hydraulic equilibrium. This results in the common condition where low flows only partially utilize available stream channel area and physical habitat for fish (i.e., depth, cover, etc.) is absent.

As is evident, the management of the watershed's capability to retain water is of critical importance to the condition of its associated streams. Short of managing the watershed for water retention, several "band aid" enhancement activities designed to withstand present watershed conditions can help improve stream habitat.

To address the lack of physical habitat for anadromous salmonids, instream structures designedto withstand present stream energy regimes can improve this habitat for anadromous salmonids in the lower Clearwater Basin. These structures, properly designed, could also increase the duration of streamflow releases, thereby reducing the peak stream energy potential.

Another effect of high energy release,. in addition to the condition of the structural instream habitat, is the addition of sediment to the stream channel. This sediment introduction can be reduced by either stabilizing the sediment sources (i.e., streambanks, etc.) with riparian vegetation or physical means by trapping the sediment with basins upstream from the zone to be enhanced.

In order to plan for the future enhancement of the lower Clearwater River Basin, criteria for prioritization of streams are necessary so that the relative enhancement potential of such streams is rated. The following criteria are very general and are meant only to identify the four streams with the most enhancement potential from all streams surveyed.

The most critical parameter affecting fish production is the amount of waterflow within a stream. The amount of flow dictates the extent of enhancement of the habitat. The second most critical parameter is the quality of the water, including temperature, nutrients, and Pollutants. The third parameter, in order of importance to fish production, is the rate of sediment input into the stream. The fourth factor, and by far the easiest to enhance, is the physical habitat (depth, width, velocity, cover, etc.). These parameters are also in order of their complexity and cost in relation to attempts to alter their present condition.

Following this line of reasoning SIX streams were identified from the qroup surveyed durinq 1982-1984 as havinq the best potential for enhancement of anadromous fish production.

1) Orofino Creek System
2) Lolo Creek System
3) Clear Creek System
4) Big Canyon Creek System
5) Lapwai Creek System
6) Small mainstem Clearwater Tributaries
7) Potlatch Creek

These streams had the larqest watersheds and the hiqhest annual flows with qood quality water in the lower basin. Both streams exhibited problems with sedimentation and habitat availability to varying extents.

Two additional criteria are necessary to finalize the prioritization process. These are not physical but policy criteria. The first consideration is the importance of the species to be enhanced. The second consideration is the excediency of an enhancement project (i.e., a project would be easier if done on land controlled by the initiator of the project). Federal, State, or Tribally controlled land would be easier to access than privately owned land.

The following is a prioritized list of enhancement zones in the lower Clearwater Basin:

1) Orofino Creek

During the period of this study the Orofino Creek System was submitted to the Northwest Power Planning Council for inclusion in the Fish and Wildlife Program. This project to provide passage over a falls to provide access to the upper stream has been designated as a new start for Bonneville Power Administration Funding in 1985. The Tribe is proceeding with planning of this project.

2) Lolo Creek

This stream is also included in the Fish and Wildlife Program and work to enhance stream habitat and passage is ongoing by the Clearwater National Forest. In addition to these activities we recommend that the pond on Musselshell Creek be converted to a rearing pond for spring chinook salmon. This will provide increased production in the Lolo Basin and provide adult capture facilities so that when the facility is full, additional adults can be captured and redistributed elsewhere in the Lolo Basin or trucked to a hatchery facility. This pond provides an important component of spring chinook production for the entire Clear-water Drainage. This work is entirely on USFS land which reduces access problems.

3) Clear Creek

The Clear Creek System is the major water source for the U.S. Fish and Wildlife Service spring chinook hatchery at Kooskia, Idaho. The primary problems found in this drainage were temperature related. The lower portion of this creek has been denuded of riparian vegetation which historically shaded the stream from solar heat input. In addition, the vegetation stabilized the streambanks and reduced sediment input. This stream is in the Fish and Wildlife Program though water temperature problems and riparian vegetation rehabilitation are incorrectly left out. As this is a critical water source to a hatchery this lower section of Clear Creek should be a high priority.

4) Big Canyon Creek

Big Canyon Creek is one of the top Steelhead producing streams on the reservation. The major problem is that flow in the upper reaches goes subsurface during the summer months. The Bureau of Land Management has proposed to improve flow from several springs on Bureau land. The primary activities needed for restoration are those related to raising the water table in the canyon, (i.e., Sub gravel dams, revegetation channel structuring, flow addition). The restoration of this system is a high priority due to its present status as a key Steelhead site and the high enhancement potential.

5) Mainstem Tributaries

The small mainstem tributaries are important as a group in terms of wild Steelhead production. The primary problem found in these streams is poor land use practice. The problem faced in any enhancement effort on these streams will be the multi private ownership. The Tribe is involved in a multi-agency effort to encourage landowner involvement in better land use methods. This program, coordinated through the U.S. Soil Conservation Service, will enlist landowners to protect riparian and aquatic habitats in these basins. As cooperation in this program increases the ability to enhance and protect these habitats will also improve. Top priority small streams already in this program are Bedrock and Pine Creeks as the landowners have already voiced intent for cooperation toward stream enhancement.

The following chapter includes identification athe problems and recommended solutions. They should provide a general outline from which specific enhancement projects can be developed (Table 1).

Table 1 Anadromous fish habitat improvement and passage restoration needs.

STREAMS	SPECIES	REARING HABITAT	ADULT HOLDING HABITAT	SPAWNING HABITAT	LOW FLOWS	WATER TEMP.	SEDIMENT./POLLUTION	MINING/DREDGING	ADULT/JUVENILE PASS.	RIPARIAN DEGRAD.	LOGGING ACT.	CHANNEL DEGRAD/BANK INSTAB.	GRAVEL DEGRAD.	ROAD CONSTRUCT.	FIRE DAMAGE	IRRIGATION DIVERS.	HAB STUDY	ENVIRON. ASSESS. RPT.	FEASIBILITY STUDY	PROJECT. FENCING	IMPRV. IRRIGATN EFF.	FISH SCREENS	IMPRV. FLOWS	CONTROL WATER TEMP.	RIPARIAN REVEGETATION	BANK STAB.	CHANNEL REHAB.	STORAGE DAM & RESERV.	PROVIDE PASSAGE	CONSTRUCT ADULT COLLECT.	IMPRV. REAR. HAB/CONST. POOLS	GRAVEL RESTORATION	HAB STUDY	OFF CHANNEL DVLOPMT	RESERV. REAR.
		HABITAT/PASSAGE PROBLEMS																ENHANCEMENT PROJECTS																	
CLEAR	CH ST	X			X		X		X											X			X	X	X	X	X	X	X		X				
PIG CEDAR	ST	X			X		X				X	X								X			X	X	X			X							
HOODOO	ST				X		X		X		A		X																						
M. FORK CLEAR.	ST	X			X				Y.																X			XX			X				
W. FORK CLEAR.	ST				X		X		X			X																							
S. FORK CLEAR.	ST	X					X																		X						X				
PINE KNOB	ST	X			X		X																X		X			X			X				
LOLO	CH ST			X			X	X	X		X			X											X	X	X	X			X	X			
YAKUS	CH ST	X					X					X	X	X											X	X	X				X				
MUSSELSHELL	CH ST						X		X	X	X		X										X	X		X		X			X	X			
ELDORADO	CH ST						X		X																			X				X			

Table 1 Continued:

		HABITAT/PASSAGE PROBLEMS																ENHANCEMENT PROJECTS																	
STREAMS	SPECIES	REARING HABITAT	ADULT HOLDING HABITAT	SPAWNING HABITAT	LOW FLOWS	WATER TEMP.	SEDIMENT./POLLUTION	MINING/DREDGING	ADULT/JUVENILE PASS.	RIPARIAN DEGRAD.	LOGGING ACT.	CHANNEL DEGRAD/BANK INSTAB.	GRAVEL DEGRAD.	ROAD CONSTRUCT.	FIRE DAMAGE	IRRIGATION DIVERS.	HAB STUDY	ENVIRON. ASSESS. RPT.	FEASIBILITY STUDY	PROJECT. FENCING	IMPRV. IRRIGATN EFF.	FISH SCREENS	IMPRV. FLOWS	CONTROL WATER TEMP.	RIPARIAN REVEGETATION	BANK STAB.	CHANNEL REHAB.	STORAGE DAM & RESERV.	PROVIDE PASSAGE	CONSTRUCT ADULT COLLECT.	IMPRV. REAR. HAB/CONST. POOLS	GRAVEL RESTORATION	HAB STUDY	OFF CHANNEL DVLOPMT	RESERV. REAR.
YOOSA	ST																																		
BROWNS	CH ST						X				X	X	X	X											X	X	X					X			
OROFINO	CH ST								X																				X						
COW		X			X		X			X	X				X					X				X	X		X		X		X				
POORMAN		X			X		X																				X	X	X		X				
QUARTZ							X				X														X										
WHISKEY	ST CH										X				X										X										
TRAIL	ST	X			X							X													X	X		X			X				
LITTLE BEAVER	ST	X			X																						X		X		X				
CANAL GULCH	ST	X			X		X																												
RHOADES	ST	X																													X				
SHANGHAI	ST				X		X																X		X			X							
POTLATCH	ST																																		
LITTLE POTLATCH	ST	X			X	X	X			X																	X								
MIDDLE POTLATCH	ST				X	X	X		X	X														X	X			X	X		X				
BIG BEAR	ST				X	X	X		X	X														X	X				X	X	X				

Table 1 Continued:

		HABITAT/PASSAGE PROBLEM																ENHANCEMENT PROJECTS																	
STREAM	SPECIES	REARING HABITAT	ADULT HOLDING HABITAT	SPAWNING HABITAT	LOW FLOWS	WATER TEMP.	SEDIMENT./POLLUTION	MINING/DREDGING	ADULT/JUVENILE PASS.	RIPARIAN DEGRAD.	LOGGING ACT.	CHANNEL DEGRAD/BANK INSTAB.	GRAVEL DEGRAD.	ROAD CONSTRUCT.	FIRE DAMAGE	IRRIGATION DIVERS.	HAB STUDY	ENVIRON. ASSESS. RPT.	FEASIBILITY STUDY	PROJECT. FENCING	IMPRV. IRRIGATN EFF.	FISH SCREENS	IMPRV. FLOWS	CONTROL WATER TEMP.	RIPARIAN REVEGETATION	BANK STAB.	CHANNEL REHAB.	STORAGE DAM & RESERV.	PROVIDE PASSAGE	CONSTRUCT ADULT COLLECT.	IMPRV. REAR. HAB/CONST. POOLS	GRAVEL RESTORATION	HAB STUDY	OFF CHANNEL DVLOPMT	RESERV. REAR.
POTLATCH CONT.																																			
CEDAR	ST					X	X																	X				X							
LITTLE BOULDER	ST	X			X		X																												
E. FORK POTLATCH	ST				X		X			X											X				X										
PURDUE	ST				X		X					X																							
W. FORK POTLATCH	ST				X		X					X																							
BIG CANYON	ST CH				X	X													X				X	X	X	X			X		X				
LITTLE CANYON	ST				X	X																									X				
LAPWAI	CH ST	X			X	X	X													X			X	X	X	X			X		X				
SWEETWATER	ST	X			X	X										X				X			X	X	X	X		X			X				
WEBB	ST	X			X	X	X									X				X			X	X	X	X		X			X				
MISSION	ST	X				X						X								X			X	X	X	X		X			X				
COTTONWOOD I	ST	X			X	X	X													X			X	X	X	X		X			X				
BEDROCK	ST	X			X		X			X		X												X	X	X	X	X			X				
COTTONWOOD II	—	X			X	X	X			X													X	X	X	X	X	X			X				
JIM FORD	ST	X			X	X						X													X	X	X				X				

Table 1 Continued:

HABITAT/PASSAGE PROBLEMS

STREAMS	SPECIES	REARING HABITAT	ADULT HOLDING HABITAT	SPAWNING HABITAT	LOW FLOWS	WATER TEMP.	SEDIMENT./POLLUTION	MINING/DREDGING	ADULT/JUVENILE PASS.	RIPARIAN DEGRAD.	LOGGING ACT.	CHANNEL DEGRAD/BANK INSTAB.	GRAVEL DEGRAD.	ROAD CONSTRUCT.	FIRE DAMAGE	IRRIGATION DIVERS.	HAB STUDY
LAWYERS	RE					X	X			X		X					
WILLOW	RB	X				X	X										
BIG	ST				X					X							
BUTCHER	ST	X			X	X				X			X				
CATHOLIC	ST	X			X	X				X		X					
PINE	ST	X															
SALLY ANN	ST				X		X										
WALL	ST CT	X					X										
THREE MILE	ST	X			X	X	X			X							
SIXMILE	ST	X			X	X	X										
SEVENMILE	ST	X			X	X	X										
TOM TAHA	ST	X			X		X					X					
CORRAL	ST	X															
RABBIT	ST				X												
MAGGIE	ST	X			X	X	X				X	X					
JACKS		X			X	X	X										

ENHANCEMENT PROJECTS

STREAMS	SPECIES	ENVIRON. ASSESS. RPT.	FEASIBILITY STUDY	PROJECT. FENCING	IMPRV. IRRIGATN EFF.	FISH SCREENS	IMPRV. FLOWS	CONTROL WATER TEMP.	RIPARIAN REVEGETATION	BANK STAB.	CHANNEL REHAB.	STORAGE DAM & RESERV.	PROVIDE PASSAGE	CONSTRUCT ADULT COLLECT.	IMPRV. REAR. HAB/CONSTRUCT POOLS	GRAVEL RESTORATION	HAB STUDY	OFF CHANNEL DVLOPMT	RESERV. REAR.
LAWYERS	RE			X			X	X	X	X	X	X			X				
WILLOW	RB			X			X	X	X	X		X			X				
BIG	ST								X		X								
BUTCHER	ST							X	X	X	X								
CATHOLIC	ST							X	X	X	X								
PINE	ST							X	X	X					X				
SALLY ANN	ST						X		X		X								
WALL	ST CT						X		X						X				
THREE MILE	ST							X	X	X	X				X				
SIXMILE	ST			X			X	X	X	X	X				X				
SEVENMILE	ST			X			X	X	X	X	X								
TOM TAHA	ST			X	X				X	X	X				X				
CORRAL	ST														X				
RABBIT	ST																		
MAGGIE	ST						X	X	X		X				X				
JACKS							X	X		X	X				X				

MATERIALS AND METHODS

SITE SELECTION

The major drainages were surveyed by automobile, railroad car, and aerially, at the beginning of the study season. The topographical character of each drainage and major barriers or limits within the habitat were identified. Later, most of the barriers were examined from the streambed. Tributary streams or stream reaches were walked when possible but this inventory contained some 2205 km of streams, which made this method, for the most part, prohibitive. Stream sample stations were selected as being representative of habitat types (e.g., high meadow or lowland), particular stream reaches (by distance from the mouth), or individual tributary streams. Access into the drainages determined which areas could be sampled. Each sample station consisted of a 40 to 100 m section from which fish population and physical parameter information was collected.

FISH POPULATIONS

Fish population estimates were made by two methods, electrofishing and snorkeling. Where flow and depth were suitable, electrofishing techniques were utilized. Electrofishing equipment consisted of a @orator portable generator, with a single electrode set at 230 volts direct current. The sample section was blocked off with block nets and the fish were shocked and captured from downstream to upstream. A removal method (Zippen, 1958; Seber and LeCren, 1967) was used to determine fish densities, which required at least a 60% reduction in the target species between consecutive passes. Between passes, the fish were stored in large plastic garbage cans, individually weighed to the nearest gram, and measured (total length and fork length) to the nearest millimeter. After sampling was completed, the fish were returned to the stream. A list of fish species sampled in the lower Clearwater is presented in Table 2.

Snorkeling methods (Platts, 1983) were utilized where extreme depth or stream flow prevented the effective use of electrofishing equipment. The station length was snorkeled, at least twice, from downstream to upstream. Fish were counted and identified and conservative estimates of population numbers were made. Salmonids were recorded as being overyearlinq (>90 mm) or subyearlings (<90 mm) . Biomass estimates were based on electrofishing samples either in the sample area or nearby.

PHYSICAL ATTRIBUTES

Twelve physical parameters were measured at each sample station. These parameters were determined by Binns and Eiserman (1979) and the U.S. Forest Service Ocular Method to be those which have the greatest effect, singularly or synergistically, on salmonid production. Fuller et al. (1984) explained the relative importance of each physical parameter to salmonid production, hence, they will only be described here.

1. Late summer stream flow:
   Representative of late or low summer stream flow estimated by the formula:
   Flow (m3/sec) = velocity (m/set) x width (m) x depth (m)

2. Annual stream flow variation:
   A subjective estimate of variation in flow determined by evidence of scouring, past flood marks, and bed load deposition (Binns and Eiserman, 1979).

3. Summer water temperature:
   Water temperature (C) recorded during late summer flow. Maximum temperatures were taken at the lower mainstem reach of each of the principal tributary streams during the initial, 1982 inventory.

4. Water velocity:

Measured by determining sample station thalweg length and the amount of time necessary for a small quantity of dye to pass through this length in cm/set.

5. Stream width:

Measured distance (m) across the wetted perimeter of the sample station channel at 10 m intervals.

5. Stream depth:

Measured stream depth (cm) at10 equal intervals on the stream width transect.

7. Instream cover:

Measured surface area (m2) of instream cover components within the sample section and recorded as percent of total sample section area. Instream cover consisted of: overhanging vegetation, submerged rocks and debris, depth, surface turbulence, and undercut banks.

8. Eroding bank:

Measured length of eroding bank (m) and recorded as percent of total sample station banks.

9. Cobble embeddedness:
Estimated by gasket effect and amount of substrate surface area covered by fine sediment (Table 3); recorded as percent gasket of total sample stream area.

10. Major substrate type:
Highest percent of a substrate size as classified by a modified Wentworth scale (Table 3).

11. Pool/riffle ratio:
Measured length of pool and riffle areas in each sample station recorded as a ratio.

12. Periphyton coverage:
Eetimated substrate surface area covered by algae and recorded as percent of total sample station area.

In addition to these measurements, pool stability was noted, and a general description of the riparian habitat and the amount of stream area shaded by the riparian habitat were included.

The physical habitat measurements were compared with generally accepted indices of habitat quality for salmonids. Summer water temperatures, water velocity, depth, and major substrate types were compared with the probability-of-use curves developed by Bovee (1978) for juvenile rainbow-Steelhead. The curves represent an optimum from a wide range of juvenile rainbow-Steelhead habitats and may not reflect the optimum juvenile Steelhead habitat in any particular stream system (Figure 2). However, these curves are currently employed by the Idaho Department of Fish and Game and, in order to keep habitat evaluation techniques comparable, were also used here. The results in this report will describe optimum conditions as those being greater than 0.8 and the suboptimum condition or range being less than 0.8 on the juvenile Steelhead probability-of-use curves. The effects of cobble embeddedness or sediment content on salmonid habitat was described by Bjornn et al. (1977) and their results will be used in assessing substrate conditions of the streams inventoried during the present sample season. A gasket effect of 25% or greater will indicate that 'Steelhead habitat is being reduced. Pool/riffle ratio of 40:60 to 60:40 is generally considered to provide suitable holding area and habitat diversity for both juvenile salmonids and benthic invertebrates, which are utilized as prey items by the salmonids. Periphyton abundance can indicate relative primary production and will be used as such in the results. Zero to 30% periphyton coverage will indicate low primary production, 30% to 60%, moderate primary production, and greater than 60% high primary production.

WATER CHEMISTRY DATA

Water samples were collected from 13 sample stations during 1984. The 1982 (Kucera et al., 1983) and 1983 (Fuller et al., 1984) inventories found that water quality in the lower Clearwater Basin streams was not detrimental to salmonid production. Therefore, during the 1984 inventor!-, water samples were not collected in the lower stream reaches but were chosen to represent the higher upstream areas. Water samples were collected in l-qt plastic jugs, labeled, cooled in ice chests, and transported to the University of Idaho Analytical Laboratory where they were analyzed within 24 hours. All water samples were taken during mid-September and early October. Parameters measured, methodology, and detection limits are presented in Table 4.

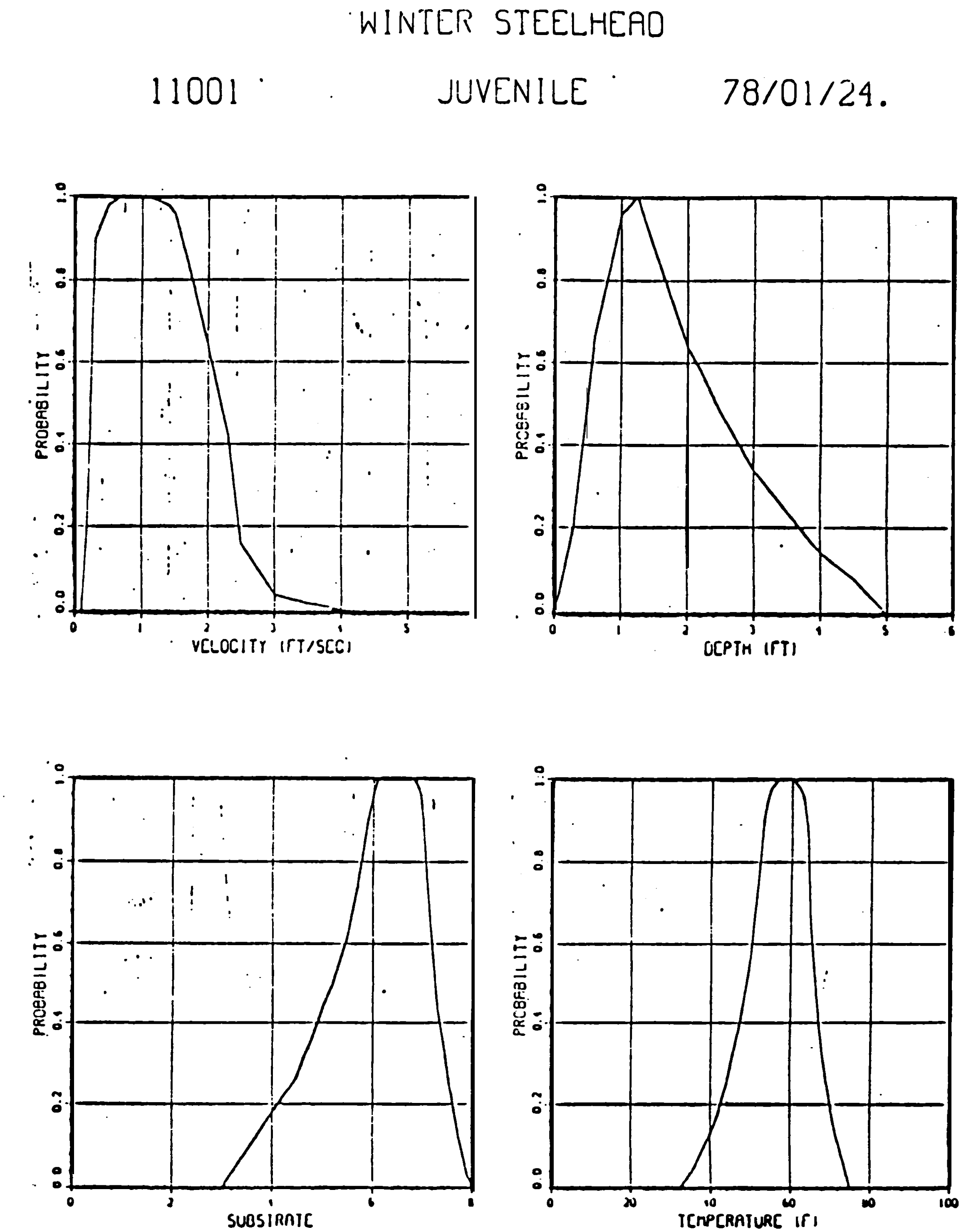

Figure 2. Probability-of-use curves for juvenile rainbow-steelhead trout, from Bovee (1978).

Table 2. List of fish species sampled in the streams within the lower Clearwater Basin, 1982-1984.

Common Name	Scientific Name
Rainbow-Steelhead Trout	*Salmo gairdneri*
Chinook Salmon	*Oncorhynchus tshawytscha*
Kokanee Salmon	*Oncorhynchus nerka*
Bull Trout	*Salvelinus confluentus*
Brook Trout	*Salvelinus fontinalis*
Cutthroat Trout	*Salvo clarki*
Mountain Whitefish	*Prosopium williamsoni*
Small Mouth Bass	*Micropterus dolomieui*
Pumpkinseed, a	*Lepomis gibbosus*
Longnose Date	*Rhinichthys cataractae*
Speckled Date	*Rhinichthys osculus*
Paiute Sculpin	*Cottus beldingi*
Torrent Sculpin, a	*Cottus rhotheus*
Northern Squawfish	*Ptychocheilus oregonensis*
Chiselmouth	*Acrocheilus alutaceus*
Redside Shiner	*Richardsonius balteatus*
Bridgelip Sucker	*Catostomus columbianus*
Largescale Sucker	*Catostomus macrocheilus*
Pacific Lamprey (ammocoete) a	*Entosphenus tridentatus*

a
Probable species identification

Table 3. Example of bottom substrate and cobble embeddedness or gasket categories utilized in Cleardater River Basin inventories, 1982-1984.

Bottom substrate:

1. Bedrock	5. Small Rubble (3-6")
2. Large Boulder (3'+)	6. Loose Gravel (1-3")
3. Small Boulder (1-3')	7. Fine Gravel (.1-1")
4. Large Rubble (6-12")	8. Sand, silt, clay

Cobble embeddedness (Gasket effect)

0 gasket:	Cobble easily moved, resting and surrounded by large substrate (greater than 0.25 inch).
l/4 gasket:	Cobble still easily moved, however, 1/4 of surface area surrounded by sand and fine material.
l/2 gasket:	Cobble difficult to move with hand or foot; l/2 of surface area lost to sand and fine material.
3/4 gasket:	Cobble very difficult to move 3/4 of surface material lost to sand and fine material.
Full gasket:	Cobble almost impossible to dislocate from streambed; surface area needed for aquatic insect habitat almost completely choked off or eliminated; "gasket" of sediment even with upper surface of cobble.

Table 4. Water sample analysis outlining constituents measured, methods of detection, and detection limits for samples taken from Clear Creek, Orofino Creek, and the Potlatch River, Idaho, 1984.

Constituent	Detection Method	Detection Limit
Carbonate, CO,	Titrimetric-H SO and phenolphthalein	0.22 mg/l
Bicarbonate, HCO_3	Titrimetric-H SO and methyl orange	0.09 mg/l
Sulfate, SO,	Turbidimetric	1.0 mg/l
Nitrate, NO,	Colorimetric, automated, cadmium reduction	0.01 mg/l
Orthophosphate, PO_4	Colorimetric, automated ascorbic acid	0.01 mg/l
Chloride, Cl	Titrimetric-Silver nitrate and potassium chromate	0.01 mg/l
Calcium, Ca	Inductively Coupled Plasma-Atomic Emission Spectrometer	0.15 mg/l
Magnesium, Mg	Inductively Coupled Plasma-Atomic Emission Spectrometer	0.25 mg/l
Sodium, Na	Inductively Coupled Plasma-Atomic Emission Spectrometer	0.10 mg/l
Potassium, K	Inductively Coupled Plasma-Atomic Emission Spectrometer	0.05 mg/l
Total Dissolved Solids	Gravimetric	10.0 mg/l
pH	Calorimetric	0.1 unit

ENHANCEMENT RECOMMENDATIONS

Clear Creek System

CLEAR CREEK

Problems: Lack of riparian habitat; sedimentation; lack of instream cover; low summer flows; high summer water temperatures; and migration barriers.

The lower 12 km of Clear Creek is the most severely impaired reach of this stream. Privateresidences, cattle pens ' and small farm plots line much of the lower reach. Overgrazing has diminished riparian vegetation, thereby contributing to high summer water temperatures, unstable Sank structure,reduction of streamside cover, extremefluctuation in flow, and increased sedimentation. Furthermore, agricultural and grazing activities are most intense within the lower tributary basins, adding to sediment content of mainstem Clear Creek. Sedimentation can reduce pool habitat, cover good spawning gravels, cause braiding of the stream course, reduce survival of emerging fry, and diminish diversity of prey type.

The upper drainage receives a high content of sediment from logging and roading activities. Clear cuts have long impacted the headwaters of Clear Creek. Eartin (1976) and the U.S. Forest Service (1980) found that upper Clear Creek would be excellent salmonid rearing habitat if not for the sediment load attributed to logging in this area. The present inventory found that the lower Clear Creek stations supported a small population of rainbow-steelhead, the middle reach a moderate population with a greater number of overyearlings, and the headwaters an excellent population of juvenile cutthroat trout. Since much of Clear Creek flows through steep, narrow, high gradient canyons, debris jams often form and act as temporary barriers to migrating anadromous salmonids.

Solution: Extensive revegetation and exclusion of livestock from the lower 12 km stream reach would address the lack of riparian habitat and its associated effects. Cooperation and coordination with local farmers and ranchers for better land management practices is needed. The upper basin would benefit from better logging practices, reforestation-or revegetation of clear cuts, and reseeding unused logging roads. The upper basin will always be subject to debris jam barriers, but they should be removed and monitored annually. Check dams and placement of large boulders throughout the stream drainage would increase pool habitat and instream cover. Stream braiding in the lower reach could be corrected with rechannelization and bank reinforcement. Head sloping of existing vertical banks and bank reinforcement would correct sites of mass erosion. Flow augmentation by construction of a storage reservoir in the headwaters of Clear Creek, would reduce low flow effects, increase instream cover, and reduce high summer water temperatures.

Predicted results:

1. Stabilize banks.
2. Reduce sedimentation.
3. Increase streamside cover.
4. Increase instream cover.
5. Reduce high summer water temperatures.
6. Increase pool habitat.
7. Provide anadromous salmonid access into the upper reaches.
8. Flow augmentation.

Specific activities:

1. Revegetation of the lower 12 km of stream banks.
2. Fencing to exclude livestock from most of the lower 12 km -of stream.

3. Construction of approximately 30 check dams in the lower 20 km of stream.

4. Placement of large boulders or wing deflectors in the lower 20 km of stream.

5. Headsloping of vertical banks and bank reinforcement on sites of mass erosion in the lower 12 km of stream.

6. Removal of debris jams and annual monitoring.

7. Revegetation of clear cuts and logging roads affecting the upper 5 km of stream.

8. Construction of a storage reservoir in the headwaters of Clear Creek.

9. Rechannel areas of excessive stream braiding in the lower 12 km of stream.

Land ownership:

54% U.S. Forest Service:

46% private.

BIG CEDAR CREEK

Problem; Low summer flow; shallow mean depth; sedimentation; lack of good pool structure; and loss of riparian habitat.

Big Cedar Creek flows overground from the community of Big Cedar to the mouth of the creek, a distance of approximately 9.5 km. Livestock graze in several sites along this reach and have not severely impacted the riparian zone but, nevertheless, influence sediment load and bank structure. A road paralleling the creek and agricultural activities on-the surrounding slopes also contribute to the sediment load. Since this is generally a low land stream, flow and mean depth are regulated by seasonal precipitation. Pools are formed primarily by small debris jams and are structurally controlled by flow variation.

Solution: Fencing off cattle yards to exclude livestock from the stream banks would promote riparian development, thereby reducing extreme fluctuations in water temperature, reduce sedimentation, and provide greater streamside cover. The construction of a storage reservoir below Big Cedar would augment flows, increasing overall depth, pool habitat and instream cover, and reduce extreme variations in water temperature. Check dams at several sites within the lower reach would act as sediment traps, provide a more stable pool structure, and increase instream cover.

Predicted results:

1. Increase streamside cover.
2. Reduce sedimentation.
3. Reduce variation in water temperature.
4. Increase pool cover.
5. Augment low summer flow.
6. Increase instream cover.

Specific activities:

1. Approximately 3 km of riparian enhancement and fencing below cattle use areas.
2. Construction of a storage reservoir below Rip, Cedar, Idaho.
3. Construction of approximately 10 check dams on the lower 8 km of Rig Cedar Creek.

Land ownership:

100X Private.

HOODOO CREEK

Problem: Migration barriers; low summer flows; unstable stream course; lack of instream cover; shallow mean depth; lack of good pool habitat; and sedimentation.

Migration barriers are the main deterrent to salmonid production in Hoodoo Creek. Falls, located at SK 1.0, and the West Fork Clear Creek barriers at SK 0.5, prevent the passage of anadromous fish into this stream. A population of cutthroat trout could be supported in the upper reaches of Hood00 Creek, since the habitat is similar to West Fork Clear Creek, but the fish would have to be transplanted into this system. The problems associated with low flow, shallow mean depth, lack of instream cover, lack of pool habitat, and unstable stream course, also impact Hoodoo Creek. Sedimentation, attributed to logging and roading activities, reduces the potential salmonid habitat of this stream

Solution: Providing passage over the falls on Hood00 Creek is not recommended. The stream flows though a narrow, high gradient canyon which would be susceptible to annual debris jams. No other enhancement procedures are recommended.

Specific activities:

None.

Land ownership:

100% U.S. Forest Service.

MIDDLE FORK CLEAR CREEK

Problem: Low summer stream flow; lack of instream cover; shallow mean depth; lack of pool habitat; and migration barriers.

Previous studies by Martin (1976) and the U.S. Forest Service (1980) determined that Middle Fork Clear Creek is of little use to anadromous fish. Martin (1976) attributed the poor condition of Middle Fork to high sediment content, marginal benthos production, high gasket effect, and a series of 3-4 m high waterfalls just above the confluence with Solo Creek, acting as migration barriers. The U.S. Forest Service (1980) found that the barriers and lack of spawning habitat rendered the Middle Fork unsuitable for salmonid production.

The present inventory found that a population of rainbow-steelhead was supported above the barriers cited in Martin's (1976) and the U.S. Forest Service (1930) reports. Rainbow-steelhead density in this reach was more likely regulated by abundance of spawning pairs, than the limitations of the rearing habitat. Low summer flow contributed to lack of instream cover, shallow mean depth, and lack of pool habitat.

Solution: Improved passage over the falls in the middle reach would result in the most significant increase of anadromous salmonids in this stream, but access into Middle Fork Clear Creek is limited, and most enhancement measures would be restricted to hand work. Boulders and check dams would provide for greater pool habitat and increase instream cover. Construction of a storage reservoir in the headwaters would also augment low summer flow, increase overall stream depth, pool habitat, instream cover, and reduce extreme fluctuations of water temperature. Revegetation of selected stream banks would provide greater streamside cover, reduce stream sedimentation, and reduce fluctuations of water temperature. Although sedimentation and gasket effect were determined to limit salmonid production of Middle Fork in the earlier studies (Martin, 1976; U.S. Forest Service 1980), these substrate parameters were not inordinately high over the stream area surveyed in the present inventory.

Predicted results:

1. Increase passage into the upper and middle reaches of the stream.
2. Increase pool habitat.
3. Increase instream cover.
4. Increase overall stream depth.
5. Augment low summer flows.
6. Reduce extreme temperatures.
7. Increase streamside cover.
8. Reduce sediment load.

Specific activities:

1. Improve passage over the falls above the confluence with Solo Creek.
2. Placement of Approximately 30 check dam structures between the confluence of Solo Creek with Middle Fork Clear Creek and Forest Service Road 286.
3. Placement of large boulders or wing deflectors above the confluence of Solo Creek with Middle Fork Clear Creek and Forest Service Road 286.
4. Revegetate approximately 6 km of stream banks between the Solo Creek confluence and Forest Service Road 286,
5. Construct a storage reservoir in the headwaters of Middle Fork Clear Creek.

Land ownership:

100% U.S. Forest Service.

WEST FORK CLEAR CREEK

Problem: Migration barriers; low summer flow; unstable stream course; lack of instream cover; shallow mean depth; lack of good pool habitat; and sedimentation.

Migration barriers are the main deterrent to anadromous salmonid production in West Fork Clear Creek. Several debris jams and extreme stream gradient prevent the passage of fish above SK 0.5. Within the headwaters, low summer flow regulates pool habitat, mean depth, and amount of instream cover. The channel was shallow, not well defined, and could be altered by small accumulations of debris. Sedimentation, attributed to logging and reading activities, also reduced potential of this stream as rearing habitat for anadromous salmonids. Despite the unsuitability for anadromous fish, a relatively productive cutthroat trout population was supported in the headwaters of West Fork Clear Creek.

Solution Providing, passage above the barriers in West Fork Clear Creek is not recommended. As the creek travels through a narrow, high gradient canyon, debris jams will be an annual occurrence with the advent of spring runoff. Development of spring sources and the construction of a storage reservoir in the headwaters would enhance the cutthroat trout population, but have negligible effect enhancing the anadromous salmonid habitat of the lower 0.5 km of West Fork Clear Creek.

Specific Activities:

None.

Land ownership:

100% U.S. Forest Service.

SOUTH FORK CLEAR CREEK

Problem: Sedimentation; lack of instream cover; lack of pool and occasional debris jams.

South Fork Clear Creek receives a high sediment load from logging activities in the West Branch of South Fork Clear Creek. The South Fork Clear Creek and the Clear Creek #3 stations were similar in almost every aspect, excepting sediment content. The Clear Creek #3 station produced a relatively high standing crop of rainbow-steelhead, while few rainbow-steelhead occupied the South Fork station. Sedimentation results in reduced pool volume, reduced instream cover, and decreasing the diversity of benthic invertebrates (Bjornn et al., 1977); Sediment also covers spawning gravels, reducing potential for adult spawning and survival of emerging fry.

Solution: Both instream cover and pool habitat could be improved by placement of check dams or sediment traps at several sites in the stream. However, South Fork Clear Creek flows over a moderate to high gradient; small waterfalls are abundant and should already act as check dams. Evidently, these are not effective, so other enhancement measures must address the sediment problem.

Control of the source of sedimentation is necessary. Revegetation of the clear cut areas and unused logging roads, in addition to protection of existinq riparian habitat in the headwaters, could reduce the amount of sediment continually washing into South Fork Clear Creek. Much of the clear cut areas in the upper basin are naturally becoming revegetated After the soil becomes tied down, high spring flows should clear the sediment from the streambeds. Methods have been developed to actually wash the substrate-by using caterpillar tractors or a suction dredge, but access into South Fork Clear Creek is extremely limited, making these procedures cost ineffective.

Predicted results:

1. Reduce sedimentation.
2. Increase pool cover.
3. Increase instream cover.
4. Increase streamside cover.

Specific activities:

1. Approximately 30 km of riparian enhancement in both the West Branch and Kay Creek tributaries and in the headwaters of South Fork Clear Creek.
2. Revegetation of old logging roads in the upper South Fork Clear Creek basin.

Land ownership:

100% U.S. Forest Service.

PINE KNOB CREEK

Problem: High sedimentation and gasket effect; low summer flow; lack of instream cover; shallow depth; and lack of pool habitat.

A clear cut in the headwater area of Pine Knob Creek has resulted in extensive stream sedimentation and cobble embeddedness. Martin's (1976) survey reported that, although this system has a good pool-riffle structure and riparian zone, sediment content reduced the beneficial effects these parameters might have contributed to salmonid production. The U.S. Forest Service (1980) also noted that poor logging practices in the clear cuts added excessive sediment to Pine knob Creek. The present inventory documented an unusually high population of cutthroat trout occupying Pine Knob Creek; however, the sample station was located above the sites of massive erosion.

Solution: Enhancement measures must focus- on reducing the source of sediment and promoting cleansing of the existing sand from the stream. Methods of stabilizing erosion are revegetation of the stream banks where buffer zones have been degraded and revegetation within the clear cut itself. Natural revegetation is now occurring, but could be enhanced. Once the sources of erosion have been controlled, instream cover and pool habitat will gradually be restored. Seasonal runoff would sweep much of the sand and silt downstream. Low flow and shallow depth could be augmented by construction of by construction of a storage reservoir in the headwaters of Pine Knob Creek.

Predicted results:

1. Decrease sediment load and gasket effect.
2. Increase pool habitat.
3. Increase streamside cover.
4. Increase instream cover.
5. Flow augumentation.

Specific activities:

1. Identify the sites of denuded riparian zone and replant these areas.
2. Revegetation of the clear cut slopes.
3. Construction of a storage reservoir in the headwaters of Pine Knob Creek.

Land ownership:

100% U.S. Forest Service.

Lolo Creek System

LOLO CREEK

Problem: High water temperatures in lower reaches; sedimentation; degraded riparian zone: and impediment to migration.

The lower reaches of Lo10 Creek, off the Clearwater National Forest, has limited enhancement potential due to its size and. inaccessability. The primary problems identified in this section were lack of premium spawning substrate, siltation, and high summer water temperatures, none of which can be addressed at this point. The upper 6.4 km below the Forest boundary provide spawning habitat for salmonids although excessive silt is present in places. From the forest boundary to the mouth of Musselshell Creek, the stream shows signs of heavy siltation (#3), and is the location of Lolo Falls. The remaining streams (#4-7) are impacted by road construction and mining activities. Due to its location in the upper watershed and good access on Forest Service roads, this section of stream is the logical area for major enhancement activities.

Solution: The addition of instream cover and riparian enhancment is recommended on Lo10 Creek near the mouth of Yakus Creek. Instream scouring structures could be installed in the section between the mouth of Musselshell Creek and the forest boundary. However, decreased sediment load from Musselshell Creek should be the primary objective. Additional blasting of Lo10 Falls is recommended to provide better access to the upper system. Lo10 Creek, from the mouth of Musselshell Creek to the mouth of Yoosa Creek, is subject to excessive sediment deposits, and lacks instream cover and pool habitat. Scouring structures such as check dams, large boulder groups, and a greatly increased amount of secured cedar stump wads and logs would improve this section of stream. In addition, heavy vegetative cover should be planted on slopes of Forest Service road (# 100) where necessary to decrease erosion and reegetate the south bank of Lolo Creek.

Predicted results:

1. Increase clean substrate.
2. 'Increase cover.
3. Decrease streamside erosion.

Specific activities:

1. Riparian enhancement.
2. Woody -debris
3. Instream structures

Land ownership:

30% BLM

SO% Forest Service

10% State

10% Private

Water rights:

5.14 cfs

YAKUS CREEK

Problem: Sedimentation (upper reaches);lack of instream cover and bank erosion (lower reaches); and lack of pool habitat.

The upper reaches of Yakus Creek are subject to sedimentation from logging road construction and other logging activities. Otherwise, the stream is in good condition.

Solution: Installation of check structures and sediment collectors is recommended on small side streams which receive high sediment loads. Riparian enhancement and bank stabilization are recommended in the lower reaches of this system. In addition; check dams and the introduction of woody debris would increase instream cover and pool habitat.

Predicted results:

1. Decrease sedimenation in upper reaches.
2. Decrease bank erosion.
3. Increase instream cover and pool habitat in lower reaches.

Specific activities:

1. Installation of sediment collectors (14) in key tributaries.
2. Riparian enhancement of lower 3.2 kilometers.
3. Check dam construction (15) on lower 3.2 kilometers.

Land ownership:

50% USFS

15% State

35% Private

MUSSELSHELL CREEK

Problem: Sedimentation; impediments to migration; and high water temperature.

Musselshell Creek has an exceptionally high rate of sedimentation transport which is attributed to intensive logging in the upper drainage. Road construction paralleling the upper 2/3 of this stream also provide a sediment source. Riparian vegetation while sufficient in the upper and lower reaches, is lacking in the vicinity of the Musselshell work station. Several debris dams are located in the lower 2 miles of strewn which impede potential up-stream migration by adult anadromous salmonids. -High water temperatures found in the lower reaches of Musselshell Creek are primarily due to lack of riparian vegetation.

Solution: Riparian enhancement is recommended in the vicinity of Musselshell work station. Check dams or siltation collectors are recommended on all small tributaries to upper Musselshell Creek. The removal of debris dams in the lower reaches should facilitate upstream migration by salmon and steelhead. In addit ion to these recommendat ions, scouring structures placed in mainstem Musselshell Creek should provide clean spawning Travels. The spawning channel and pond located adjacent to Musselshell work station should be opened for rainbow-steelhead or salmon propagation.

Predicted results:

1. Decrease sediment imput.
2. Decrease water temperature.
3. Improve upstream access for salmonids.

Specific activities:

1. Riparian enhancement - 2 miles
2. Scouring structures - 50
3. Sediment collectors - 100
4. Dam removals - 3
5. Spawning channel and pond clean up.

Land ownership:

90% USFS

10% Private

l-later rights:

20 cfs (mining)

ELDORADO CREEK

Problem: Sedimentation; barriers to migration and lack of instream cover.

Eldorado Creek contains a large amount of heavy sand bedload. The majority of this sandy material is probably of natural origin (Espinosa, personal communication) and will always be present in the upper reaches. The major limitation to salmonid production in Eldorado Creek is a series of cascades, a sheer 3.6 m falls and a rock fall that inhibit upstream movement of adult salmonids. Instream cover in stream reaches where water velocity is sufficient to scour the substrate is lacking.

Solution: Extensive blasting of both the cascades and sheer falls would create stair steps for &gratin? adult salmonids in the lower reach of Eldorado Creek. In addition, blasting or physical removal of large boulders above Eldorado falls are necessary for upstream moverkent. Instream scour structures should be placed in areas where water velocity is sufficient. This would provide clean spawning gravel for adult salmonids. Check dams and boulder groups, in addition to the above mentioned scouring structures, would provide additional cover in these areas for juvenile salmonids. Sedimentation traps are recommended on all west flowing tributaries.

Predicted results:

1. Increase clean gravel for salmonid reproduction.
2. Increase instream cover.
3. Open. lower stream to passage by adult salmonids.

Specific activities:

1. Scouring structures - 40
2. Additional instream cover - 100
3. Blastinq operations - 2
4. Boulder removal -1

Land ownership:

100% USFS

YOOSA CREEK

Yoosa Creek is in relatively good condition. Little physical enhancement in recommended with the exception of increased vegetation adjacent to forest road 103 and continued maintenance of associated drain structures.

BROWNS CREEK

Problem: Sedimentation and bank erosion.

The entire Browns Creek watershed has been either heavily grazed by cattle or logged intensively. Both of these activities have led to large amounts of sedimentation in Browns Creek. When high rates of precipitation occur renewed erosion and subsequent sedimentation take place.

Solution: Major riparian enhancement is recommended for the entire length of Browns Creek. Check structures to catch sediment runoff should be placed on al! applicable tributaries to the main stream. These activities will be especially useful in the upper drainage where logging activities and subsequent skid trails and roads pose major erosion problems. The mainstem is in need of bank stabilization measures as well as riparian vegetation. Scouring structures, such as check dams and/or boulder groups, are recommended in this mainstem reach to provide clean spawning gravels for adult rainbow-steelhead.

Predicted results:

1. Decrease sediment imput
2. Decrease bank erosion.
3. Increase channel stability.

Specific activities:

1. Riparian enhancement - 24.1 km
2. Sediment check structures - 50.
3. Scour structures - 35.

Land ownership:

10% Forest Service

10% State

80% Private

Water rights:

0.26 cfs

Orofino Creek System

OROFINO CREEK

Problem: Migration barriers; slight cobble embeddedness; high summer water temperatures; lack of pool habitat; lack of riparian habitat; lack of instream cover.

The cataract falls barrier on lower Orofino Creek is the greatest deterrent to anadromous salmonid production in this system. Overall, the habitat was well suited to salmonid production. Problem areas determined in this study, cobble embeddedness (2X), high summer water temperatures, lack of pool habitat, lack . of riparian habitat, and lack of instream cover, were marginal. If the barrier were removed, an exceptional salmonid spawning habitat would be provided to the lower Clearwater River. The U.S. Bureau of Reclamation (1984) predicted that an estimated 72,000 smolts or 1,200 returning adult spawners could utilize the habitat above the falls. Commercial and sports fishermen could also harvest an additional 2,400 adult steelhead;

The second falls, just above the confluence of Cow Creek and Orofino Creek, might also be a barrier to rainbow-steelhead migration. These falls are not as great an obstruction as the cataract, but improved passage is recommended.

The present inventory found populations of brook and rainbow trout in all the sampled tributary streams. Limited populations, but larger size brook and rainbow trout, occupied the mainstem. The tributary streams may act as a nursery area for the large mainstem trout.

Solution: Passage over the cataract falls and the smaller falls above Cow Creek should be provided.- Further enhancement recommendations for tributaries of Orofino Creek will be proposed as if passage has been provided.

Predicted results:

1. 74 km of additional steelhead habitat in the mainstem Orofino Creek.

Land ownership: .

34% private;

34% Potlatch Forest Industries;

16% Idaho State land;

16% U.S. Forest Service.

cow CREEK

Problem: Low summer flow; shallow mean depth; high sediment content; cobble embeddedness; lack of riparian habitat; and lack of stable pool habitat.

The Cow Creek system consists of small, shallow, brushy streams. Historically, the greatest impairment of this drainage was low summer flow, which influenced shallow mean depth, instream cover, and water temperature. Pool structure was temporary as small debris jam are regulated by fluctuations in runoff.

Significant salmonid production is probably limited to the lower 1.5 km of Cow Creek, the headwaters of Cow Creek, and headwaters of the tributary streams. The middle reaches are impacted by both logging and grazing activities. Logging sites on the tributaries have denuded riparian habitat and cluttered the stream beds with debris. The road paralleling Cow Creek receives moderate use from logging trucks and private vehicles, contributing to sediment content and hence, cobble embeddedness. Cattle graze in the middle meadow reach, also adding to loss of riparian habitat, sediment load, and unstable bank structure.

Solution: Logging practices should be anended and logging sites cleared up such that impact on the salmonid producing streams is limited. Revegetation of denuded stream banks would control sediment load, reduce high summer water temperatures and increase streamside cover. Fencing to exclude livestock and restoration of the meadow riparian zone would also enhance salmonid production in the middle reach. Construction of a storage reservoir in the headwaters of Cow Creek would augment low summer flows, reduce high summer water temperatures, increase mean depth and instream cover. Check dams should be constructed at reveral locations in the stream to provide a more stable pool habitat and increase the pool/riffle ratio.

Predicted results:

1. Increase streamside cover.
2. Reduce sediment load.
3. Reduce high summer water temperatures.
4. Augment low summer flow.
5. Increase instream cover.
6. Increase pool habitat.

Specific activities:

1. Revegetation of approximately 10 km of denuded stream banks

on all three tributaries and the middle, meadow reach of Cow Creek.

2. Revegetation of loading zones impacting the tributary streams.
3. Clearing logging debris from approximately 2 km of stream channel in the logged areas.
4. Fencing to exclude livestock from approximately 2 km of the meadow reach.
5. Construction of a storage reservoir in the headwaters of Cow Creek.
6. Construction of 10 check dam structures in the lower 3 km of Cow Creek.

Land Ownership:

57% Potlatch Forest Industries;

28% Private;

. 15% Idaho State.

POORMAN CREEK

Problem: Low summer stream flow; shallow mean depth; lack of instream cover; bank erosion; cobble embeddedness; and lack of good pool habitat.

Poorman Creek is subject to low summer flows, hence, shallow mean depth, lack of instream cover, and lack of pool habitat. Although Campbells Pond, a storage reservoir, is located on a tributary of Poornan Creek, the purpose of the pond is for providing a recreation area, not for flow augmertation in the lower stream. Cobble embeddedness is attributed to logging activities in the drainage and can limit successful spawning of salmonids. Presently, logging is focused on the western slope of the drainage, above the confluence of Hay Creek and Poorman Creek, and in the headwaters above Highway 11. The actual streambed runs through a steep valley from Highway 11 to the mouth and receives little logging impact. Enhancement measures should concentrate on improving the habitat within the stream itself.

Solution: Constructing a storage facility on the headwaters of poorman Creek to augment low summer flow would also increase mean depth, instream cover, and pool habitat. Check dams and boulders would also provide additional pool habitat and instream cover. Eroding banks could be stabilized by headsloping and bank reinforcement.

Predicted results:

1. Augment low summer flow.
2. Increase mean depth.
3. Increase instream cover.
4. Increase pool habitat.
5. Stabilize eroding banks.

Specific activities:

1. Construction of a storage facility in the headwaters of Poorman Creek.
2. Construction of approximately 10 check dam structures between Highway 11 and the mouth of Poorman Creek.
3. Placement of- large boulders in several sites within the creek.
4. Stabilize approximately 2 km of eroding stream banks, between Highway 11 and the mouth of Poorman Creek.

Land ownership:

70% Potlatch Forest Industries;

30% Idaho State.

`QUARTZ CREEK

Problem: High use area; lack of riparian habitat; high sediment content; high cobble embeddedness.

Several land use activities impact Quartz Creek which will limit the effectiveness of any enhancement measures. Both Highway 11 and the Bald Mountain Ski Area Road parallel the entire stream length. Traffic into Jaype Mill is constant and the mill yard itself borders this reach of stream bank. Livestock are penned in the upper meadow and a repair yard for logging trucks operates there. The riparian habitat has been reduced in the logging yard, the meadow reach, and beside the highway. Cobble embeddedness and sediment content are both high, thereby reducing potential spawning grounds for anadromous salmonids. This stream will continue to be subject to heavy vehicle traffic, making enhancement measures rather futile. Brook trout populations should survive in the upstream meadow as long as the thick riparian habitat remains relative11 undisturbed. It is recommended that Quartz Creek contim- to be managed as a "put-and-take" rainbow-steelhead stream; no enhancement measures are proposed.

Specific activities:

None.

Land ownership:

77%. Potlatch Forest Industries;

9X Idaho State;

9% private;

5% U.S. Forest Service.

WHISKEY CREEK

Problem: Sedimentation

Except for the upper 4.8 km of Whiskey Creek, where logging and agricultural activities have degraded the riparian zone leading to increase sediment input, the drainage is generally in good condition.

Solution: Riparian enhancement is recommended for the upper 4.8 km of Whiskey Creek. In addition, a dirt road crossing the creek at approximately SK 19.3 should be stabilized to reduce erosion. (resident fish only)

Predicted results:

1. Decrease sediment load to the upper drainage.
2. Decrease water temperature.

Specific activities:

1. Riparian enhancement - 4.8 km
2. Road stabilization - 1 location

Land ownership:

257, State

75% Private

Water rights:

0.49 cfs

TRAIL CREEK

Problem: Low summer flow; lack of instream cover; cobble embeddedness; high sediment load; lack of pool habitat; and hank erosion.

Trail Creek winds through typical meadow habitat. Riparian growth is generally well developed but in areas where it's absent, the humic topsoil rapidly erodes into the stream, adding to sediment load and cobble embeddedness. The upper drainage has been log&d, which also contributes to sediment load. Low s-r flows limit both pool habitat and instream cover. Riparian growth has been impaired by grazing livestock, contributing to bank erosion and sediment load.

Solution: Bank erosion should be controlled by headslopins of vertical banks and stabilizing sites of mass erosion. Revegetation of denuded banks and excluding livestock from the streambed will also control erosion and sediment load. Check dams and boulders or wing deflectors would provide for increased pool habitat and instream cover. A storage reservoir in the headwaters of Trail Creek would augment low summer flows, increasing pool habitat and instream cover.

Predicted results:

1. Reduce sediment load and cobble embeddedness.
2. Increase instream cover.
3. Increase streamside cover.
4. Increase pool habitat.
5. Augment low summer flows.

Specific activities:

1. Headsloping and stabilizing approximately 4 km of eroding stream banks throughout the stream length.
2. Revegetate approximately 2 km of stream banks.
3. Construction of approximately 15 check dam structures throughout the stream length.
4. Placement of boulders or wing deflectors throughout the stream length.
5. Construction of a storage reservoir in the headwaters to augment low summer flows.

Land ownership:

80% Potlatch Forest Industries;

20% U.S. Forest Service

LITTLE BEAVERCREEK

Problem: Low summer flow; shallow mean depth; and lack of pool habitat.

The greatest deterrent to anadromous salmonid production in Little Beaver Creek is low summer flow. Overall, habitat conditions and land use activities were not disadvantageous to rainbow-steelhead, but several parameters relating to flow could be enhanced.

Solution: A storage reservoir constructed in the headwaters of Little Beaver Creek would augment low summer flows, increasing mean depth and providing pool habitat. Check dams and boulders or wing deflectors would also increase pool habitat and instream cover.

Predicted results:

1. Augment low summer flows.
2. Increase pool habitat.
3. Increase mean depth.
4. Increase instream cover.

Specific activities:

1. Construction of a storage reservoir in the headwaters of Little Beaver Creek.
2. Construction of approximately 10 check dams throughout the stream length.
3. Placement of boulders or wins deflectors throughout the stream length.

Land ownership:

95% Potlatch Forest Industries;

5% Idaho State.

CANAL GULCH

<u>Problem</u>: Debris jams; low summer flow; lack of pool-riffle structure; lack of instream cover; high sediment load.

Most of the Canal Gulch system flows through a low gradient, brushy, meadow habitat. The drainage contains a high sediment load, which is attributed to logging and logging traffic. The creeks are often choked with debris, creating numerous small ponds, which probably support a substantial population of brook trout, but do not provide favorable habitat for anadromous salmonids. Production of rainbow-steelhead is limited by lack of spawning gravels, pool-riffle structure, and instream cover; all attributed to the low gradient and sediment load of this system.

<u>Solution</u>: Enhancement measures on Canal Gulch are limited. The low gradient, brushy habitat will continue to promote formation of debris jams. Since flow, gradient, and velocity are not sufficient to flush accumulated sediment from the streambed, spawning substrate, pool-riffle structure, and instream cover will not be improved. Therefore, no enhancement measures are proposed for the Canal Gulch system.

Specific activities:

None.

Land ownership:

70% Potlatch Forest Industries;

21% Idaho State;

5% U.S. Forest Service;

2% private.

RHODES CREEK

Problem: Lack of instream cover; lack of distinct pool riffle structure.

'Rhodes Creek is in fairly good condition; the only habitat parameters in need of enhancement are instream cover and pool habitat. The upper reaches of Rhodes Creek are impacted by logging activities but the system apparently controls any adverse effects associated with the operation.

Solution: Wins deflectors and large boulders should provide the instream *cover* necessary. Pool habitat is available, but due to the relatively large size of this creek, there is considerable distance between each. The system needs a few mall obstructions to interrupt flow, create small pools, and additional instream habitat.

Predicted results:

1. **Increase pool habitat.**
2. Increase instream cover.

Specific activities:

1. Placement of wing deflectors and boulders throughout the lower 6 km of Rhodes Creek.

Land ownership:

84% Potlatch Forest Industries;

10X Idaho State;

4% U.S. Forest Service;

2% private.

SHANGHAI CREEK

Problem: Low summer stream flow; high sediment content; shallow mean depth.

Upper Shanghai Creek was the site of a substantial logging operation but most of the activity is now over. Although log trucks still use the Shanghai Creek Road, the stream is slowly returning to its natural state. Moderate gradient and the good riparian structure will facilitate transport of sediment load downstream. The clear cut needs to regrow a multi-layered canopy to better hold the soil. Presently, the clear cut contains ferns, annual grasses, and little else. From the Shanghai Creek Road to the confluence with Rhodes Creek, the stream travels through a narrow steeper gradient which is relatively undisturbed by land use activities. Tinis draw might provide the best habitat for rainbow-steelhead.

Solution: Enhancement measures should focus on encouraging this basin to return to its undisturbed state. Revegetation of-the clear cut with conifers, and, perhaps creating greater flow regimes with a storage reservoir, would diminish the sediment load of this system.

Predicted results:

1. Decrease sedimentation.
2. Augment low summer flows.

Specific activities:

1. Revegetate approximately 3.8 km2 of the upper basin with conifers.
2. Construct a storage facility in the headwaters of Shanghai Creek.

Land ownership:

90% Potlatch Forest Industries;

10% Idaho State.

POTLATCH RIVER SYSTEM

POTLATCH RIVER

Problem: Extreme flow variation; high summer water temperatures; unsuitable substrate; lack of riparian habitat.

The Potlatch River can be divided into three separate stream reaches; from the mouth to the confluence with Cedar Creek, from the confluence with Cedar Creek to the confluence with the East For& and upstream from the confluence with East Fork. Each has its own stream conditions determined by the topography and the degree of use or' the surrounding watershed. Generally, the limiting parameters which occur throughout the drainage are high summer water temperatures and extreme fluctuation in flow.

The most severely impacted reach of the Potlatch River is between Cedar Creek and the mouth. This reach receives runoff from the streams which flow through heavily agricultural watersheds. The water temperatures are highest and the variability in flow the most extreme, which hasresulted in denuded banks, embedded large cobble, and limited spawning gravels. The reach also receives effluent from the communities of Juliaetta and Kendrick. The habitat upstream from Kendrick improves considerably.

The mainstem Potlatch, from Cedar Creek to the confluence with East Fork Potlatch, is relatively undisturbed and provides the best salmonid habitat in the drainage. Pool-riffle structure is good, gravels are suitable for spawning., riparian vegetation is the most undisturbed of the mainstem, and this area receives little direct impact from land use activities. Any habitat improvement recommendations should focus on improving this reach of Potlatch, since the upstream and downstream areas offer so little potential.

From the confluence of the East Fork to the headwaters, salmonid habitat is aqain reduced. The stream gradient levels out, causing a decrease in stream velocity, which allows the sediment to build up and cover any suitable spawninq gravels. Instream cover is limited to woody debris and undercut banks, a partial canopy provided by annual grasses. Pool-riffle structure is lacking as the stream is primarily an even depth run. The stream also travels through grazing lands (which results in unstable bank structure), and the outskirts of the community of Bovill. Enhancement alternatives would provide little benefit to salmonid production within this reach, and, as mentioned above, should concentrate on improving the habitat, primarily as related to flow and temperature, within the middle reach.

Solution: The U.S. Bureau of Reclamation (1383) studied the feasibility of putting a storage reservoir in the middle reaches of the East Fork Potlatch to augment lowsummer flows, control high summer water temperatures, and reduce erosion in the mainstem of the Potlatch River. Since this recommendation would provide the greatest improvement to the middle reach of Potlatch, it is still considered to be the most viable alternative. However, the Bureau of Reclamation's (1984) study determined that the costs associated with the reservoir would be greater than the benefits. The benefits include an optimistic estimate of 1,300 returnins adult steelhead spawners after a five year build up period. But the capital expenditures and the operating costs were much greater than the monetary benefits attributed to increased steelhead production. Yet the fact still remains that flow and temperature regimes must be controlled to promote increased salmonid use of the Potlatch River. Therefore, the storage reservoir will still be recommended as the best enhancement measure for the Potlatch.

Prediced Results:

1. Flow augmentation.
2. Decrease summer water temperatures.
3. An additional 1,300 returning adult steelhead into the Potlatch River.

Specific Activities:

1. Construction of the Fry Meadow Reservoir as proposed by the Bureau of Reclamation.

Land ownership:

60% Private;

20% Potlatch Forest Industries;

15% U.S. Forest Service;

5% Idaho State.

LITTLE POTLATCH CREEK

Problem: Extreme flow variation; high summer water temperatures; shallow mean depth; lack of instream cover; cobble embeddedness; lack of pool habitat; and lack of riparian vegetation.

Little Potlatch is of marginal use as salmonid habitat. The entire lenqth of the creek receives runoff from agricultural land, which results in high sediment and nutrient content, and extreme, rapid fluctuations in flow. The lower 3 km in particular, evidence the extreme flow conditions impacting this stream. The channel is very wide, the substrate is large,(predominantly boulder and rubble size) vegetation is absent, and during summer, the stream may occupy only five percent of the channel. High summer water temperatures are typical in the lower reach, and often exceed the lethal limit of salmonids. The upper reaches provide only minimal flow, they also carry a high sediment load and flow over a low gradient, which decreases the probability of natural rehabilitation. In addition most of the upper streams flow through farmlands, and receive more immediate effects from livestock and farming activities. The only suitable habitat for salmonids might be found just below the falls in the middle reach. At least pools are present here, which might provide more cover than is generally available. No enhancement recommendations will be made for Little Potlatch Creek.

Specific activities:

None.

Land ownership:

100% private.

MIDDLE POTLATCH CREEK

Problem: Extreme flow variation; subsurface flow; high summer water temperatures; cobble embeddedness; and lack of riparian habitat.

Middle Potlatch is typical of the lower tributaries of the Potlatch River. Agricultural activities throughout the surronding watershed contribute to extreme, rapid runoff, which precludes the establishment of a suitable riparian zone, summer water temperatures are often very hiqh, and the stream contains a high sediment and nutrient load. Most of the lower 10 km of stream, throughout the canyon reach, is unsuitable for salmonid production. As indicated earlier, the sample station during the present study was a typical of overall stream conditions, and may have been the site of a "glory hole" for rainbow-steelhead which were pushed into the pool by receeding flow and high water temperatures. The 3 km reach above and below the falls at SK 12.9 might offer the most suitable habitat for salmonids, as pool cover and riparian structure were better developed, but this area was inaccessible for sampling. And, the upper tributary streams flow through farmlands and cattle pastures which results in more immediate detrimental impacts to salmonid habitat. Unless agricultural practices can be amended, extreme runoffs and the associated effects, will continue to be a problem throughout this drainage. Therefore, no enhancement measures will be recommended.

Specific activities:

None.

Land ownership:

100% private.

BIG BEAR CREEK

__Problem__: **Migration barrier; extreme flow variation; high summer water temperatures; lack of riparian vegetation.**

An aerial observation of the Big Bear Creek drainage indicated that the stream habitat in the canyon reach was well suited for salmonid production. The canyon slopes were heavily timbered (providing some control of agricultural runoff), pool-riffle habitat was well developed, stream flow was adequate, and the reach received little direct impact from land use activities. Much of this habitat was unavailable to salmonids, however, as the falls at SK 9.0 are impassable. From the top of the canyon reach at SK 22, to the mouths of the upper tributaries at approximately SK 30, the stream flows through agricultural lands, which have directly impaired stream conditions and quality. The headwaters above the farmlands appear to provide some valuable salmonid rearing habitat, as evidenced by the rainbow-steelhead population in the uppermost station.

Solution: Providing passage above the falls would result in the most insnediate improvement of the Big Bear Creek salmonid production potential. Additional enhancement measures should focus on reducing the effects of agricultural use, stabilizing stream banks, constructing sediment traps, and excluding livestock from the streambed. And, a storage reservoir in the upper canyon reach could augment flows, reducing high summer water temperatures and allowing a riparian zone to become established in the middle and lower canyon.

Predicted results:

1. Passage above the falls would provide an additional 13 km of suitable steelhead rearing area.
2. Reduce sediment load.
3. Increase riparian structure.
4. Flow augmentation.
5. Reduce high summer water temperatures.

Specific activities:

1. Provide passage over the falls-at SK 9.0.
2, Construct check dams in the 8 km reach above the canyon,
3. Construction of a storage reservoir in the upper canyon.

Land ownership:

75% private

10% U.S. Forest Service

10% Potlatch Forest Industries

5% Idaho State

CEDAR CREEK

Problem= High summer water temperatures; shallow mean depth; cobble emdeddedness.

The lower canyon reach of Cedar Creek provides the only significant amount of habitat for salmonids. From the headwaters on the plateau, to the beginning of the canyon reach, the stream flows through farming and grazing lands. The upper canyon reach flows over an extreme gradient until approximately SK 5.0. Below the gradient barrier, pool-riffle structure is good, the riparian zone is well developed, and spawning substrate is available. However, the lower reach is also susceptible to debris jams, (which can be impassable), and high summer water temperatures. But habitat conditions in the lower reach are generally well suited for salmonid production.

Solution: A storage reservoir just below the gradient barrier would augment low flows, increase overall depth, reduce extreme summer water temperatures, and act as a sediment trap, thereby reducing cobble embeddedness. However, present stream conditions are not degraded to such an extent that would warrant making this enhancement recommendation a priority.

Predicted results:

1. Augment low summer flows.
2. Increase mean depth.
3. Reduce high summer water temperatures.
4. Reduce cobble embeddedness.

Specific activities:

1. Construction of a storage reservoir below the gradient barrier at SK 5.0.

Land ownership:

90% private;

10% Potlatch Forest Industries.

LITTLE BOULDER CREEK

Problem: Low summer stream flow; shallow mean depth; high cobble embeddedness; lack of pool habitat.

No enhancement measures will be proposed for Little Boulder, Creek, since the stream is already suitable for salmonids, and no signigicant land use activitces are occurring which might reduce the stream condition. Although depth and pool cover are lacking, and the flow is minimal the stream provides some very important salmonid rearing habitat, as evidenced by the high biomass of subyearling and overyearling rainbow-steelhead. The surroundin! higher slopes are being logged, but the direct impact on the stream itself is marginal. Evidently, the stream can respond to the present level of activity and still provide valuable rearing habitat, such that enhancement measures would not be necessary.

Specific Activities:

None.

Land ownership:

100% U.S. Forest Service.

EAST FORK POTLATCH CREEK

Problem: Lack of riparian habitat; high sediment load; high summer water temperatures; lack of pool-riffle structure.

Overall stream conditions in the East Fork Potlatch are quite suitable for rainbow-steelhead, but a few problem areas have been identified. The lower 5 'km of the East Fork is grazed heavily, and as such, riparian habitat is reduced. This area also has a high degree of cobble embeddedness and its summer water temperatures can get to be extreme. The middle reach paralleling the highway and to the east of Bovill also receives livestock use, but this area has a more stable riparian zone. The stream substrate in this reach is of good quality for both rearing and spawning salmonids. However, it does contain a high content of finer particle size, which if allowed to continue, can be detrimental to salmonid production. The upper reach, from SK 20 to the headwaters, has a high sediment load. Stream flow is frequently blocked by debris jams, within the headwaters, which results in a loss of good pool-riffle structure. Presently though, these jams act as sediment traps which affords some protection to the downstream area.

Solution: The lower 5 km of stream should be revegetated and protected from excessive livestock use. Control of the sediment sources in the headwaters is also recommended, which would require revegetation of logged areas and unused logging roads.

Predicted results:

1. Decrease sediment load.
2. Increase streamside cover.
3. Reduce summer water temperatures.

Specific activities:

1. Revegetation and fencing to exclude livestock from approximately 5 km of the lower stream.
2. Revegetation of unused logging roads and logged areas in all of the upper tributary streams.

Land Ownership:

29% U.S. Forest Service;

28% Potlatch Forest Industries;

23% private;

20% Idaho State.

PURDUE CREEK

Problem: High sediment load; low stream velocity; eroding bank structure.

Purdue Creek is typical of the higher meadow streams of the Potlatch system. These streams are slow moving, generally have a well developed riparian structure, but also have a very high sediment load, which is unsuitable for salmonid production. The meadow streams flow through a deep humic topscil which is constantly eroding into the stream. In addition, there is not enough energy provided by gradient or' velocity to flush the sediment from the streambed. Rainbow-steelhead were present in Purdue Creek, but in very lownumbers. Although instream and streamside *cover* was abundant, the substrate size is too small to promote any significant salmonid use. And, since this condition is regulated by the topography of the drainage, no enhancement measures are recommended.

Specific activities:

None.

Land ownership:

50% Idaho State;

30% US Forest Service;

209, private

WEST FORK POTLATCH CREEK

Problem: High sediment content; low stream velocity; bank erosion.

The potential for salmonid production in West Fork Potlatch is substantially reduced by the unsuitable susbstrate type. The streams in the Vest Fork Potlatch drainage are, for the most part, low gradient, meandering, meadow streams. The humic meadow topsoil readily decomposes, resulting in a high sediment load, and the streams lack the velocity necessary to flush the sediment from the streambed. In addition, livestock grazing in the meadow can further erode stream banks, contributing to sediment load. Generally, depth, instream cover, and a suitable riparian structure are avaiLable for salmonids, and it was surprising to not see a larger population of brook trout in the lower reaches The headwater areas might be the only sites suitable for anadromous salmonid production as the velocity is greater, water temperatures are somewhat cooler, and although cobble embeddedness is high, there is still a differentialsubstrate size. However, the middle reaches at the upper ends of the meadows, are cluttered with beaver dams and debris jams, which may act as barriers to migrating salmonids. It is doubtful that any enhancement measure, short of actually removing the existing sediment from the stream channel, will be effective in developing, suitable anadromous salmonid habitat in West Fork Potlatch. Therefore, no enhancement measures will be recommended.

Specific activities:

None.

Land Ownership:

80% U.S. Forest Service;

20% private.

BIG CANYON CREEK SYSTEM

BIG CANYON CREEK

Problem: Low summer stream flow; high summer temperatures: low instream cover; annual stream flow variation.

Maximum stream temperatures and lack of instream cover are the most limiting to the fishery resource in terms of sub-optimum temperatures and restriction of overyearling habitat. Logging activities have impacted fishery resources through yarding of logs, soil distrubance and slash deposition on on stream banks. Grazing also impacts the creek. The creek courses through the town of Peck and is paralleled by a high-way for the lower two to three miles.

Solution: It is generally believed that steelhead populations in Big Canyon Creek could be substantially improved by a storage reservoir used to augment low flow periods, reducing high stream temperatures, and increasing available instream habitat. This option would also open up an additional seven to eight miles of potential habitat which is currently dewatered. Construction of log K-dams or check dams for in-creasing instream cover for anadromous solmonids would also aid in sediment trapping. Instream enhancement (large boulders or gabions as wing deflectors) would improve instream cover and augment the amount of anadromous salmonid habitat present in the lower middle and middle sections. Any instream work should be directed in the areas above the confluence of Little

Canyon Creek. A strict long term riparian enhancement program (riparian vegetation) would be developed to provide stream shading and thus reduce water temperatures to more acceptable levels. Further enhancement of the riparian zone would be accomplished by exclusion of livestock from stream banks, and bank stabilization by headsloping and/or placement of riprap and logs in areas where excessive erosion and bank cutting is occurring.

Predicted Results:

1. Augment low flow periods.
2. Reduce high summer stream temperatures.
3. Improve instream cover through added stream flow.
4. Aid in water storage during peak runoff thus reducing runoff and soil erosion potential.
5. Increase pool habitat.
6. Reduce points of erosion.

Specific Activities:

1. Water storage
2. Log K-dams or check dams
3. Large boulders or gabions in upper middle stretch
4. Fencing of stream areas
5. Headsloping and/or riprap and logs

Land ownership:

Water rights:

LITTLE CANYON CREEK

Problem: Low summer stream flow: lack of instream cover; nitrate problems in upper section; annual stream flow variation in lower stretches; siltation.

Little Canyon Creek experiences very low summer flow, which adversely affects water temperatures. Little Canyon Creek. also undergoes extreme fluctuations in annual stream flow variations in the lower reaches. As such, it supports extremes from spring runoff to summer low flows which limit instream fishery resources. High erosion potential may also occur because of logging-and grazing problems in the drainage.

Solution: A reservoir for water storage in the headwaters would augment flow. Flow augmentation could have a considerably positive effect in enhancing steelhead populations by . reducing high stream temperatures and increasing instream salmonid cover. Water storage in the headwater areas would have to take into account sewage effluent being released by the town of Nezperce. Instream enhancement would improve instream cover and increase the amount of overyearling habitat. These should be directed from the upper middle stretches downstream to avoid poor water quality conditions in the upper drainage. This alternative does not address the problem of high temperature. Since there are good riparian areas in the lower stretches, concurrent riparian enhancement options are not provided.

Predicted Results:

1. Augment low flow periods.
2. **Reduce high summer stream temperatures.**
3. **Instream cover improvement.**
4. **Reduce runoff and soil erosion potential due to water storage during peak runoff.**
5. **Increase pool habitat.**
6. **Reduce points of erosion.**

Specific Activities:

1, Water storage reservoir

3, Log K-dams or check dams

3. Large boulders or gabions

Land Ownership:

Water Rights:

LAPWAI CREEK SYSTEM

LAPWAI CREEK

Problem: Extreme annual stream flow variation; low-summer flows; high summer water temperatures; lack of instream cover.

Lapwai Creek, in general, provides poor to marginal anadromous fish habitat. Highway 95 parallels the creek for the majority of its length, resulting in excessive stream channelization and stream bank stabilization. Department of. Health and Welfare noted that water quality conditions were marginal with frequent focal coliform violations, and seasonally high turbidity, suspended sediment and nutrient concentrations. Irrigation withdrawal further reduced summer low conditions in the lower stretch of Lapwai Creek.

Solution: Enhancement efforts should integrate multi-concept measures to address habitat deficiencies. Construction of a storage reservoir in the headwater of Lapwai Creek would augment low flow periods, improve high summer stream temperatures, through added flow improve instream habitat, and aid in water storage during peak spring runoff thus reducing runoff and soil erosion potential.

Lapwai Lake is a 104 surface acre lake located in a state park in the headwaters of Lapwai Creek. The Lake is currently managed for a resident salmonid fishery through hatchery planting. even though the lake currently is managed in a recreational park atmosphere, it may have some potential as a source of water for flow augmentation. Construction of log K-dams or check dams would increase instream cover and also aid in sediment trapping. Installation of large boulders or gabions as wing deflectors would help create deeper pools, help scour out undercut banks, and serve to reduce points of bank erosion. Bank erosion should be controlled by headsloping and/or placement of riprap and logs in areas where excessive erosion and bank cutting is occurring. Revegetation of denuded stream banks and excluding livestock from the streambed would also control erosion and sediment load.

Predicted Results:

1. Decrease variation in annual streamflows.
2. Decrease summer water temperatures.
3. increase instream cover and habitat.
4. Increase pool habitat.
5. Reduce sediment.

Specific Activities:

1. Storage reservoir
2. Large boulders or gabions

SWEETWATER CREEK

Problem: Low summer stream flows: annual stream flow variation; high summer water temperatures: siltation; and lack of instream cover.

Sweetwater Creek is affected by a water diversion dam which diverts approximately 17 cfs of water into a canal that feeds into Manns Lake. Diversion of water into this canal by the Lewiston Orchards Irrigation District is the major cause of low summer stream flow and the ensuing problems related to that and annual stream flow variation. Moderate to heavy grazing practices cause elevated siltation levels. Several irrigation pumps withdraw water from an already diminished stream flow and septic tank leakage into the creek may possibly occur.

Solution: The Lewiston Orchard Irrigation District water diversion located on Sweetwater Creek can divert the majority of surface flow thus dewatering extensive areas of the stream. Any enhancement measures undertaken should take the water diversion into account. Construction of a water storage reservoir in the headwaters of Sweetwater Creek would augment flow, reduce high summer temperatures, improve instream habitat, and reduce run-off and soil erosion potential. Instream cover would aid in sediment trapping. Instream devices such as large boulders or gabions as wing deflectors would help create deeper pools, scour out undercut banks and serve to reduce points of bank erosion. Further enhancement of the riparian zone would be accomplished by exclusion of livestock from stream banks, bank stabilization by headsloping and/or placement of riprap and logs in areas where excessive erosion and bank cutting occurs, and revegetation of denuded and/or headsloped areas.

Predicted Results:

1. Decrease variation in annual stream flows.
2. Decrease summer stream temperatures.
3. Increase instream cover and habitat.
4. Increase pool habitat.
5. Reduce points of erosion.

Specific Activities:

1. Water storage reservoir
2. Log K-dams or check dams
3. Large boulders or gabions
4. Fencing of stream areas
5. Headsloping and/or riprap and logs
6. Revegetation

Land ownership:

Water rights:

WEBB CREEK

Problem: Low summer stream flow; high summer stream temperature; reduced instream cover: heavy siltation.

Soldiers Meadow Reservoir, located in the upper drainage, is a water storage facility for the Lewiston Orchards Irrigation District. The diversion structure can essentially dewater the stream under summer low flow conditions. Webb Creek flows through a canyon area for the majority of its length and has extensive roads, in the upper drainage, causing siltation problems.

Solution: Any measures undertaken to improve anadromous salmonid poupulations or supporting habitat must consider the Lewiston Orchard Irrigation District water diversion structure. Construction of a water storage reservoir in the headwaters of Webb Creek would augment low flow periods, improve high summer stream temperature, improve instream habitat through added flow, and aid in water storage during peak spring runoff thus reducing runoff and soil erosion potential. Sediment trapping and increased instream cover would result from construction of log K-dams or check dams. Instream devices (large boulders or gabions as wing deflectors) would create deeper pools, help scour out undercut banks, and serve to reduce points of bank erosion. Further enhancement of the riparian zone would be accomplished by exclusion of livestock from stream banks, bank stabilization by headsloping and/or placement of riprap and logs in areas where excessive erosion and bank cutting occurs, and revegetation of denuded and/or headsloped areas.

Predicted Results:

1. Decrease variation in annual stream flows.
2. Decrease summer stream temperatures.
3. Increase instream cover and habitat.
4. Increase pool habitat.
5. Reduce siltation.
6. Reduce points of erosion.

Specific Activities:

1. Water storage reservoir
2. Log K-dams or check dams
3. Large boulders or gabions
4. Fencing of stream areas
5. Headsloping and/or riprap and logs .
6. Revegetation

Land ownership

Water rights:

MISSION CHEEK

Problems: Heavy siltation; low summer stream flows: annual flow variations; high summer stream temperatures; low instream cover.

Logging, roading, grazing, and agricultural practices have had negative impacts on the habitat quality of Mission Creek. Extremely high siltation levels, resulting from these practices, have affected quality of spawning gravels and insect producing habitat. Several barriers to migration also exist. There is a low amount of riparian vegetation which causes high stream temperatures. Much of the lower stream has been channelized and irrigation withdrawals also exist in this lower section.

Solution: Stabilization of extremely high erosive areas will be a critical component of the potential enhancement options. Existing conditions of high sediment loads in bottom substrates should be addressed in conjunction with instream cover options to trap and/or eliminate as much sediment as is practical. Construction of a water storage reservoir in the headwaters of Mission Creek would augment low flow periods, improve high summer temperatures, improve instream habitat through added flows, and aid in water storage during peak spring runoff thus reducing runoff and soil erosion potential. Sediment trapping and increased instream cover would result from construction of log K-dams or check dams. Large boulders or gabions as wing deflectors within the stream would create deeper pools, help scour out undercut banks, and serve to reduce points of bank erosion. Further enhancement of the riparian zone would be accomplished by exclusion of livestock from stream banks, bank stabilization by headsloping and/or placement of riprap and logs in areas where excessive erosion and bank cutting occurs, and revegetation of denuded and/or headsloped areas.

Predicted Results:

1. Decrease variation in annual stream flows.
2. Decrease summer stream temperatures.
3. Increase instream cover and habitat.
4. Increase pool habitat.
5. Reduce siltation.
6. Reduce points of erosion.

Specific Activities:

1. Water storage reservoir
2. Log K-dams or check dams
3. Large boulders or gabions
4. Fencing of stream areas
5. Headsloping and/or riprap and logs
6. Revegetation
7. Woody debris-depended on availability

Land ownership:

Water rights:

COTTONWOOD CREEK

Problem: Low summer flows; extreme fluctuation in annual stream flow variation; high summer stream temperatures; lack of instream cover.

Some stretches of Cottonwood Creek have been impacted by grazing and logging activities. In these areas there is considerable silt deposition which clogs spawning gravels and reduces total available spawning substrate. A dairy operation is also located adjacent to the stream. There is evidence of high runoff and flood damage.

Solution: Substantial potential exists for anadromous salmonid enhancement in Cottonwood Creek. Since flow and temperature related problems are the most critical issues, flow augmentation would be the primary enhancement measure. Construction of a water storage reservoir in the headwaters of Cottonwood Creek would augment low flow periods, improve high summer stream temperatures, improve instream cover through added flow, and aid in water storage during peak spring runoff thus reducing runoff and soil erosion potential. This option would also open up an additional seven to eleven miles of stream which is currently dewatered during low flow periods. Construction of log K-darns for increasing instream cover would also aid in sediment trapping. Installation of large boulders as wing deflectors will create deeper pools, help scour out undercut banks and serve to reduce points of bank erosion. Bank erosion would be controlled by headsloping and/or placement of riprap and logs in areas where excessive erosion and bank cutting is occuring. Revegetation of denuded stream banks and excluding livestock from the stream banks would also control erosion and sediment load.

Predicted Results:

1. Decrease variation in annual stream flow.
2. Decrease summer water temperatures.
3. Increase instream cover and habitat.
4. Increase pool habitat.
5. Reduce sediment.
6. Reduce points of erosion.

Specific Activities:

1. Storage reservoir

i. Log K-dams

3. Large boulders as wirg deflectors
4. Fencing of stream areas
5. Headsloping and/or riprap and logs
6. Revegetation.

Land ownership:

Water rights:

BEDROCKCREEK

Problem: Extreme annual streamflow variation; low summer flow; and lack of pool habitat.

The Bedrock Creek watershed is characterized by extremely steep slopes which have sparse vegetation on the southern exposures. The upper reaches of Bedrock Creek flow through agricultural land and lack well developed riparian vegetation. These two conditions result in extreme variation in annual stream flow; extremely high spring run off and low flow during the summer months. The extreme spring runoff has caused most debris, boulders, and other instream structures to be washed out of the system. Thus, the stream has developed flood plains in the middle and low reaches which inhibit riparian vegetation growth that would shade the stream at the reduced flow stage.

Solution: Riparian enhancement on agricultural land in the upper watershed would decrease the rate of water runoff in the spring. Additional riparian enhancement is needed in the vicinity of Louse Creek. Since the watershed has a very steep gradient, stream flow velocity in Bedrock Creek can be controlled best by placing instream deflectors such as log and boulder dams, boulder clusters, woody debris such as stumps and logs, etc., throughout the stream system. These structures would also contribute to the development of instream cover. After the conditions in the upper reaches have been addressed, the lower reaches of Bedrock Creek can be rechannelized (meandering path) and riparian vegetation can be developed along the new stream banks to shade the stream and provide overhead cover.

Predicted results:

1. Decrease annual variation in flow.
2. Increase low summer flow.
3. Increase cover for juvenile salmonids.
4. Increase pool habitat.

Specific activities:

1. Approximately 8 km of riparian enhancement.
2. Placement of approximately 176 (every SO m) velocity check structures.
3. Rechannelize approximately 1.2 km of stream in the lower reaches.

Land ownership:

100% private

COTTONWOOD CREEK S.F. TRIBUTARY

Problem: Extreme annual stream flow variation; lack of pool habitat; high summer water temperatures; lack of instream cover; and sedimentation.

Cottonwood Creek has poorly developed riparian vegetation throughout the entire system. This condition results in extreme variation in stream flows; high spring runoff and low summer flow. Farmland in the upper reaches of Cottonwood Creek have very high rates of soil erosion. Due to the high energy and scouring action during periods of peak runoff, little pool habitat is available in the lower 10.4 km of stream. The presence of a 9.8 m of falls at SK10.4 completely prohibits any upstream movement by anadromous fish beyond this point.

Solution: Major rejuvination of Cottonwood Creek will be necessaryto reestablish anadromous fish runs. Extensive riparian enhancement is needed along the entire length of stream, particularly in the upper reaches of agricultural land. The lower 10.4 km are eroded by floods leaving an established floodplain. Rechannelization with bank reinforcement and riparian rejuvenation of vegetation isnecessary in the lower 10.4 km. Instream deflectors and dam and debris placement is recommended to increase cover for juvenile salmonids.

Predicted results:

1. Decrease water temperatures.
2. Increase pool habitat.
3. Decrease annual stream flow variation.
4. Decrease sedimentation.
5. Increase instream cover.

Specific activities:

1. Approximately 25.7 'km of riparian enhancement.
2. Silt collection basins (15) on key tributaries.
3. Check dam construction and pool excavation for the lower 6.5 km.

Land ownership:

99X Private

1% Nez Perce Tribe

Water rights:

0.91 cfs

JIM FORD CREEK

Problem: Moderate annual flow variation; lack of instream cover; high water temperatures; and lack of pool habitat.

The major problem confronting Jim Ford Creek is its shallow channel, which expands laterally with increased flow. Thus, during periods of low flow, the channel has very restricted riparian cover or overstory. This condition is prevalent in the middle reach of the stream. Since scouring does occasionally take piace during portions of high flow, instream cover (boulders, debris, etc.) is limited.

-Solution: The habitat above Jim Ford falls is heavily silted and prone to erosion. Riparian enhancement on all tributaries on the stream is recommended. In addition, bank stabilization measures are needed to curb erosion. The stream below the falls, which is available to anadromous fish, is prone to flooding. Velocity check structures and adjacent pool habitat are recommended from this point to the mouth. The area where floodplains exist, rechannelization of the stream, bank stabilization, and enhancement of the riparian zone is recommended.

Predicted results:

1. Decrease sedimentation in the headwaters.
2. **Decrease** water temperatures.
3. **Increase** pool habitat.
4. Decrease in peak flows in velocities.

Specific activities:

1. Riparian enhancement for 11.2 km.
2. Construction of 40 pools.

Land ownership:

15% Nez Perce Tribe

22% State Land

63% Private

Water Rights:

13.77 cfs

13 cfs (Grass Hopper Creek)

LAWYERS CREEK

Problem: Low summer stream flow; annual stream flow variation; high summer stream temperatures: lack of instream cover: heavy siltation; eroding banks.

Grazing at moderate to heavy levels occurs in many stretches of -Lawyers Creek causing chronic erosion/siltation potential. Lower reaches of Lawyers Creek have been channelized and banks re-stabilized also increasing erosion/siltation potential.

Solution: Construction of a storage reservoir in the headwaters of Lawyers Creek would augment low flow periods, improve high summer stream temperatures, improve stream habitat through added flow, and aid in water storage during peak spring runoff thus reducing runoff and soil erosion potential. Construction of log K-dams or check dams would also increase instream cover and aid in sediment trapping. Installation of large boulders or gabions as wing deflectors would help create deeper pools, help scour out undercut banks, and serve to reduce points of bank erosion. Bank erosion would also be controlled by head-sloping and/or placement of riprap and logs in areas where ive erosion and bank cutting is occurring. Revegetation of denuded stream banks and/or headsloped areas and excluding livestock from the stream banks would also control erosion and sediment load.

Predicted results:

1. Decrease variations in annual Stream flows.
2. Decrease summer water temperatures.
3. Increase instream cover and habitat.
4. Increase pool habitat.
5. Reduce sediment.
6. Reduce points of erosion

Specific activities:

1. Storage reservoir
2. Log K-dams or check dams
3. Large boulders or gabions.
4. Fencing of stream areas.
5. Headsloping and/or riprap and logs.
6. Revegetation.

Land ownership:

100% private

Water rights:

WILLOW CREEK

Problem: High summer stream temperatures; lack of instream cover ; bank stability; low stream flows: heavy siltation.

Grazing practices are at moderate to heavy levels causing heavy siltation and turbidity. Adding to this is the presence of high cut banks that have high erosive potential.

Solution: Construction of a storage reservoir in the headwaters of Willow Creek would augment low flow periods, improve high summer temperatures, improve stream habitat through added flow, and aid in water storage during peak runoff thus reducing run-off and soil erosion potential. Construction of K-dams or check dams would also increase instream cover and aid in sediment trapping. Installation of large boulders or gabions as wing deflectors would help create deeper pools, help scour out under-cut banks, and serve to reduce points of bank erosion. Bank erosion would also be controlled by headsloping 'and/or placement of riprap and logs in areas where excessive erosion and bank cutting is occurring. Revegetation of denuded stream banks and/or headsloped areas and excluding livestock from the stream banks would also control erosion and sediment load.

Predicted results:

1. Decrease variations in annual stream flow.
2. Decrease summer water temperatures.
3. Increase instream cover and habitat.
4. Increase pool habitat.
5. Reduce sediment.
6. Reduce points of erosion.

Specific activities:

1. Storage reservoir

2. Log K-dams or check dams

3. Large boulders or gabions

4. Fencing of stream areas

5. Headsloping and/or riprap and logs

6. Revegetation

Land ownership:

100% private

Water rights:

BIG CREEK

Problem:. Moderate variation in annual stream flow; partial migration barriers.

Major enhancement to decrease variation in annual stream flow is probably not economically feasible since this stream has limited access in the canyon area. However, development of riparian vegetation can be conducted in the upper reaches of agricultural land. There are a series of small falls within k 0.4 on Big Creek, the largest of which is a natural rock formation. In addition, a small falls was created as a result of railroad trestle construction. Since these barriers are not complete migration obstructions, they should not be high priority.

Predicted results:

1. Decrease variation in annual stream flow.
2. Improve upstream passage.

Specific activities:

1. Approximately 4.8 km of riparian enhancement.
2. Remove or modify several partial passage barriers within approximately 3.2 km of stream.

Land ownership:

100X private

BUTCHER CREEK

Problem: Extreme annual stream flow variation; low summer flow; high summer water temperatures; and lack of pool habitat.

Because of excessive grazing, the entire length of Butcher Creek has poor riparian vegetation, principally in the upper and lower reaches. This condition is a principal cause for extreme variation in annual stream flow. High spring runoff has scoured the middle and lower reaches of the stream leaving rocky floodplain areas and little pool habitat area. The lack of shading has resulted in high water temperatures, especially toward the stream mouth.

Solution: Extensive riparian enhancement is necessary in the lower 0.3 km of stream and in the headwaters, which flow through agricultural land. Instream deflector structures, such as log and rock dams, boulder groups, and woody debris, are needed in the middle and lower reaches of the stream to reduce water velocity and provide instream cover. The lower reach, including the floodplain, needs rechannelization (meanders) and bank stabilization, in addition to the aforementioned riparian enhancement.

Predicted results:

1. Decrease variation in annual stream flows.
2. Decrease summer water temperatures.
3. Increase cover and pool habitat.

Specific activities:

1. **Approximately 8 km of riparian enhancement.**
2. Placement of approximately 50 instream deflectors.
3. **Stream channelization of 0.8 km.**

Land ownership:

190X private

Water rights:

0.33 cfs

CATHOLIC CREEK

Problem: Extreme annual stream flow variation; low summer flow; lack of instream cover; eroding banks; and lack of Pool habitat.

Catholic Creek is subject to excessive grazing activity in the lower reaches and intensive agricultural activity in the extreme headwaters. The middle section of the creek is within a steep canyon with well developed riparian vegetation.

Solution: Riparian enhancement is needed in the uppermost 4.8 km of stream in agricultural land and the lower 3.2 km where grazing activity is present. Instream structures and woody debris are recommended for the lower 4.8 km of stream. In addition pool construction aside from the instream structures is advised.

Predicted results:

1. Decrease in peak runoff.
2. Increase instream cover.
3. Stabilize banks.
4. Increase pool habitat.

Specific activites:

1. Approximately 6.4 km of riparian enhancement.
2. Placement of 90 instream check structures at points of high water velocity.
3. Construction of 10 pools within the lower 4.8 km of stream.

Land ownership:

100% private

PINE CREEK

Problem: Pine Creek is in fairly good condition. Grazing by cattle is moderate and does not seem to adversely affect the stream. Only 0.8 km section at SK 2.4 shows signs of floodplain activity. The lower 3.2 km of Pine Creek lacked sufficient instream cover for juvenile steelhead.

Solution: Riparian enhancement is recommended for the 0.8 km miles section at SK 2.4 and additional woody debris, pool excavation and log or rock dam structures is recommended for the lower 3.2 km of stream.

Predicted results:

1. Increase instream cover for juvenile salmonids.
2. Decrease erosion and water temperatures below SK 2.4.

Specific activities:

1. Riparian enhancement - 0.8 km
2. Woody debris - As available
3. Log or rock structures - 32 km
4. Pool excavation - 16.1 km

Land ownership:

98X Private

2% Nez Perce Tribe

SALLY ANN CREEK

Problem: Sedimentation; and extreme annual stream flow variation.

The section of Sally Ann Creek below the falls (SK O.S)is in fairly good condition. High spring runoff and excessive sedimentation in the lower end is probably a function of land use practices in headwater areas.

Solution: Riparian enhancement on Sally Ann Creek is recommended above the falls. Check dams or instream deflectors should be locater! in side tributaries to trap high inputs of sediment.

Predicted results:

1. Decrease peak runoff.
2. Decrease sedimentation.

Specific activities:

1. Riparian enhancement - 3.2 km
2. Side channel defelctors - 16.1 km

Land ownership:

10% State land

90% Private

Water rights:

0.58 cfs

WALL CREEK

Problem: Lack of instream cover; sedimentation; moderate annual stream flow variation.

The aquatic habitat found in Wall Creek is generally of high quality. The exceptions are found where the creek flows through pasture land at approximately SK 3.2. Riparian vegetation in general is good.

Solution: Riparian enhancement is recommended in the vicinity of SK 3.2. Sediment collectors should be located in side drainages to prevent the input of sediment from nearby logging operations and grazing activities. Additional instream cover for juvenile salmonids can be provided with the addition of boulder groups, check dams and woody debris in the upper reaches of the stream (cutthroat trout only).

Predicted results:

1. Increase cover for juvenile salmonids.
2. Decrease sedimentation during peak runoff.
3. Decrease peak runoff.

Specific activities:

1. Sediment collectors located on key tributaries (20).
2. **Additional instream cover structures in middle reach(25 structures).**

Land ownership:

7% State

93% Private

Water rights:

0.46 cfs

THREE MILE CREEK

Problem: Extreme annual stream flow variation; high water temperature; lack of instream cover; sedimentation; and lack of pool habitat.

The Three Mile Creek drainage is generally in poor condition. Sewage effluent from the town of Grangeveille, Idaho flow into this system high in the watershed. Riparian vegetation throughout the upper watershed is degraded due to grazing and agricultural activites.

Solution: Extensive riparian enhancement is recommended in the upper Three Mile Creek watershed. Check dams constructed at strategic locations where sediment innut is greatest would reduce sediment load to the lower sections of the stream, which are potentially usable by anadromous salmonids. The lower 9.5 km of Three Mile Creekrequires extensive pool construction, which could be maintained with either check dams or boulder groups. In locations where floodplains now exist rechannelization (meanders) is recommended with subsequent riparian enhancement to establish new banks and riparian zones.

Predicted results:

1. Increase pool habitat and instream cover in the lower 9.5 km of stream.
2. Decrease water temperatures and sedimentation.
3. Decrease peak runoff.

Specific activities:

1. Rechannelization 2.4 km
2. Riparian vegetation - 24.1 km
3. Check dams - (sedimentation - 25)
4. Check dams -(Pool construction - 100)

Land ownership:

1007, Private

Water rights:

1.24 cfs

SIXMILE CREEK

Problem: Low summer stream flows, high summer stream temperatures; annual stream flow variation: lack of instream cover: heavy siltation; light reparian vegetation.

General problems impacting the stream are low summer stream flows, high summer stream temperatures, annual stream flow variation and lack of instream cover. Logging road construction and timber harvest activities have created high siltation levels. Stream channelization has occurred in some stream stretches.

Solution: Spring development or construction of a small water storage reservoir in the headwaters of Sixmile Creek would augment low flow periods, improve high summer stream temperatures, improve instream cover, and aid in reducing runoff and soil erosion potential. Construction of log K-dams or check dams would also increase instream cover and aid in sediment trapping. Installation of large boulders or gabions as wing deflectors will create deeper pools, help scour out undercut banks, and serve to reduce points of bank erosion. Bank erosion would also be reduced by exclusion of livestock from stream banks, headsloping and/or placement of riprap and logs in areas where excessive erosion and bank cutting is occurring, and revegetation of denuded stream banks and/or headsloped areas.

Predicted results:

1. Flow augmentation.
2. Stream temperature improvement.

3. Instream cover improvement.

4. Reducing runoff and soil/bank erosion.

5. Sediment reduction.

6. Increase pool habitat.

7. Improve riparian zone.

Specific activities:

1. Water storage reservoir or spring development

2. Log K-dams or check dams

3. Large boulders or gabions

4. Fencing of stream areas

5. Headsloping and/or riprap and logs to stabilize banks

6. Revegetation of denuded and/or headsloped stream banks

Land ownership:

Water rights:

SEVENMILE CREEK

Problem: Low summer stream flow; annual stream flow variation; high summer stream temperature; instream cover; high siltation; stream channelization.

Sevenmile Creek is paralleled by a highway for the majority of its length. General problems in the drainage are low summer stream flows, annual stream temperatures and lack of instream cover. High siltation and stream channelization were other areas of concern. Riparian vegetation was sparse due to highway development, and provided limited stream shading. This was not adequate in helping reduce elevated water temperatures in the creek.

Solution: Construction of a small water storage reservoir in the headwaters of sevenmile Creek would augment low flow periods, improve high summer stream temperatures, improve instream cover (through added flow), and aid in reducing runoff and soil erosion potential. Construction of log K-dams or check dams would also increase instream cover and aid in sediment trapping. Installation of large boulders or gabions as wing deflectors will create deeper pools, help scour out undercut banks, and serve to reduce points of bank erosion. Bank erosion would also be reduced by exclusion of livestock from stream banks, headsloping and/or placement of riprap and logs in areas where excessive erosion and bank cutting is occurring, and revegetation of denuded stream banks and/or headsloped areas.

Predicted Results:

1. Flow augmentation.
2. Stream temperature improvement.
3. Instream cover improvement.
4. Reduction of runoff and soil/bank erosion.
5. Sediment reduction.
6. Increase pool habitat.
7. Riparian zone improvement.

Specific Activities:

1. Water storage reservoir
2. Log K-dam or check dams.
3. Large boulders or gabions as wing deflectors
4. Fencing of stream areas
5. Headsloping and/or riprap andlogs to stabilize banks
6. Revegetation of denuded and/or headsloped stream banks

Land Ownership:

Water Rights:

TOM TAHA CREEK

Problem: Low summer stream flows; extreme fluctuation in annual stream flow; lack of instream cover: siltation; water velocity.

Riparian vegetation is sparse providing little stream shading. High erosion/siltation levels are also a concern with gravel roads paralleling the lower stream section and logging activity in the drainages. The relative small stream size facilitates enhancement measures.

Solution: Spring development or construction of a small water storage reservoir in the headwater; of Tom Taha Creek would augment low flow periods, improve instream habitat through added flow, and aid in water storage during peak runoff thus reducing runoff and soil erosion Potential. Instream habitat would also be improved by the installation of instream devices such as log K-dams or check dams. These will also aid in sediment trapping. Installation of large boulders or gabions will help scour out deeper pools. These would also augment the amount of overyearling rainbow-steelhead habitat present in Tom Taha Creek. Riparian enhancement would be accomplished by exclusion of livestock from stream banks, bank stabilization by placement of riprap and logs in areas where excessive erosion is occurring, and revegetation of denuded stream banks.

Predicted results:

1. Augment low flow periods.
2. Improve instream habitat.
3. Increase pool habitat.
4. Reduce runoff and soil erosion potential.
5. Sediment trapping.
6. -Bank stabilization..
7. Improve riparian zone.

Specific activitiesi _

1. Water storage reservoir or spring development
2. Log K-dams or check dams
3. Large boulders or gabions
4. Fencing of stream areas
5. Riprap and logs to stabilize banks
6. **Revegetation of denuded stream banks**

Land ownership:

Water rights:

CORRAL CREEK

Problem: Instream cover; lack of pool habitat; moderate annual stream flow variation.

Corral Creek is not as severely degraded as many streams on the Nez Perce Reservation. The lower 3.2 km show signs of grazing activity while the upper reaches have been logged.

Solution: Since the discharge from Corral Creek is small, adult fish can probably navigate only the lower 3.2 km Therefore, it is recommended that any enhancement be limited to this area. Instream structures, and debris such as stumps and logs will provide additional cover and pool habitat. Pool construction is possible in many locations though the bedrock layer is not very deep.

Predicted results:

1. Additional instream cover.
2. Additional pool habitat.
3. Reduce stream velocity (energy).

Specific activities:

1. Approximately 35 instream structures.
2. Pool construction within 8 km stream section.
3. Debris addition for 3.2 km.

Land ownership:

5% **State**

15% Nez Perce Tribe

RABBIT CREEK

Problem: Cessation of flow to lower 4.0 km during late summer months; and lack of flow.

Solution: As the watershed of Rabbit Creek is quite small, no enhancement activities are recommended for this stream.

Water rights:

0.04 cfs

MAGGIE CREEK

Problem: Extreme annual stream flow variation; high water temperatures; lack of instream cover; bank erosion; sedimentation; and lack of pool habitat.

High spring runoff and the related erosion and scouring activity are the primary problems on Maggie Creek. Scourins has displaced much of the *woody* debris and filled in natural pool habitat. Lack of overstory and riparian vegetation in the lower reaches has led to high summer water temperatures.

Solution:. Check dams, instream deflectors, and related pool habitat enhancecent is recommended for the lower 12.9 km of Maggie Creek. Enhancement of stream side riparian vegetation in the lower 3.2 km of stream is greatly needed. Intermittent riparian enhancement is recommended for the next 9.6 km in locations where floodplains exist. The addition of anchored woody debris (i.e., stumps, logs) is recommended throughout the system. Pool construction is especially needed in the lowest 3.2 km of stream.

Predicted results:

1. Additional instream cover.

2. Additional pool habitat.

3. **Reduce stream velocity (energy).**

4. Decrease water temperatures.

5. Reduce erosion and sedimentation.

Specific activites:

1. Pool habitat construction - 3.2 km (20).

2. K dams, log structures - 30.

3. Riparian vegetation - 9.6 km

Water rights:

0.25 cfs

JACKS CREEK

Problem: Low summer stream flows: annual stream flow variation high summer stream temperatures: lack of instream cover.

Jacks Creek is relatively short and of small size. Habitat parameters which are most in need of improvement are low summer stream flows, annual stream flow variation, high summer stream temperatures and lack of instream cover. Substantial potential exists for anadromous salmonid enhancement in Jacks Creek.

Solution: Development of upstream spring areas may possibly be a method to supplement low flow periods, especially in a smaller stream-such as Jacks Creek. Flow augmentation via reservoir storage would also improve flow, temperature and instream cover habitat problems. Due to small size and relatively short stream mileage, a small storage facility could substantially improve rainbow-steelhead numbers. Construction of log K-dams or check dams would increase instream cover for overyearling steelhead and also aid in sediment trapping. Installation of large boulders or gabions as wing deflectors would create deeper pools and serve to reduce points of bank erosion.

Predicted Results:

1. Flow augmentation.
2. Stream temperature improvement.

3. Instream cover improvement.

4. Sediment reduction.

5. Increase pool habitat.

6. Reduce bank erosion.

Specific Activities:

1. Water storage reservoir or upstream spring development

2. Log K-dams or check dams

3. Large boulders or gabions as wing deflectors

Land ownership:

Water rights:

LITERATURE CITED

Binns, N.A. and F.M. Eiserman. 1979. Quantification of fluvial trout habitat in Wyoming. Transactions of the American Fisheries Society 108:215-228.

Bjornn, T.C., M.A. Brusven, M.P. Molnan, J. H. Milligan, R.A. Klamt, E. Caho, and C. Schaye. 1977. Transport of granitic sediment in streams and its effects on insects and fish. Bulletin Number 17. Forest, Wildlife, and Range Experimental Station, University of Idaho, Moscow, Idaho. 43 pages.

Bovee, K.D. 1978. Probability of use criteria for the family salmonidae. Instream Flow Information Paper Number 4. Cooperative Instream Flow Service Group, Western Energy and Land Use Team, Office of Biological Services, Fish and Wildlife Service, U.S. Department of the Interior. 78 pages.

Espinosa, F.A. 1975. Lolo Creek Fisheries habitat survey. Pierce Ranger District. Clearwater National Forest. Region 1.

________. 1984. Personal Communication.

Fuller, RX., J.H. Johnson and M.A. Bear. 1984. A biological and physical inventory of the streams within the lower Clearwater River Basin, Idaho. Annual report for the 1983 field season submitted to the Bonneville Power Administration. Department of Fisheries Resource Management, Nez Perce Tribe, Lapwai, Idaho. 206 pages.

Johnson, D.B. 1985. A biological and physical inventory of Clear Creek, Orofino Creek and the Potlatch River, tributary streams of the Clearwater River, Idaho. Annual report submitted to the Bonneville Power Administration. Department of Fisheries Resource Management, Nez Perce Tribe, Lapwai, Idaho. 29? pages.

Kucera, P.A., J.H. Johnson and M.A. Bear. 1983. A biological and physical inventory of the streams within the Nez Perce Reservation. A final report submitted to the Bonneville Power Administration. Department of Fisheries Resource Management, Nez Perce Tribe, Lapwai, Idaho. 150 pages.

Martin, D.M. 1976. Cooperative fisheries habitat survey. Idaho Department of Fish and Game and Nez Perce National Forest, U.S, Forest Service. 113 pages.

Platts, 1983. Methods for evaluating stream, Riparian and Biotic Conditions. Intermountain Forest and Range Experiment Station, Ogden, Utah, 84401. General Technical Report INT-138.

Seber, G.A.F. and E.D. LeCren. 1967. Estimating population parameters from catches large relative to the population. Journal of Animal Ecology. 36:631-643.

U.S. Bureau of Reclamation. 1984. Idaho anadromous fish habitat restoration. Appraisal Report. Bureau of Reclamation, U.S. Department of the Interior. 87 pages.

U.S. Forest Service. 1980 Fish habitat surveys and channel condition surveys. Clear Creek drainage (Unpublished manuscript of Nez Perce National Forest).

Zippen, C. 1958. The removal method of population estimation. Journal of Wildlife Management 22:82-90.