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The Fisheries Program Response to the Floods of the mid-1990's

Wash Creek Bridge, Fish Creek Watershed, Clackamas River, Oregon.

Mt. Hood National Forest

2001

Thank you to the employees of the Mt. Hood National Forest who contributed photographs and information for this report.

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Report by
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Introduction

In February 1996, the combination of record-breaking rain, warm temperatures and a deep snow pack led to severe flooding in northern Oregon and southwest Washington (Taylor 1996). On the Mt. Hood National Forest (the Forest) flood impacts were widespread. Roads and bridges were washed out, stream channels re-arranged and hillside debris torrents left acres of bare soil.

The February 1996 flood event was preceded in November 1995, and followed in January 1997, by smaller floods. This paper describes those storms, the aftermath of the storms, and the actions undertaken by employees of the Forest. Also documented is the special funding appropriated by the U.S. Congress to repair storm damages, and the resulting fish habitat and watershed restoration projects.

The February 1996 Storm

As described by Taylor (1996), the first precursor to a major flood in the Pacific Northwest is an unusually wet winter. At Government Camp on Mt. Hood, the normal precipitation October through January is 46 inches. In 1996, during the same period of time, there was 71 inches of precipitation. This was 155% of the normal amount, and accounted for a slightly higher than normal snowpack.

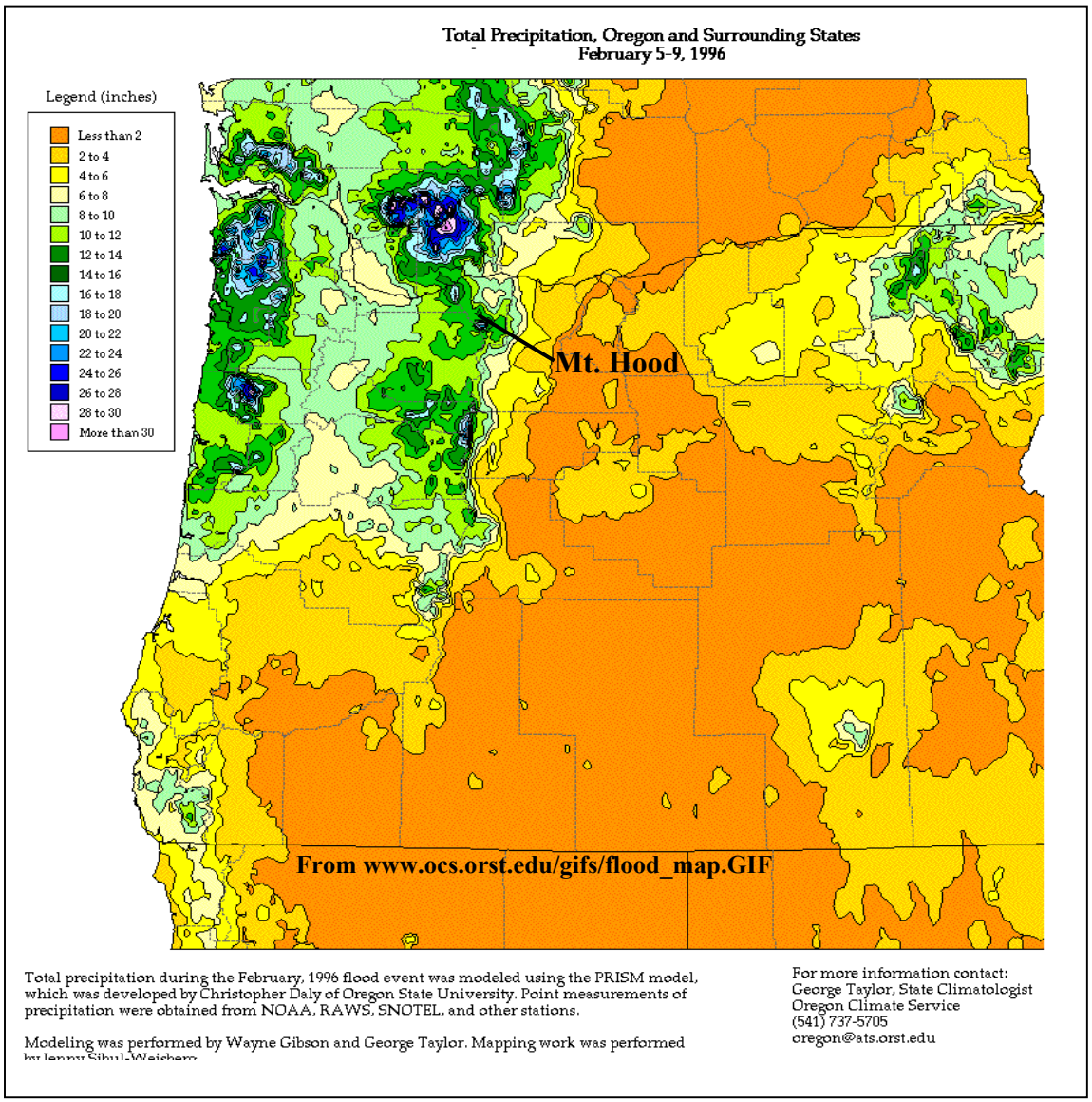
During the first week of February there was a major cold spell. Many Willamette Valley locations had low temperatures in the teens for four to five consecutive days. In eastern Oregon, many locations had low temperatures well below zero.

Then on February 6th, a strong tropical jet stream reached Oregon. This warm, very humid air mass brought record rainfall amounts to northern sections of the state (Map 1). Such tropical storms are somewhat common in the Pacific Northwest. This storm was unusual in its intensity and duration of three-four days. Four-day precipitation totals at recording stations in northern Oregon include:

- Government Camp – 11.3 inches
- Hood River – 7.5 inches
- Oregon City – 7.5 inches.

Storm intensity differed in major river basins, depending on elevation, snow pack, topography, the track of the storm and ground conditions. Across the Forest there was also a variation in storm intensity within each river basin.

Map 1. Total Precipitation February 5-9, 1996.



In addition to the wet conditions, temperatures rose and were unusually mild. In the Willamette Valley, nighttime lows in the mid-50's were common. The freezing level rose upward, to 7,000-8,000 feet. The warm rain and air temperatures quickly began to erode the snowpack. Total precipitation (rain and snowmelt) February 7-11 at collection sites around the Mt. Hood National Forest include:

- Sandy River at the Mt. Hood site – 14.7 inches (elevation 5,400 feet)
- Clackamas River at Peavine – 16.1 inches (elevation 3,500 feet)
- Hood River at Red Hill – 19.9 inches (elevation 4,400 feet)
- Bull Run at North Fork – 18.2 inches (elevation 1,060 feet)

Severity of a flood event is measured by recurrence interval, or odds an event could occur in a 100 years. For example, the odds of a 25-year flood event occurring is 4% in any given year, or about four times over the span of a 100 years. On the Mt. Hood National Forest, the November 1995 flooding was significant, but the February 1996 storm struck the west side of the Forest with ferocity, causing more severe flooding. Table 1 displays flood severity across the Forest. Individual watersheds within river basins may have experienced different, probably higher return intervals. For example, in the Bull Run watershed there are six stations, which record stream flow information, and the recurrence interval varied between 25 to greater than 100 years.

Table 1. Estimated flood recurrence interval for November 1995 and February 1996 at locations on the Mt. Hood National Forest.

Basin	Estimated Flood Severity or Return Interval	
	November 1995	February 1996
Mile Creeks	**N/A**	**25**
Sandy River	**25**	**>100**
Hood River	**5**	**25**
Bull Run River*	**10-25**	**25 - >100**
Clackamas River	**5-10**	**>100**

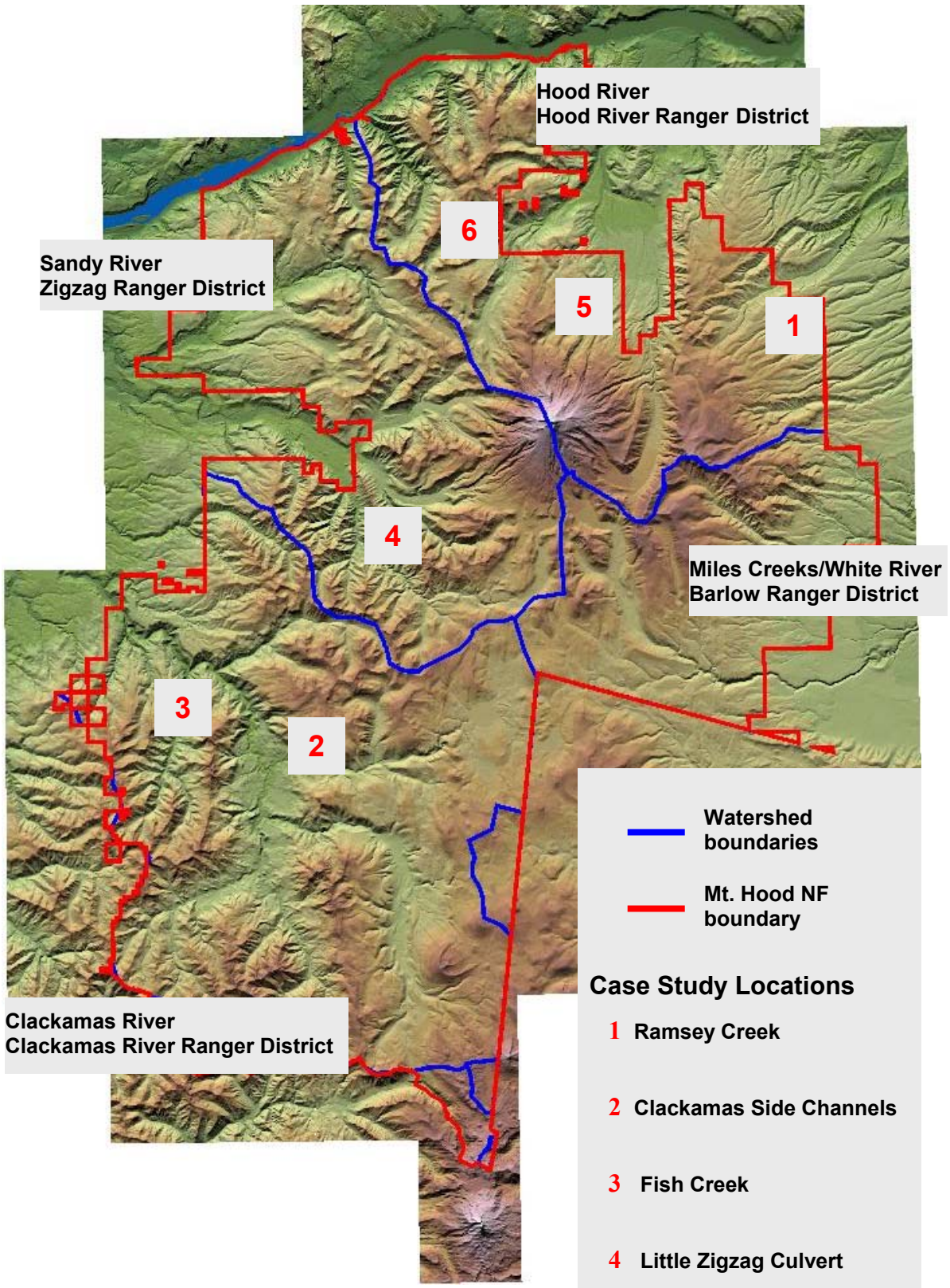
**There are six gaging stations in the Bull Run watershed.*

As flood waters receded, the storm of February 1996 was compared to the 1964 flood. In general, the flood stage of the February 1996 storm was less than in 1964. For example, at Estacada the Clackamas River crested at 18.4 feet in 1964, compared to 17.4 feet in 1996. One anomaly was on the Sandy River, where the crest in 1964 was 22.3 feet and in 1996 the crest was 22.6 feet. However, the flood of 1964 covered a greater geographic area, stretching from Northern California northward through most of Washington, and from the coast eastward to Idaho. The 1964 flood also began with much more low-elevation snow. For example, Portland Airport had 11 inches of snow on the ground when the warm rains began in 1964 (Taylor 1996).

Flood Impacts on the Mt. Hood National Forest

The Mt. Hood National Forest is organized into four ranger districts; Clackamas River, Zigzag, Hood River and Barlow. The ranger districts somewhat follow major river basin boundaries (Map 2). The four major river basins on the Mt. Hood National Forest are shown on Map 2-Mile Creeks/White River, Hood River, Sandy River and Clackamas River. Descriptions of storm damage are described by river basin. Discussion of funding, flood repair and restoration projects is organized by ranger district.

Map 2. Location of Major Sub-basins, Ranger Districts and Flood Repair Case Studies, Mt. Hood National Forest



On the Mt. Hood National Forest the greatest damage and change appeared to be in the Clackamas River basin. Highway 224 along the Clackamas River sustained considerable damage, requiring long-term re-routing of traffic at one detour. Two watersheds, Collawash and Fish Creek, sustained the majority of road damage. There were also extensive landslides in portions of the upper Clackamas River basin, damaging roads and trails. Landslides also introduced sediment and large wood into some stream channels. The majority of landslides occurred in the Fish Creek watershed, but landslides occurred in other geologically unstable watersheds such as the Collawash.

In the Clackamas River basin impacts to fish habitat varied. In one detailed study in Fish Creek and nearby Roaring River, overall pool-riffle ratios changed little, but some stream reaches changed radically (Shively et al. 1996). There was some movement of fish habitat structure. Some large wood moved within watersheds and some migrated into larger river systems.

In the Sandy River basin, there was a thorough evaluation of storm impacts in the Bull Run system completed by the Forest hydrology staff in the headquarters office (Steinblums 1997). The Bull Run watershed is unique in that it provides drinking water for the city of Portland. There were three small landslides initiated from areas of natural instability. Turbidity increased from stream channel scour. At the intake for the drinking water supply the turbidity peak was 9.5 NTUs. Maximum turbidity allowed for the unfiltered water supply system is 5 NTUs. This forced the city of Portland to use a backup well system for drinking water for four days.

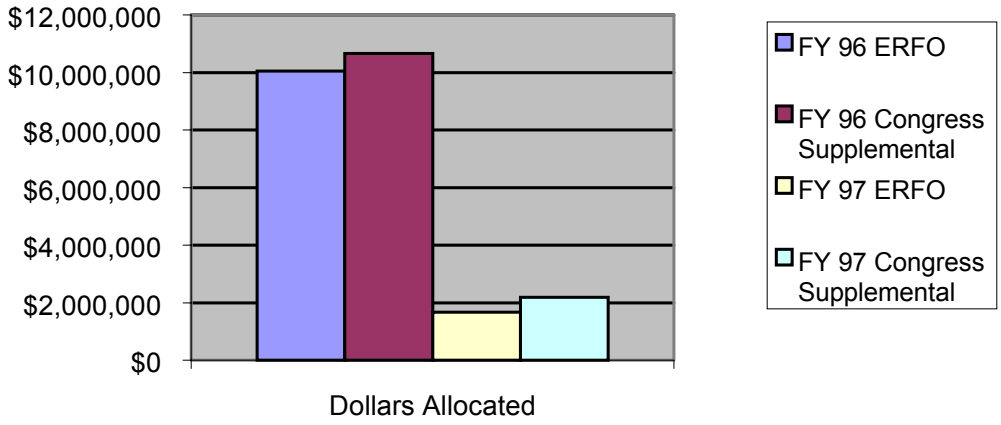
In other locations within the Sandy River basin there were a few landslides, substantial changes in stream geomorphology, and damage to several trails and roads. Overall, movement of large wood appeared to be minimal. There were reported changes in large wood position and distribution in some reaches.

On the east side of the Forest, storm impacts were localized and in some cases severe. Ground conditions were still frozen from the early February freeze. Water, unable to infiltrate the frozen ground, began sheeting off causing high, flashy flows. For example, the East Fork of the Hood River experienced major damage to trails and roads. There was large bedload movement and channel migration in the East Fork of the Hood River. Stream channel impacts were sometimes negative, with locations of extensive downcutting, bank erosion and downstream channel aggrading. Similar impacts occurred throughout locations on the east side of the Forest.

After initial reconnaissance of flood damage, ranger districts submitted proposals for flood repair projects. Most road repair was funded through the Emergency Repair Federally Owned (ERFO) roads program administered by the Federal Highways Administration. The U.S. Congress appropriated supplemental flood repair money, of which the Forest Service Washington D.C. Office received a share and distributed to the Region 6 Office. Across the Forest, 91 projects were submitted for funding to repair fish habitat, trails, campgrounds, and stabilize and reconstruct roads. After review by an interdisciplinary team, projects were ranked against each other, and then submitted to the Regional Office for funding. A similar process was used following the smaller flood in 1997.

Figure 1, below, displays the total funding received by the Forest for flood repair. The grand total received by the Forest was $24,550,000.

Figure 1. Flood Repair Funding



Flood repair and restoration dollars were allocated during two funding cycles, representing storm events occurring during different fiscal years. The magnitude and impacts of storms during 1995-1996 represent the bulk of flood repair funding. As indicated by Figure 1, a large proportion of flood repair funding was in the ERFO program. The majority of ERFO funding was used for road repair. In a few circumstances, after public comment and environmental analysis, ERFO funding was used to obliterate rather than repair roads. This was after analysis showed it was a more economical option and was determined to better meet resource management needs.

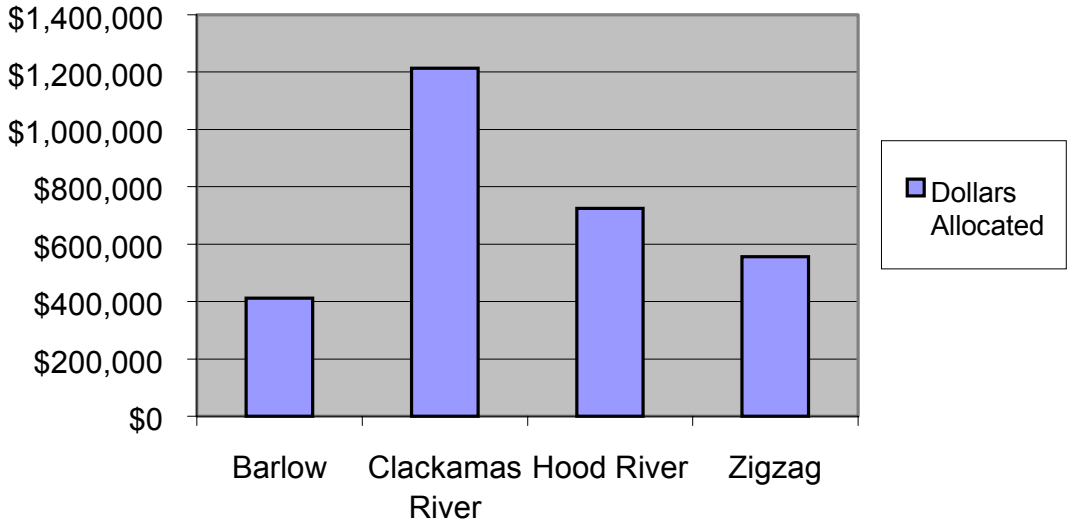
Fish Habitat Restoration

The implementation of the Northwest Forest Plan in 1994 initiated ecosystem management following watershed boundaries in the Pacific Northwest. The Northwest Forest Plan required watershed analysis documents, which evaluate watersheds at the fifth-field level and assess natural processes overlaid with historic, current, and future conditions.

Watershed analysis documents were the starting point for identification of potential management options and restoration needs for flood-damaged areas. Fish biologists and hydrologists assessed storm impacts in context with natural processes identified in watershed analysis. The broad landscape view, evaluated in the perspective of the natural disturbance cycle of forested landscapes, was the basis for proposed fish habitat and stream channel projects following the floods.

A portion of the funding displayed in Figure 1 was for fisheries restoration projects. Figure 2 displays the total dollar amount received by each ranger district in fiscal years 1996 and 1997 for fish habitat restoration projects. The total allocation on the Forest was $2,906,000 for fish habitat restoration. Project costs were derived from records provided by the ranger districts and Headquarters (Monitoring and Evaluation Report Fiscal Year 1998). Projects were implemented over the course of the following four years, finishing in 2001.

Figure 2. Fish Restoration Funding by Ranger District



Case Studies

Thirty-two fish habitat restoration projects initially were funded (Table 2). Projects varied in size and scope, from isolated small repairs such as Robin Hood Creek fish habitat at Hood River Ranger District, to massive watershed wide projects in Fish Creek on the Clackamas River Ranger District. Costs shown in Table 2 represent the initial request from each Ranger District. After further field reconnaissance projects were refined, and the dollars represented may vary slightly from the final true cost after planning, implementing and monitoring.

Six case studies are presented to display the variety of fish flood repair projects undertaken by biologists on the Forest. The locations of the six projects are identified on Map 2. The case studies represent a range of complexity of habitat repair projects across a broad geographic scale. The projects are presented in a similar format for the your reading ease. Additional information about each project can be found at the respective ranger district.

The case studies are:

- Ramsey Creek, Barlow Ranger District;
- Upper Clackamas Side Channels, Clackamas River Ranger District;
- Fish Creek, Clackamas River Ranger District;
- Little Zigzag River Culvert Replacement, Zigzag Ranger District;
- Clear Branch Creek, Hood River Ranger District; and
- Lake Branch, Hood River Ranger District.

Each case study gives a brief project overview, including a list of Endangered Species Act (ESA) listed fish. Overall goals of each project are listed, restoration actions undertaken, and a brief description of project monitoring.

Table 2. List of Projects and Forest Ranking (in parenthesis)

Project List and Forest Ranking		Project Estimate	Case Study (√)
Barlow Ranger District			
15 Mile Creek (75)		113,100	
Rock Creek (new) (funded in 97)		120,000	
Ramsey Creek (new) (funded in 97)		179,000	√
	District Total	$412,100	
Clackamas River Ranger District			
Fish Creek CR Fish (1D)		260,000	√
Collawash Buckeye Road 63 (3B)		5,000	
Collawash Hot Springs Fork (5A)		280,000	
Collawash Hugh Creek (5B)		11,000	
Collawash Pansy Creek (5C)		32,000	
Upper Clackamas Side Channel 1 (6A)		140,000	√
Upper Clackamas Side Channel 2 (6B)		140,000	
Oak Grove In Channel (10)		38,000	
Oak Grove CMP (31)		24,000	
Upper Clackamas Cub Creek Fish (33)		23,000	
Fish Creek CR Fish (1E)		170,000	
Collawash Ogre /6370 (3C)		5,000	
Road 46 wetland restoration		85,000	
	District Total	$1,213,000	
Hood River Ranger District			
Clear Branch #1 (7)		160,700	√
Clear Branch below dam (8)		74,000	
Clear Branch above pit (9)		176,800	
East Fork Levee (22)		38,000	
East Fork Fish Habitat (23)		218,000	
Robin Hood CR Fish Habitat (69)		6,500	
West Fork Habitat Maintenance (79)		6,700	
Lake Branch Fish Habitat (80)		45,100	√
	District Total	$725,000	
Zigzag Ranger District			
Cheeney Creek Restoration (15)		73,400	
Upper Bull Run River Restoration (17)		98,600	
Still Creek Inchannel Repair (29)		34,200	
Lower Bull Run River Restoration (58)		80,400	
Zigzag River Trib Inchannel Repair (61)		76,000	
Sandy River Trib Restoration (64.4)		63,300	
Sandy/Salmon ('98 & '99)(funded in 97)		60,000	√
Lolo Pass Utility ('00, '99, '98)(funded in 97)		70,000	
	District Total	$555,900	
	Forest Total	**$2,906,000**	

Ramsey Creek

Barlow Ranger District

Project Overview

This project addresses three miles of Ramsey Creek impacted by the flood of February 1996. Ramsey Creek downcut and straightened during the flood and contributed large pulses of sediment downstream. More than two miles of floodplain was abandoned. The natural surface road next to Ramsey Creek contributed fine sediments. Ramsey Creek has ESA threatened winter steelhead.

Goals

- Increase amount of in-channel and floodplain large wood.
- Reconnect the stream channel with the floodplain.
- Increase fish habitat complexity targeting different life stages.
- Increase gravel retention.
- Restore riparian area function.
- Decrease road related sediment.

Actions

- Transport and place wood throughout project area.
- Create log jams within the channel and floodplain with 1,100 logs over 2.9 miles of stream. 56 of 74 project sites were constructed in 2000.
- Stabilize, scarify and plant riparian area and streamside roadbed along Ramsey Creek.

Monitoring

- Establish forty-two photo points.
- Survey fourteen cross-sections.
- "Ready" map lowest one mile of project area.
- Conduct pebble count sites at 12 sites.
- Establish 3 miles of longitudinal profile.
- Inventory all large wood.
- Establish bank pins.

Before

After

Upper Clackamas Side Channels

Clackamas River Ranger District

Project Overview

The Wild and Scenic Clackamas River Plan has a management goal of restoring riparian habitats altered by the river-adjacent road. Fill from road construction was dumped in existing side channels. After the flood of 1996 an opportunity was identified to re-establish the connection of side channels with the river channel. There are two ESA listed fish, chinook and steelhead.

Goals

- Provide off–channel, slow water habitat for juvenile salmonids.
- Restore floodplain function to historic side channels.
- Provide high water energy dissipation.
- Provide habitat for other slow water, riparian dependent species.

Actions

- Create inlets and outlets at historic side channels by removing road surface and fill, and replacing with large, fish-friendly culverts.
- Excavate and remove fill from historic side channels. Re-establish native vegetation.
- Add large wood for fish habitat and hydraulic drops to increase dissolved oxygen levels.

Monitoring

- Two-way fish traps monitor movement of fish in and out of side channels. The traps also help determine which species are using the side channels.
- Snorkel side channels in summer to estimate juvenile fish populations.
- Establish photo points.

Before - fill site from road construction

After - reconnected to river and side channel excavated

Fish Creek

Clackamas River Ranger District

Project Overview

The Fish Creek project is one of the largest whole watershed restoration projects undertaken in the United States. Watershed restoration specialists determined aggressive actions were warranted to restore natural processes. The references section lists documents with the history and background of Fish Creek. There are two ESA listed fish, chinook and steelhead.

Goals

- Decrease frequency and magnitude of landslides to a more natural disturbance level.
- Accelerate recovery of upslope and riparian vegetation.
- Restore hydrologic function at road/stream crossings.

Actions

- Obliterate 74% (105 miles) of the roads in Fish Creek.
- Repair and storm proof 38 miles of road.
- Restore large wood movement and hydrologic function at over 300 road-stream crossings.
- Replicate intact fish habitat conditions in flood impacted areas.

Monitoring

- Inventory landslides.
- Monitor peak flows at gaging station.
- Continue vegetation-stocking surveys.
- Establish photo points.
- Continue long-term Pacific Northwest Research Station fish habitat and population monitoring.
- Monitor water temperature at 16 sites.

Road Obliteration/Stream Crossing

Fish Habitat Log Jam

Little Zigzag Culvert Replacement

Zigzag Ranger District

Project Overview

The Little Zigzag River is a glacial-fed stream supporting ESA listed steelhead. The original box culvert was built in the early 1950's. The culvert created a velocity and jump barrier. After evaluating interim design proposals, a prefabricated, modular bridge was installed, opening up ½ mile of habitat. Upstream, two more barrier culverts are slated for replacement.

Goals

- Review and analyze alternative designs for culvert replacement.
- Provide stable passage for juvenile and adult salmonids.
- Accommodate 100-year flood event.

Actions

- Install a prefabricated, modular bridge.
- Apply erosion control to disturbed areas.
- Minimize damage to residual riparian vegetation.

Monitoring

- Establish pre- and post-project implementation photo points.
- Establish species present upstream before and after culvert replacement.
- Continue effectiveness monitoring and determine if the structure meets criteria for fish passage.

Before

After (with erosion control)

Clear Branch

Hood River Ranger District

Project Overview

Clear Branch Creek of the Middle Fork of Hood River supports an isolated population of ESA listed bull trout. Three unique, valuable habitat areas were identified for restoration following the 1996 flood. They include an abandoned stream channel, a streamside rock quarry and adjacent road, and a stream channel with poor quality fish habitat. Total project length is about two miles.

Goals

- Restore stream flow to the abandoned channel, offering excellent fish habitat.
- Restore and reconnect to the stream channel areas of the quarry and road in the riparian area.
- Restore fish habitat to mainstem and adjacent floodplains of Clear Branch Creek using large wood.

Actions

Abandoned Channel

- Excavate sediment plug and remove 900 yards of material.
- Create a large log jam to back water into the channel.

Quarry Restoration

- Smooth quarry floor to replicate stream terrace.
- Large wood placed & conifers planted throughout site.

Stream Restoration

- Add large wood to stream.

Monitoring

- Microhabitat survey and night snorkeling to identify juvenile bull trout use.
- Survey before and after project implementation to determine fish densities.
- Physical habitat measurements including stream bed profile, shade survey, cross-sections, pebble counts and large wood surveys.

Quarry Before

Quarry After

Lake Branch

Hood River Ranger District

Project Overview

During the 1960's, Lake Branch Creek and its floodplain were "cleaned" of large wood. Over the decades, the stream channel has scoured and abandoned many side channels. Dominant stream substrate was gravel and is now boulder. After the February 1996 flood, several sites were identified for stream restoration. ESA listed steelhead occur in Lake Branch.

Goals

- Reconnect .4 mile of the channel to the floodplain.
- Create roughness elements that mimic natural structure.
- Increase spawning gravel.
- Slow high stage stream velocities.
- Decrease compacted skid roads and restore riparian areas.

Actions

- Fell large (up to 60" diameter) roadside hazard trees and move to project sites.
- Construct multi-log mainstem and off-channel structures.
- Obliterate old skid road.
- Move 20 windfall trees with attached root wads to project site.
- Use the windfall trees to construct five complex stream structures.

Monitoring

- Establish photo points.
- Evaluate feasibility of moving large wood (> 60" diameter) to project site.
- Evaluate use of log loaders and low boys to move and place large wood.
- Report findings in "Lake Branch Non-ERFO Flood Project Summary Report 2000".

Windfall Trees in Main Channel

Windfall Trees in Side Channel

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