Final Report:
2004 - 2005 South Humboldt Bay Coastal Resources Protection Project, Salmon Creek and South Fork Elk River Watersheds, Humboldt County, CA

California State Water Resources Control Board
Agreement #03-211-551

prepared for

California State Water Resources Control Board,
&
Bureau of Land Management

by

Pacific Watershed Associates
Arcata, California
(707) 839-5130
December 2005

Table of Contents

Section **Page**

Final Report
2004-2005 South Humboldt Bay Coastal Resources Protection Project
Salmon Creek and South Fork Elk River Watersheds, Humboldt County, CA

SWRCB Agreement #03-211-551-1
and BLM Agreement #BAA050001

INTRODUCTION

The 2004 – 2005 South Humboldt Bay Coastal Resources Protection Project was created and implemented to reduce sediment delivery from sites of current and future erosion that could degrade water quality in the South Fork Elk River and Salmon Creek Watersheds. Both of these watersheds drain directly into Humboldt Bay, and provide an extensive network of biologically important stream channels, stream estuary reaches and tidal areas. Specifically, the goals of the project were to treat a minimum of 20 sites and prevent at least 17,350 cubic yards (yd^3) of sediment from reaching the stream channel network in the Salmon Creek and South Fork Elk River watersheds. These goals would primarily be accomplished through the removal or decommissioning of old logging roads in the Headwaters Forest Reserve, managed by the Bureau of Land Management (BLM). The project was designed to reduce sediment related water quality impacts and benefit three salmonid species listed for protection under the Federal Endangered Species Act, as well as several other important sport and commercially valuable fish, shellfish, and migratory waterfowl. This project was funded by Proposition 13 and administered by the California State Water Resources Control Board (SWRCB), with partial matching funds provided by the BLM.

LOCATION

All the work carried out in this project took place within the Headwaters Forest Reserve in Humboldt County, California (Figure 1). The Headwaters Forest Reserve spans portions of two coastal watersheds, the South Fork Elk River and Salmon Creek. Both Salmon Creek and the South Fork Elk River originate in the Coast Range and flow north-westerly into Humboldt Bay, the largest embayment in California north of San Francisco Bay. The project is located in Humboldt County on the United States Geological Survey (USGS) Fortuna, Hydesville, and McWhinney Creek California 7.5' quadrangle maps. The South Fork Elk River drains into Humboldt Bay approximately one mile south of Eureka, California, and borders the Salmon Creek watershed located to the south. The portion of this project within the upper Salmon Creek

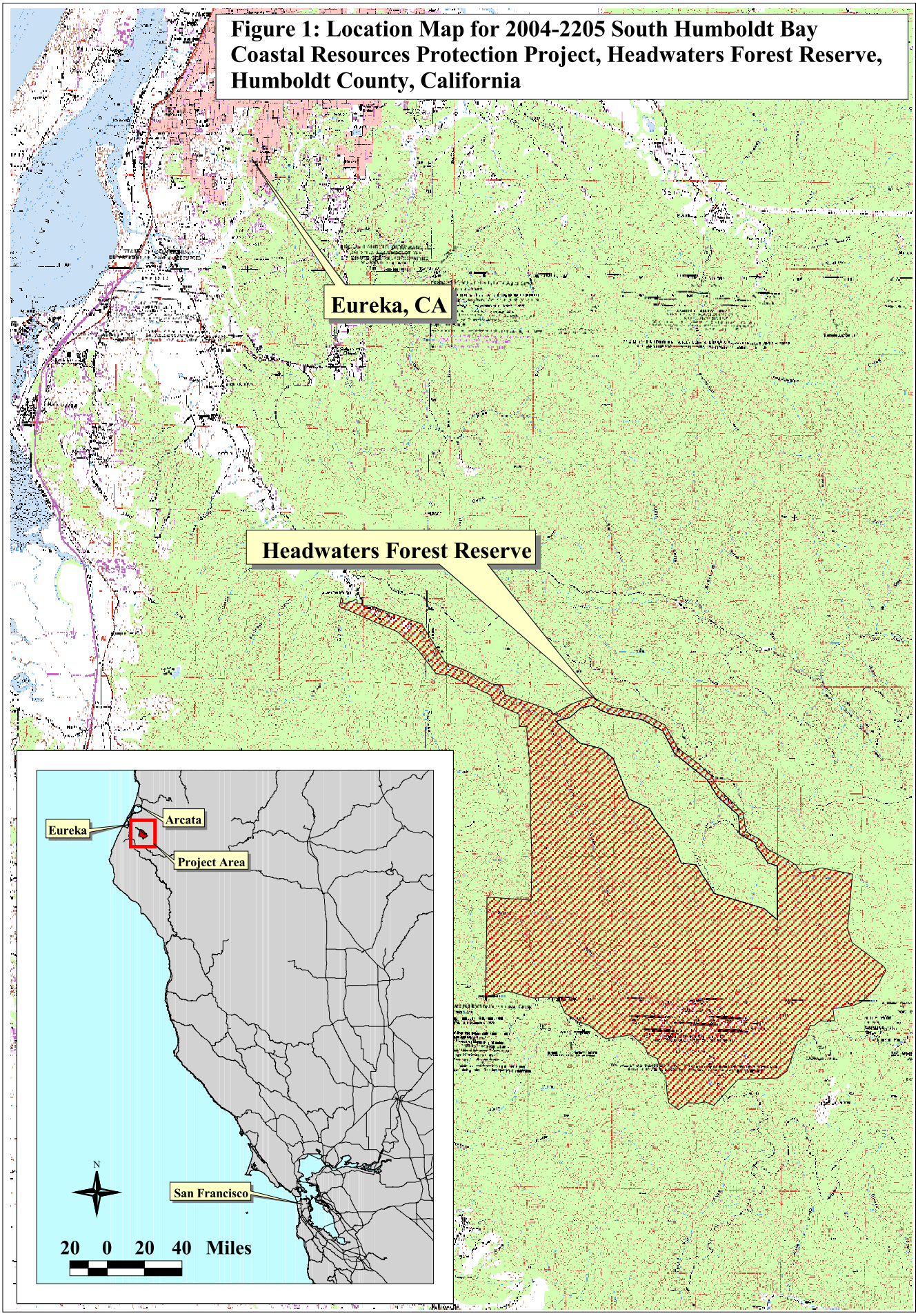


Figure 1: Location Map for 2004-2205 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, Humboldt County, California
Eureka, CA
Headwaters Forest Reserve
Eureka
Arcata
Project Area
San Francisco
N
20 0 20 40 Miles

watershed lies approximately 1.5 miles due east of Fortuna. The attached road map (Map 1) and site-specific project maps (Maps 2-5) depict the exact locations of the implementation project, roads, and sites that have been treated. A list of GPS coordinates of pertinent road intersections and detailed directions are attached to the end of this report in Appendix A.

BACKGROUND

The South Fork Elk River and Salmon Creek watersheds are typical of the north coast region, where private land ownership in the watersheds has resulted in intensive management of the land for timber production. In 1999, a large portion of the upper areas of both watersheds, owned and managed by Pacific Lumber Company (PL), were publicly acquired as part of the Headwaters Forest Agreement. This land is now managed primarily for resource protection, conservation and restoration by the BLM and is now referred to as the Headwaters Forest Reserve (Headwaters Forest).

Since 1998, a number of projects, focused primarily on the Salmon Creek watershed, have been funded in part by funds from the Coastal Salmon Recovery Program administered by the California Department of Fish and Game (CDFG). These projects include:

ASSESSMENT PROJECTS

1998 SB 271 Salmon Creek Assessment Project

A 1998 sediment source inventory and restoration planning project for the Salmon Creek watershed, funded through the CDFG administered SB 271 Restoration Grant Program and National Fish and Wildlife Foundation funds, was completed in 1999 (PWA, 1999). The assessment identified all recognizable current and future sediment sources from roads within the watershed, including both lower basin lands managed by Simpson Resource Company, as well as upper watershed areas originally owned by PL. A final basin-wide plan was prepared for erosion prevention and erosion control work within the assessment project area.

2002-2004 South Fork Elk River Road Assessment and Restoration Plan

A sediment source inventory and restoration planning project for the South Fork Elk River watershed within the Headwaters Forest Reserve, funded by the BLM, was completed in 2004. The assessment identified all recognizable current and future sediment sources from old logging roads within the watershed originally owned by PL and Elk River Timber Company. A final restoration plan was prepared for erosion prevention and erosion control work within the assessment project area.

RESTORATION PROJECTS

1999 SB 271 Salmon Creek Road Decommissioning Project

In 1999, a grant, funded through the CDFG administered SB 271 Restoration Grant Program and National Fish and Wildlife Foundation funds, was used to carry out road decommissioning work on nearly 2 miles of Simpson Resource Company inner gorge roads in the lower basin and five separate roads in the upper watershed on BLM lands (PWA, 2001). These roads were treated in the dry summer seasons of 2000 and 2001, and included erosion prevention work on some of the highest priority roads identified in the original assessment project. In that project, a total of 8.1 miles of roads were decommissioned, with over 28,000 yds^3 of sediment prevented from future delivery to stream channels in Salmon Creek.

Map 1: Road Map for the 2004-2005 South Humboldt Bay Coastal Resources Project, Headwaters Forest Reserve, Humboldt County, California

To Eureka

U06

South Fork Elk River

Site #1129

Little South Fork Elk River

Mainstem South Fork Elk River

Pacific Lumber Company (P.L.)

Pacific Lumber Company (P.L.)

U06.6966

U06.6966 Spur 1

Pacific Lumber Company (P.L.)

Simpson Resource Company

S.F. Elk River Watershed

Salmon Creek

Salmon Creek Watershed

B.L.M.

S1

R15

Salmon Creek

R8

R14

Salmon Pass

R Road (P.L.)

B.L.M.

R21

Pacific Lumber Company (P.L.)

N09

R22

Alicia Pass

N09

Strongs Creek Watershed

N09

To Fortuna

Legend

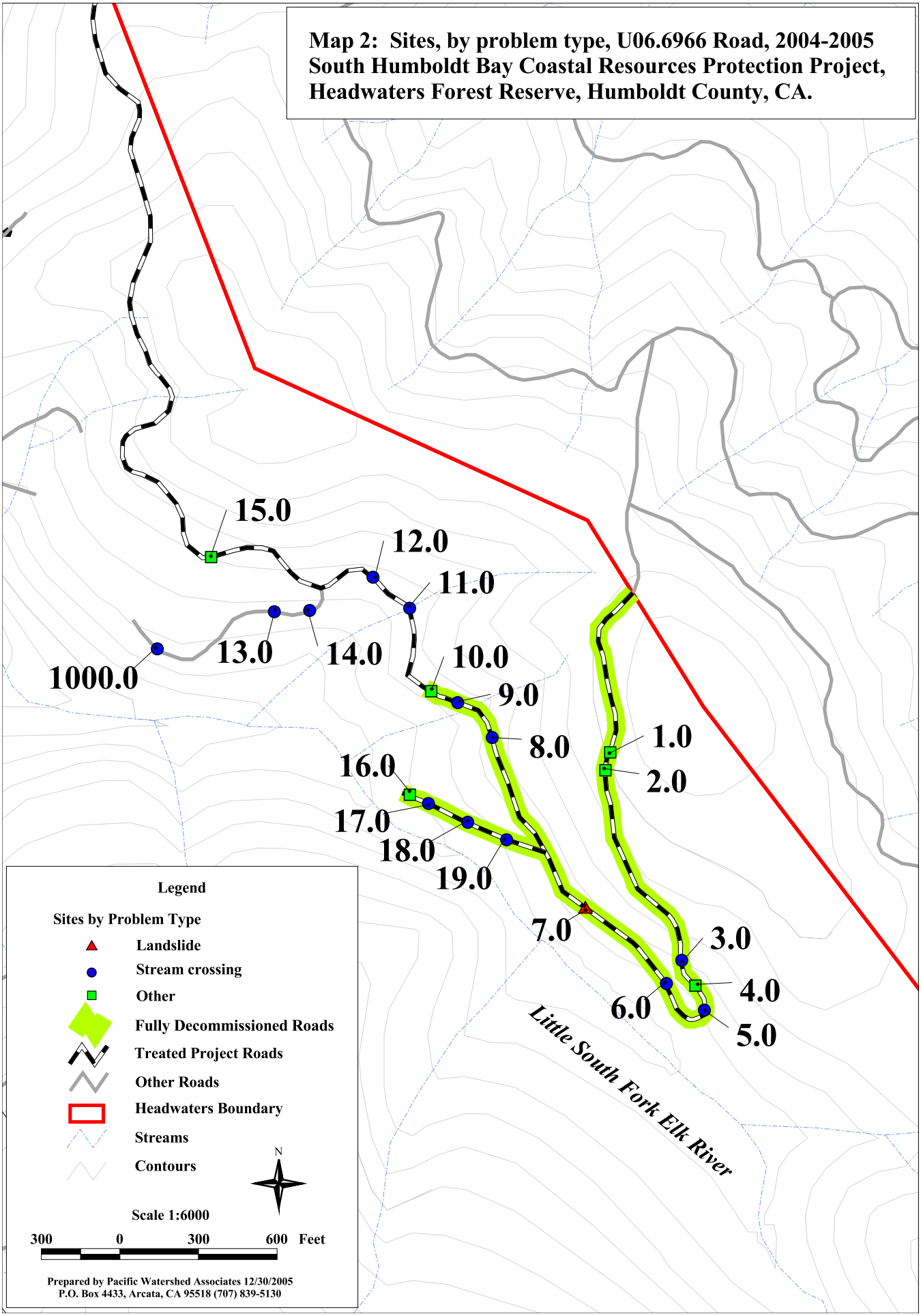
- Treated Project Roads
- Previously Decommisioned Roads
- Other Roads
- Streams
- 40' Contour
- Headwaters Boundary

N

700 0 700 1400 Feet

Prepared by Pacific Watershed Associates 12/27/2005
P.O. Box 4433, Arcata, CA 95518 (707) 839-5130
www.pacificwatershed.com

Fields Landing, McWhinney Creek, Fortuna, and Hydesville 7.5' U.S.G.S. Quadrangles


Map 2: Sites, by problem type, U06.6966 Road, 2004-2005
South Humboldt Bay Coastal Resources Protection Project,
Headwaters Forest Reserve, Humboldt County, CA.
15.0
12.0
11.0
13.0
14.0
1000.0
10.0
9.0
8.0
16.0
17.0
18.0
19.0
7.0
1.0
2.0
3.0
4.0
5.0
6.0
Little South Fork Elk River
Legend
Sites by Problem Type
Landslide
Stream crossing
Other
Fully Decommissioned Roads
Treated Project Roads
Other Roads
Headwaters Boundary
Streams
Contours
N
Scale 1:6000
300 0 300 600 Feet
Prepared by Pacific Watershed Associates 12/30/2005
P.O. Box 4433, Arcata, CA 95518 (707) 839-5130

Map 3: Sites by Problem Type, U06 Road, 2004-2005
South Humboldt Bay Coastal Resources Protection Project,
Headwaters Forest Reserve, Humboldt County, CA.
Fields Landing and McWhinney Creek 7.5' U.S.G.S. Quadrangles

Elk River Road
BLM Parking Lot
S.F. Elk Headwaters Trail
Mainstem South Fork Elk River
Tom Gulch
Falk
McCloud Creek
U08 Road
Site #1129
2004 Access Road

1168 1167 1166 500.1 1500 1501 1146.1 1146 502.1 502
1144.1 1143.1 1142.1 1503 1145 1144 1143 1142 1140.1 1140 1138 1137 1141 1141.5 1141.4 1141.3 1141.2 1141.1 1136.1
1147 1165 1165.1 1164 1148 1149 1150 1136 1135 1139 1134 1133 1132 1131.5 1131 1131.6 1130.9 1107.5 1107.1 1106.8
1108 1109 1107.2 1107 1106.9 1130 1130.1 1130.4 1130.3 1130.2 1169.1 1169.3 1169.2 1129.2 1169 1173 1128.2 1128.1 1128.3
1151 1152 1163 1153 1154 1155 1156 1129.1 1157.0 1158.0 1170.0 1159.0 1160 1161 1162
1128 1127 1126 1124.9 1124 1123 1121 1122 1119 1118 1118.1 1117 1116 1125 1126.1 1125.1 1123.1 1123.2 1122.1
1053.1 1053 1052 1120
1110 1111 1105 1105.1 1104 1103.2 1103.1 1103 1102.9 1102.9 11102 11101 11100 11156 1099 1106 1112 1113 1114 1115
1051.5 1051 1051.1 1050.1 1050 1049.9 1049.1 1049 1048.5 1048 1016 1047 1171 1172 1174 1055 1054 579.1 579 580 581

Legend

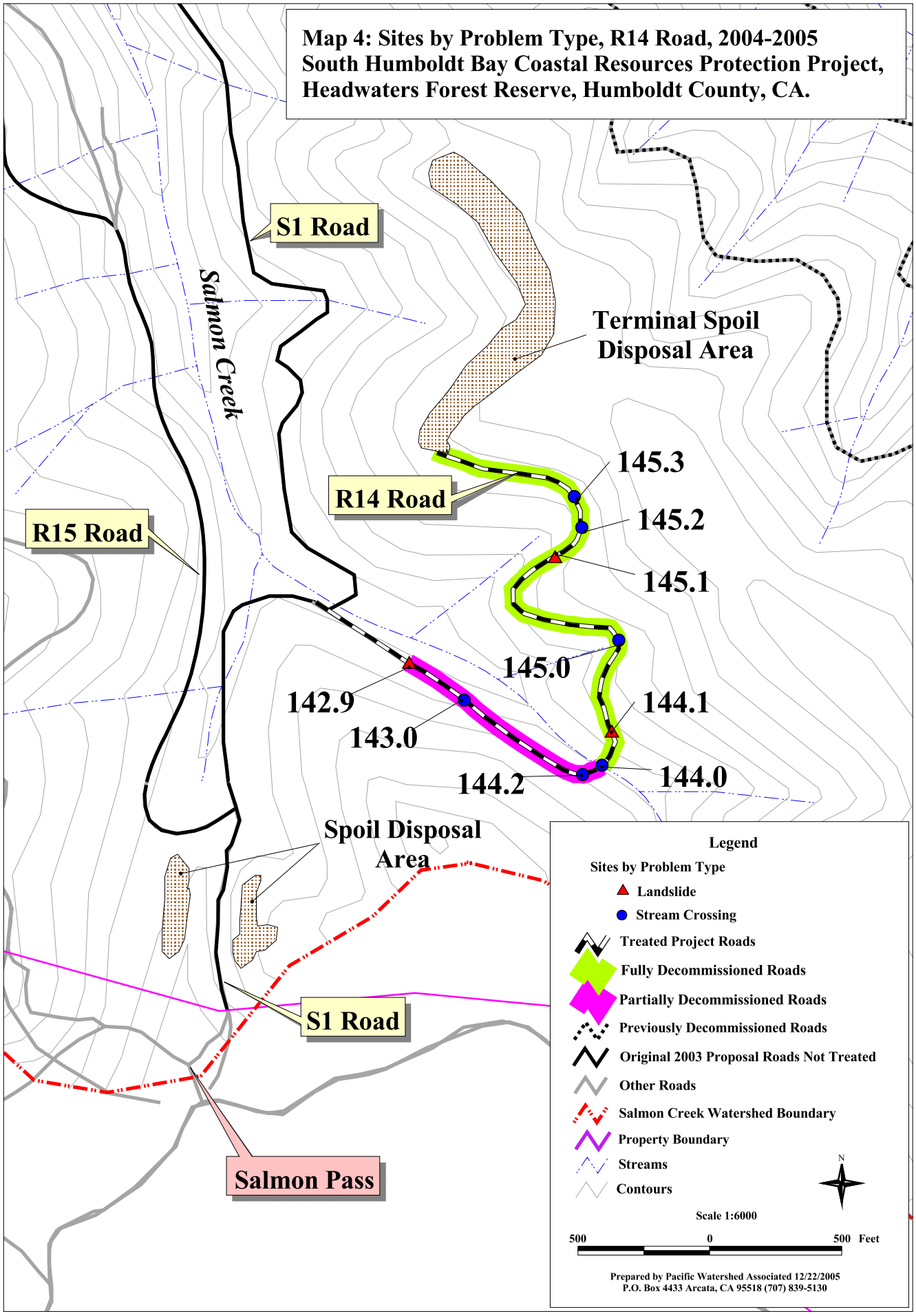
Sites by Problem Type

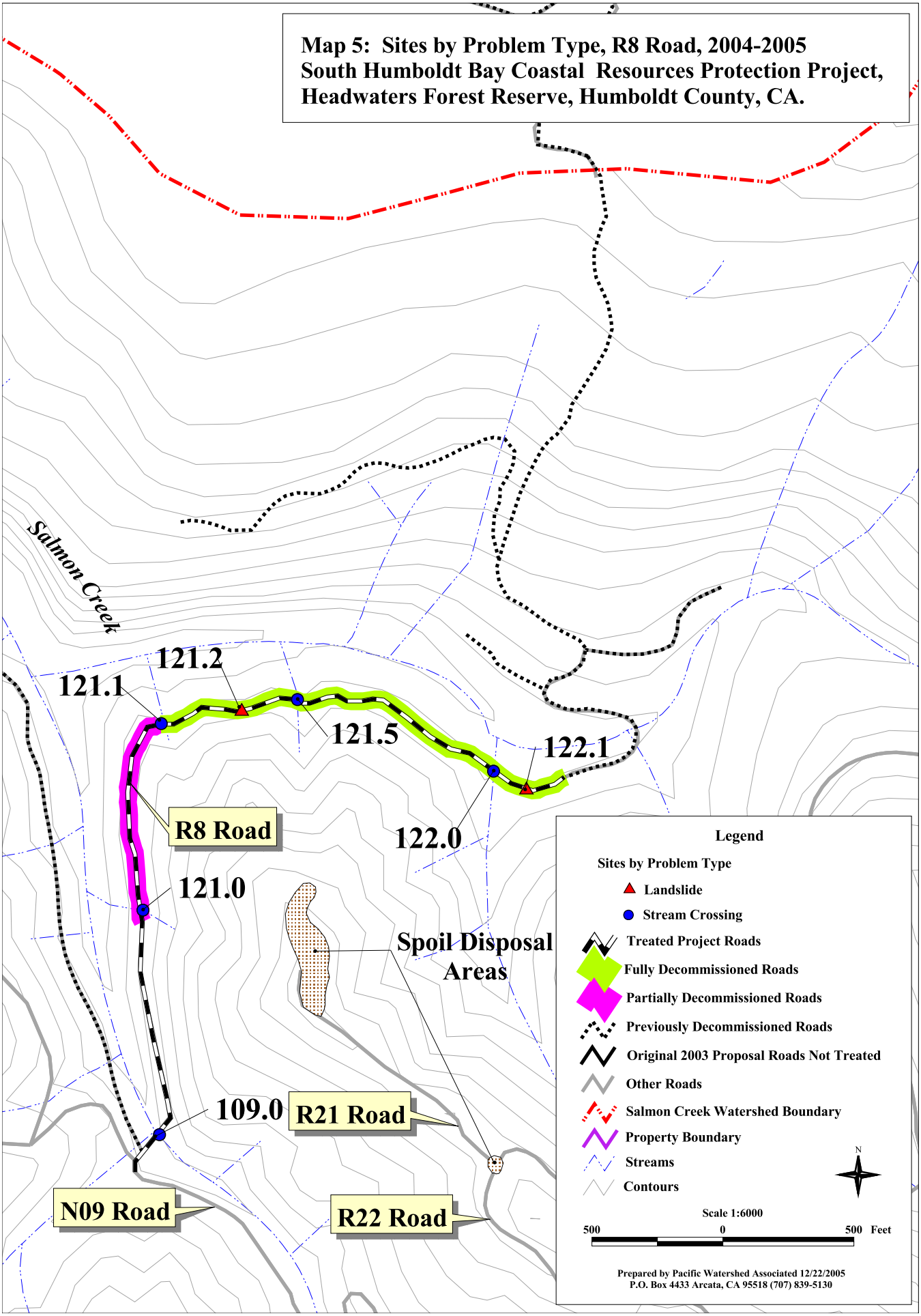
- Landslide
- Stream crossing
- Other
- Site #1129
- Project Roads
- County Road
- Other Roads
- Streams
- Headwaters Boundary
- Contours

N

900 0 900 1800 Feet

Prepared by Pacific Watershed Associates 1/2/2006
P.O. Box 4433, Arcata, CA 95518 (707) 839-5130
www.pacificwatershed.com


Map 4: Sites by Problem Type, R14 Road, 2004-2005
South Humboldt Bay Coastal Resources Protection Project,
Headwaters Forest Reserve, Humboldt County, CA.
S1 Road
Salmon Creek
Terminal Spoil
Disposal Area
145.3
R14 Road
145.2
R15 Road
145.1
145.0
142.9
144.1
143.0
144.2
144.0
Spoil Disposal
Area
S1 Road
Salmon Pass
Legend
Sites by Problem Type
Landslide
Stream Crossing
Treated Project Roads
Fully Decommissioned Roads
Partially Decommissioned Roads
Previously Decommissioned Roads
Original 2003 Proposal Roads Not Treated
Other Roads
Salmon Creek Watershed Boundary
Property Boundary
Streams
Contours
N
Scale 1:6000
500
0
500 Feet
Prepared by Pacific Watershed Associated 12/22/2005
P.O. Box 4433 Arcata, CA 95518 (707) 839-5130


Map 5: Sites by Problem Type, R8 Road, 2004-2005
South Humboldt Bay Coastal Resources Protection Project,
Headwaters Forest Reserve, Humboldt County, CA.
Salmon Creek
121.1
121.2
121.5
122.1
122.0
121.0
R8 Road
Spoil Disposal Areas
109.0
R21 Road
N09 Road
R22 Road
Legend
Sites by Problem Type
Landslide
Stream Crossing
Treated Project Roads
Fully Decommissioned Roads
Partially Decommissioned Roads
Previously Decommissioned Roads
Original 2003 Proposal Roads Not Treated
Other Roads
Salmon Creek Watershed Boundary
Property Boundary
Streams
Contours
N
Scale 1:6000
500 0 500 Feet
Prepared by Pacific Watershed Associated 12/22/2005
P.O. Box 4433 Arcata, CA 95518 (707) 839-5130

2001 SB 271 Salmon Creek Watershed Improvement Project

In 2001, the second Salmon Creek Watershed Improvement Project was funded with SB 271 Fisheries Restoration Grant Program (FRGP) funds administered by CDFG. The goal of the project was the permanent decommissioning of 8.45 miles of former logging roads, all within the upper basin under the management of the BLM. The scope of this project included most remaining roads within the upper Salmon Creek watershed that were of highest priority for treatment and not considered essential for management or restricted by legal easements.

The original scope of the 2001 Salmon Creek Watershed Improvement Project was subsequently formally altered after unforeseen difficulties prevented the project from being completed within the time frame of the contracted agreement. This was due to delays in the completion of the BLM's long-term management plan for the Headwaters Forest Reserve, on which many of the required permits allowing decommissioning work to proceed, was dependent. There were additional operational restrictions due to wildlife considerations unique to the Headwaters Forest Reserve that also limited the time available for decommissioning activities. The project was formally revised to exclude some of the roads within the Headwaters Forest Reserve, and to add several high priority sites in lower Salmon Creek on land owned and managed by Simpson Resource Company. This project was thereafter re-named the 2002 SB 271 Salmon Creek Watershed Improvement Project II and funded using FRGP grant funds and partial matching funds provided by Simpson Resource Company and the BLM, for their respective ownerships.

Heavy equipment work started in 2002 and continued through the 2003 summer work season within the Headwaters Forest Reserve on BLM managed lands in the upper basin and Simpson Resource Company lands in the lower Salmon Creek watershed. In this project, almost 3 miles of roads were decommissioned with over 25,000 yds^3 of sediment prevented from future delivery to stream channels in Salmon Creek.

2003 SB 271 Salmon Creek Watershed Improvement Project III

This project aimed to complete work on the highest priority roads remaining in the Headwaters Forest that had been targeted in the original Salmon Creek Watershed Improvement Project. Work began in late 2003 and continued through the 2004 work season. In this project, over 31,000 yd^3 of sediment on 2 miles of road was prevented from future deliver to the Salmon Creek stream system.

The previous CDFG funded road decommissioning projects carried out within the Headwaters Forest Reserve have been cooperative partnerships with the BLM. Typically, treatments of potential problem areas along a road are isolated to a few locations where stream crossings need to be excavated, or unstable landing and road side cast needs to be removed before it fails. Most of the remaining road surface simply needs permanently improved surface drainage, using decompaction, cross-road drains and/or partial outsloping. In the projects listed above, the site specific erosion control and sediment reduction efforts that follow standard CDFG protocols for decommissioned roads were supplemented with additional road decommissioning work on road segments between identified sediment delivery sites. On these intervening road segments, at the request of the BLM, the roadbed has been completely recontoured resulting in a full outslope along these reaches.

This has accomplished at least two important benefits. First, the natural hydrology of the hillside has been re-established as much as feasible, and second, treatments have reduced or eliminated

the potential for future failures on those road segments that may not have shown signs of instability prior or during the original sediment source inventory. Additional costs associated with complete recontouring of these roads have been funded by the BLM.

In the Headwaters Forest Reserve, special operating restrictions exist to protect the Marbled Murrelet, a species of bird that is currently listed as endangered under the Federal Endangered Species Act. In California, this species depends on the presence of old-growth trees for nesting such as those in the Headwaters Forest Reserve. No heavy equipment work is allowed before August 6th on any road segment located within 0.25 miles of an old growth grove. Between August 6th and September 15th, equipment is restricted to operating from one hour after sunrise to one hour before sunset, to minimize noise disturbance during the Marbled Murrelet nesting period. After September 15th, the end of the Marbled Murrelet nesting season, all special restrictions are lifted.

PROJECT SCOPE

Project Roads and Time Frame

The scope of the 2004-2005 project was divided between sediment reduction efforts in the South Fork Elk River and Salmon Creek watersheds within the Headwaters Forest Reserve (Map 1). In the South Fork Elk River, work focused primarily on one road system in the Little South Fork Elk River watershed. In this watershed, the U06.6966 Road and U06.6966 Spur 1 Road were targeted for decommissioning. Fourteen (14) sites were treated during the course of decommissioning work that took place on these two roads during the dry summer months of 2004 (Map 2). In addition, one high priority stream crossing site on the U06 Road, within the riparian corridor of the mainstem South Fork Elk River, was upgraded (Map 3).

The remainder of the project took place during the summer and fall months of 2005, and targeted two roads in the Salmon Creek watershed (Maps 4 and 5). Both the R14 and the R8 Roads were partially decommissioned during the summer of 2004 as part of a previous California Department of Fish and Game funded project (2003-2004 Salmon Creek Watershed Improvement Project III). There remained several stream crossings and landslide sites that were only partially treated, or still awaited treatment due to time limitations by the end of that previous project. Though the roads had been adequately winterized during the closure of heavy equipment operations in 2004, completing the decommissioning work was considered a top priority as part of the 2004 – 2005 South Humboldt Bay Coastal Resources Protection Project.

PEOPLE INVOLVED

There were a number of people involved to develop and implement this project. There were a large number of people that contributed to the project, without whom, this project would never have been completed. Some of the key players are listed below:

Ms. Lynda Jacobsen, and Kathleen Daly, Contract Managers, North Coast Regional Water Quality Control Board (NCRWQCB);
Mitch Farro, Executive Officer and project manager for Pacific Coast Fish, Wildlife, and Wetlands Restoration Association (PCFWWRA);
Dan Averial, Headwaters Forest Reserve Manager, Bureau of Land Management (BLM);

Dave Fuller, Assistance Representative, Bureau of Land Management (BLM);
Sam Morrison, Geologist, Bureau of Land Management (BLM);
Gordie Stephens, Heavy Equipment Contractor, Stephens Construction, Loleta, CA;
Christopher Herbst, Geologist, Pacific Watershed Associates (PWA).

This road decommissioning project was administered by Pacific Coast Fish, Wildlife and Wetlands Restoration Association, Mckinleyville, California. Actual project design, lay-out, implementation oversight and reporting was conducted under the supervision of Pacific Watershed Associates of Arcata, California. Actual on-the-ground implementation (road decommissioning) work was performed by Stephens Construction during the summer and fall of 2004 and 2005.

DESCRIPTION OF PROJECT APPROACH AND RESTORATION TECHNIQUES

Approach

In the Headwaters Forest Reserve, sites with potential to deliver sediment to the stream network were identified during two previous assessment projects, one in the Salmon Creek watershed, the other in the South Fork Elk River watershed. Sediment delivery sites identified during these assessments, as well as new sites discovered since the original assessments were conducted, were targeted for treatment. Sites consisted of stream crossings, landslides, springs, road reaches, ditch relief culverts, and associated gullies. Only sites with potential to deliver sediment to the stream network were targeted for treatment. Wet weather inspections on project roads were carried out during the winter to identify springs and seeps and to locate potential spoil disposal areas. Stream crossing sites were surveyed prior to treatment to develop computer generated excavation and erosion volume estimates and for comparison with profiles surveyed after heavy equipment work was complete. In addition, work sites, access routes, as well as potential spoil disposal areas were identified and flagged.

In this project, and following past work conducted in the Headwaters Forest Reserve, the targeted site-specific decommissioning normally undertaken as part of sediment reduction efforts was supplemented with more extensive recontouring of the original road bed between sediment delivery sites. These additional road treatments, funded by the Bureau of Land Management, resulted in the complete outsloping of the entire road system. All heavy equipment work was completed during low flow periods during the dry summer and fall months of 2004 and 2005 when impacts to water quality could be minimized or avoided. Pacific Watershed Associates (PWA) provided on-site technical support, quality control, and monitoring during and immediately following the heavy equipment operations.

TECHNIQUES

Decommissioning techniques utilized in this project essentially removed most, if not all, the road fill sidecast during road construction activities. Stream crossings were excavated and fill either stockpiled and shaped on adjoining road approaches, or exported off-site to a stable spoil disposal site with the use of dump-trucks. Landslide sites were likewise excavated, removing the unstable fill that posed a threat of failure and delivery. Road reaches between sediment delivery

sites were recontoured utilizing in-place outsloping or exported outsloping techniques described below.

Decommissioning in the Headwaters Forest Reserve included many of the following techniques[1]:
1. Road ripping or decompaction, in which the surface of the road or landing is "decompacted" or disaggregated using mechanical rippers. It is required on road surfaces that will have spoil placed upon them for permanent storage. This action reduces surface runoff and increases water infiltration into the subsurface. This reduces the potential for water pressure to build between the base of recently placed spoil and the old compacted road bed. The surface of the spoil disposal areas, once full, are contoured to shed water.

2. Cross-road drains (deep water bars) are a major component of decommissioning projects not utilizing the outsloping activities described below. Cross-road drains are installed at frequent intervals, usually every 50, 75, or 100-feet, or as necessary at springs and seeps, to disperse road surface runoff. Cross-road drains are large ditches or trenches excavated across a road or landing surface to provide drainage and to prevent the collection of concentrated runoff on the former road bed. On fully decommissioned sections of road, outsloping eliminated the need for installing cross-road drains, though they were utilized for winterizing road segments not completely treated, on the surface of some of the spoil areas, or on access roads with native surfaces.

3. In-place stream crossing excavation (IPRX) is a decommissioning treatment that is employed at locations where roads or landings were built across stream channels. The fill (including culverts, logs, and woody debris) is completely excavated and the original stream bed and side slopes are exhumed. Excavated spoil is stored at nearby stable locations where it will not erode, sometimes being pushed several hundred feet from the crossing by a dozer. A stream crossing excavation typically involves more than simply removing the culvert, as the underlying and adjacent fill material must also be removed and stabilized. Side slopes are excavated to about a 2:1 slope or back to natural grade to minimize the potential for post-project erosion.

4. Exported stream crossing excavation (ERX) is a decommissioning treatment where stream crossing fill material is excavated and spoil is hauled off-site for storage. Spoil is moved farther up- or down-road from the crossing, due to the limited amount of stable storage locations at the excavation site. This treatment requires dump trucks to endhaul spoil material to the off-site location.

5. In-place outsloping (IPOS) ("pulling the side cast") calls for excavation of unstable or potentially unstable side cast material along the outside edge of a road prism or landing, and replacement of the spoil on the roadbed against the corresponding, adjacent cutbank.

6. Exported outsloping (EOS) is comparable to in-place outsloping, except spoil material is moved off-site to a permanent, stable storage location. Where there are springs along the road cutbank or where stability of the hillslope the road is questionable, spoil material is typically not

[1]These and other erosion prevention and erosion control techniques are described in the "Handbook for Forest and Ranch Roads" (PWA, 1994) and Chapter 10 of the CDFG California Salmonid Stream Habitat Restoration Manual (CDFG, Vol.2, 3rd Edition, 2002).

placed against the cutbank and instead, end hauled to a spoil disposal site. This typically requires the excavation of the road surface farther back towards the inside edge of the road than what in-place outsloping requires to accomplish a full outslope.

Treatments at sites, and on road segments between sites, often utilized some combination of the above treatments. For example, in many locations, there was a larger volume of fill excavated compared to the available storage capacity against the cutbank, so a portion of fill was exported to a stable spoil disposal site, with the remainder placed against the cutbank to complete the outslope.

Treatments were carried out by one heavy equipment crew utilizing a hydraulic excavator and a D-7 size bulldozer, and up to 4 dump trucks. The excavator was used to: 1) help open access to, and prepare each site for treatment (brushing and filling of gullies), 2) excavate soil and organic debris (logs and chunks) from stream crossings and landslide sites, 3) place small volumes of excavated spoil on stable slopes near the decommissioned stream crossings, 4) outslope the old road bed between sites 5) decompact short segments of road, and 6) mulch the treated road with logs, limbs and brush.

The bulldozer was used to: 1) help open abandoned roads to allow access for dump trucks, if needed, 2) rip and decompact the road bed and spoil disposal areas, 3) re-contour and pack spoils placed on the road-bed during outsloping activities, 4) establish and maintain stable off-site spoil disposal areas, 5) maintain a driveable road surface for dump trucks and other vehicles, 6) create ramps to provide dump trucks access to excavation sites, and 7) help remove large logs and woody debris from stream crossings and other locations along the road.

Once the stream crossing sideslopes were excavated, the banks were covered with straw mulch. The purpose of mulching is to inhibit surface erosion and help prevent eroded sediment from being delivered to a stream. Straw mulch was also placed on any excavated fill face that was in close proximity to a stream. Grass seed, often used in other erosion control projects, was not used in the Headwaters Forest Reserve. Slash generated by brushing activities at landslide and stream crossing excavation sites was usually placed on top of the freshly disturbed surface in the last stages of treatment.

PROJECT IMPLEMENTATION

2004 Implementation - South Fork Elk River Watershed

The U06.6966 Road (Map 2) was selected as the first road slated for decommissioning for this project. It had been abandoned for over a decade and had a number of sites that had already failed or were actively failing. Due to its distance from the old growth forest, the road did not lie within areas with special operating restrictions common elsewhere in the Headwaters Forest Reserve. This allowed heavy equipment to begin operations much earlier in the season than would be allowed in the Salmon Creek watershed. The plan was to decommission the U06.6966 Road during the early part of the work season, and then move to a different road in the Salmon Creek watershed once special operating restrictions there were lifted.

The roads targeted in the Salmon Creek watershed, were slated for treatment as part of a

separate, ongoing CDFG funded restoration project (2003-2004 Salmon Creek Watershed Improvement Project III). It was necessary to utilize the equipment crew for that project due to the short heavy equipment work window within the Headwaters Forest Reserve due to Marbled Murrelet restrictions. The high level of sensitivity placed on the Headwaters Forest Reserve requires use of the most skilled equipment crews to carry out the often complex excavations.

Starting in July, 2004, a single heavy equipment team worked back from the end of the U06.6966 Road (Map 2), decommissioning sites and re-contouring road reaches between sediment delivery sites. At the junction with the U06.6966 Spur 1 Road, the equipment moved onto and decommissioned all sites and road reaches on the spur back to the intersection with the U06.6 966 Road. Work continued on the U06.6966 Road through mid-August, after which the remaining road was temporarily closed and winterized, in preparation for the move to the Salmon Creek watershed. Approximately a 0.7 mile section of the U06.6966 Road, as well as the entire 0.2 mile section of the U06.6966 Spur 1 Road was decommissioned. In total, 9 stream crossings, 1 landslide site, and 5 gully sites were treated on these road segments.

Before moving to the Salmon Creek watershed portion of the Headwaters Forest Reserve, the equipment crew was directed to treat a high priority stream crossing site (#1129) on the U06 Road along the riparian corridor of the mainstem South Fork Elk River (Map 3). This actively failing stream crossing was upgraded by rebuilding the stream crossing, removing over 1,190 yd^3 of material from the crossing as well as stored sediment from the stream channel above the crossing. The culvert inlet was wrapped with an expanding clay collar and both the inboard and outboard fillslopes armored with rip rap.

Upon completing the stream crossing upgrade, the equipment moved to the Salmon Creek watershed within the Headwaters Forest Reserve to work on the CDFG funded 2003-2004 Salmon Creek Watershed Improvement Project III. No further work was carried out as part of the South Humboldt Bay Coastal Resources Protection Project in 2004. Appendix B1 lists the specific sites, erosion volumes, and excavation volumes, by road, that were treated in the South Fork Elk River watershed as part of the 2004-2005 South Humboldt Bay Coastal Resources Protection Project.

Salmon Creek Watershed - 2005 Implementation

In 2005, all heavy equipment work implemented for the South Humboldt Bay Coastal Resources Protection Project was carried out by the same equipment crew that carried out the decommissioning work in the South Fork Elk River watershed in 2004 (Stephens Construction, Loleta, CA). All work in 2005 was carried out in the upper Salmon Creek watershed within the Headwaters Forest Reserve, and took place on two roads, the R14 Road and the R8 Road (Maps 4 and 5), respectively.

R14 Road

The heavy equipment crew moved onto the R14 Road (Map 4) in late August, 2005, after special operating restrictions were lifted. This road had been partially treated in 2004 by a different heavy equipment crew as part of the 2003-2004 Salmon Creek Watershed Improvement Project III. Almost half the road had been partially treated by excavation and removal of the outboard portion of the road prism. Several stream crossings had been partially treated by reducing the volume of fill contained in the crossing as well as the excavation of stored sediments in the

upstream and downstream reaches beyond the crossing. These sites had been only partially treated to keep vehicle access open to the only spoil disposal area on this road located at the end of the road.

Equipment operations began by reworking portions of the spoil area used the previous year. Access to a new spoil disposal area was developed beyond the old disposal area. The new spoil disposal area was located along the spine of a long ridge, portions of which had been used to store spoils from previous decommissioning projects (Map 4). Due to limited spoil disposal areas along the road and the general scarcity of adequate spoil disposal areas in the Headwaters Forest Reserve, the plan was to export as much material to the ridge-top spoil area as it could safely hold. To achieve this goal, as in the previous year, several stream crossing sites were partially excavated, leaving a reduced road prism through the sites while still allowing dump truck access to the ridge-top spoil area beyond the end of the road.

During this time frame, landslide sites #144.1, #145.1 and #142.9 were completely treated. Stream crossing sites #143, #144.2, #144, #145, and #145.2 were excavated above and below the road and the road prism was lowered. Once the ridge-top spoil area was full, the equipment moved to the end of the road and worked back, completing all remaining decommissioning work on stream crossing sites and road reaches as they went. Stream crossing sites #145, #145.2, and #145.3 were completed during this time frame.

The onset of fall rains forced the early closure of the R14 Road. By that time, approximately 0.2 mi. of road beyond stream crossing site #144 (Map 4) had been completely decommissioned with another 0.1 mi. road, down-road of site #144, being partially treated. Stream crossing sites #144, #144.2, #143, and #143.2 were all left partially treated with the minimum volume of road fill possible left to ensure continued access. Efforts were made to minimize the erosion potential at these sites over the winter. These include installing large cross-road drains to direct stream flow across the road and buttressing discharge locations with large woody debris (LWD) and straw to support remaining fill and catch sediment transported through the crossing. The streams were discharged at locations containing the minimal amount of road fill possible or at hard points created by natural bedrock outcrops. A temporary culvert and downspout was installed to drain the largest stream crossing (site #144) over the winter.

All of these sites are still accessible for treatment and are slated for completion in summer 2006. In total, 3 landslide sites and 3 stream crossings were completely treated, and 4 stream crossings partially treated by removal of the majority of fill from the crossings. After winterizing the road and spoil disposal areas, the equipment crew moved to the R8 Road where the rocked road and gentle grade facilitated continued equipment operations. Appendix B2 lists the specific sites, erosion volumes, and excavation volumes, by road, that were treated on the R14 Road in 2005 as a part of the 2004-2005 South Humboldt Bay Coastal Resources Protection Project.

R8 Road

The equipment moved onto the R8 Road (Map 5) in early October. This road, like the R14, had been partially treated as part of previous restoration efforts. The R8 Road was located directly above the upper reaches of the mainstem Salmon Creek, above streamside and inner-gorge slopes. The equipment crew began by installing a temporary culvert and downspout on a priority stream crossing site (#121) located along the inner gorge of Salmon Creek. This site was located

on a section of road that might not be treated if an early wet weather season shut down operations, or if work on other sites took longer than expected.

The crew then moved to the location where decommissioning work in the 2003-2004 Salmon Creek Watershed Improvement Project III had left off, at landslide site #122.1. Due to the limited storage capacity of the R8 Road, spoil generated from stream crossing or landslide excavations was endhauled to a large, ridge-top spoil disposal area almost two miles away on the R21 Road (Map 5). During this stage, stream crossing sites #122 and #121.5, and landslide sites #122.1 and #121.2 were fully treated, with intervening road reaches outsloped and recontoured. The upstream end of the next stream crossing (#121.1) was excavated before the onset of wet weather brought significant precipitation to the area and forced the closure of heavy equipment operations at the end of October, 2005. A temporary 18" diameter culvert was installed at site #121.1, and the remaining road was temporarily closed and winterized. This ended the equipment work for the South Humboldt Bay Coastal Resources Protection Project. Appendix B3 lists the specific sites, erosion volumes and excavation volumes that were treated on the R8 Road in 2005 as part of the 2004-2005 South Humboldt Bay Coastal Resources Protection Project.

MONITORING

Before the project commenced, photo point stations were established for most of the project work sites. These photo points were used to document the work sites before, during and after the road decommissioning work. Examples of "before" and "after" photo points have been included in photo pages in Appendix C to depict decommissioned stream crossings, landslides and road reaches. In addition, a CD has been affixed to the sleeve of the report cover, containing a complete set of photos covering all sites treated in this project. The photo points will provide opportunities for long-term effectiveness monitoring in the future.

Each decommissioned stream crossing was surveyed prior to treatment and evaluated after equipment had completed excavation work. Most of the decommissioned stream crossings were re-surveyed following equipment operations. Appendix D depicts surveyed profiles and cross sections of three stream crossings. The plotted surveys show the original ground profile, the design profile and the "as built" profile that was surveyed following heavy equipment excavation work at the three sites. Each of the stream crossings have been excavated to a stable longitudinal and cross sectional profile.

The only project sites that have gone through a winter/spring wet weather season are those on the road system in the South Fork Elk River watershed. High intensity rainfall occurred in the project area during the winter of 2004/2005. Several of the decommissioned stream crossings in the South Fork Elk River watershed have shown minor channel adjustments, but overall the project area has responded very well. The outsloped road reaches between sites and the thorough excavations at stream crossings have shown to be remarkably stable. All 10 newly excavated stream crossings that have experienced a full winter have held up well through the storms.

Probably the most common post-treatment erosional problem was associated with small channel adjustments in the newly excavated channel bottoms. Because the stream crossings were excavated down to natural ground and because the natural ground is fairly hard and durable,

these adjustments have been very small in comparison to the volume of sediment that otherwise would likely have delivered to the stream network had the crossings been left to erode. It should be noted that the condition of this road network prior to implementation was very poor. Many locations along the abandoned road network had previously experienced failures or were actively failing or eroding. It is also likely that these high intensity rainfall events could have washed out multiple crossings, delivering large quantities of sediment to the South Fork Elk River watershed.

The BLM currently operates a monitoring program covering all decommissioned roads in the Headwaters Forest Reserve. They set up additional photo points and take quantitative measurements of all voids that develop after decommissioning. The BLM makes a large effort to ensure that equipment operations are carried out with great care to minimize the potential for post-treatment failures or adjustments.

RESULTS

The purpose of the project was to reduce future sediment related water quality impacts by treating at least 20 sites and preventing the potential delivery of at least 17,350 yd^3 of sediment that would otherwise have been delivered to the South Fork Elk River and Salmon Creek stream networks and ultimately to Humboldt Bay. Table 4 and Table 5 list the sediment savings and excavation volumes, by road and by watershed, respectively, in the 2004-2005 South Humboldt Bay Coastal Resources Protection Project. By the excavating and removing over 48,329 yd^3 of material at 30 sediment delivery sites, the potential for future sediment delivery from these sites was greatly reduced or eliminated. In all, over 17,700 yd^3 of material was prevented from future delivery to the South Fork Elk River and Salmon Creek stream networks. This should translate into long term protection and improvement of water quality in these watersheds. Tables 1 and 2 summarize the results of the project, by road and by watershed, respectively.

Table 1. As-Built Future Erosion and Excavation Volumes, by Road, for the 2004-2005 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, South Fork Elk River Watershed, Humboldt County, California

Road	# Sites	Potential Sediment Delivery Volume (cubic yards)	Excavation Volume[1] (cubic yards)
U06.6966	11	3,996	9,252
U06.6966 Spur 1	4	1,993	4,259
U06	1	1,129	1,990
R14	10	6,922	20,080
R8	6	3,727	12,748
Totals	**32 sites**	**17,767**	**48,329**

[1] Excavation volumes for sites do not include additional treatments to the road bench between sites.

Table 2. As Built Future Erosion and Excavation Volumes by Watershed for the 2004-2005 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, South Fork Elk River Watershed, Humboldt County, California

Watershed	# Sites	Sediment Delivery Volume (cubic yards)	Excavation Volume[1] (cubic yards)
SF Elk River	16	7,118	15,501
Salmon Creek	16	10,649	32,828
Totals	**32 sites**	**17,767**	**48,329**

[1.] Excavation volumes for sites do not include additional treatments to the road bench between sites.

A project assessment and evaluation plan was developed during the early stages of this project, outlining the steps and goals for the project, and contained three components. The first was the identification of the sources of pollution to be prevented or reduced by the project. This was accomplished by incorporating sites identified during the original assessment projects carried out in the South Fork Elk River and Salmon Creek watersheds, and adding sites subsequently discovered during wet weather inspections or during implementation activities. New sites were documented and surveyed prior to treatment to develop treatment designs and predicted excavation and erosion volumes.

The second component of the plan was to describe the baseline water quality or environment to be addressed. The baseline water quality associated with this project was determined through the TMDL development process, indicating that excess sediment has impacted several beneficial uses of water, including the degradation of habitat for three salmonid species, at least one of which is currently listed under the federal Endangered Species Act (Coho Salmon).

The third component of the plan was to describe the manner in which the project would be effective in reducing pollution and demonstrating the desired results. Implementation of this project addressed the effectiveness of the project by removing over 48,000 yd^3 of material from these 30 sites. This prevented over 17,767 yd^3 of sediment from potential future delivery into the Salmon Creek/South Fork Elk River stream systems. The desired environmental results have been accomplished by the removal of this sediment and consequently preventing it from ever reaching the stream system. The photos and pre- and post-excavation profiles of stream crossings treated depict work carried out in this project and serve to document the sediment reduction efforts associated with this project.

TASK DELIVERABLES

As stated in the SWRCB Agreement #03-211-551-1, a list of the deliverables as listed in Section 4 of the agreement has been included below. Each of the tasks has been carried out with associated documentation provided to the SWRCB's Contract Manager. By the submission of this report, the last of these tasks has been completed.

Table 3. List of Deliverables included within SWRCB Agreement #03-211-551-1

Task	Sub-task	Deliverable
1.		PROJECT ADMINISTRATION
	1.2	Progress Reports
	1.5	Contract Summary Form
	1.6	Subcontractor Documentation
	1.7	Expenditure/Invoice Projections
	1.8	Project Survey Form
2.		CEQA/NEPA DOCUMENTS AND PERMITS
	2.1	CEQA/NEPA Documentation
	2.2	Signed Permits
3.		ONE-TIME ADVANCE PAYMENT REQUEST
	3.1	Written Justification with Recoupment Schedule
	3.2	Proof of Separate Interest-Bearing Bank Account
	3.3	Bank Statements
4.		PROJECT ASSESSMENT AND EVALUATION PLAN
	4.1	Project Assessment and Evaluation Plan
5.		PRE-IMPLEMENTATION
	5.1	Agenda, List of Attendees, and Minutes
6.		PROJECT DESIGN FINALIZATION
	6.2	List of Sites Selected
	6.3	Field Logistic Review
	6.4	Final Plan
	6.5	Landowner Agreements
	6.6	Authorization to Proceed Letter
7.		PROJECT IMPLEMENTATION
	7.2	Photograph Documentation
	7.4	“As-built” Profile Drawings
8.		DRAFT AND FINAL PROJECT REPORTS
	8.1	Draft Project Report
	8.2	Final Project Report

BUDGET

A detailed budget summary is being provided to the California State Water Quality Resources Control Board (CSWQRCB) separately by the PCFWWRA project administrator. In summary, total expenditures were $616,033.58 for all work carried out in 2004 and 2005. This includes all costs including treatment layout, heavy equipment implementation work, equipment supervision, photo documentation, project management, and reporting. This also includes costs for the additional decommissioning work carried out on road reaches between CDFG sites in the upper watershed. $234,429.85 was funded through Proposition 13 funds, administered through the CSWQRCB. Approximately $383,603.73 was contributed as matching funds from the BLM to pay for the costs of the additional road recontouring between sediment delivery sites.

Approximately 90% of the funds were expended directly on heavy equipment costs to perform the excavation and decommissioning work. The cost-effectiveness of performing erosion prevention work is defined as the cost of preventing a cubic yard of eroded sediment from entering the stream system. Using the total project cost (including the BLM contribution), the average cost-effectiveness was $34.67/yd^3 saved.

CONCLUSION

The expected benefit of completing erosion control and prevention work lies in the reduction of long term sediment delivery to Salmon Creek and the South Fork Elk River. By treating these 30 sites on former logging roads in the Salmon Creek and the South Fork Elk River watersheds, an estimated 17,767 yds^3 of sediment was prevented from future delivery to the stream network. This should result in improved water quality and fisheries habitat to the downstream system in both Salmon Creek and the South Fork Elk River.

In addition, this project contributes to a large-scale effort being carried out in the Salmon Creek watershed to improve water quality and salmonid habitat through a variety of erosion control, fish passage, and habitat improvement projects. Projects have been designed and implemented within the upper-most portion of the watershed down to the lowest reaches of the estuary. The cumulative effects from completing this and other projects should be to greatly enhance salmonid habitat in these stream systems, as well as protect long term future conditions in the watersheds. Furthermore, this project has created a valuable cooperative partnership with the BLM assisting their efforts within the Headwaters Forest Reserve, to protect and restore this land for the education and future enjoyment of the public.

Appendix A1

Coordinates for Site Locations and Pertinent Road Intersections for South Fork Elk River Watershed

2004-2005 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, Humboldt County, CA

Appendix A1. Universal Transverse Mercator (UTM) coordinates for sites treated in the South Fork Elk River watershed, 2004-2005 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, Humboldt County, California

Road Name	Site #	X coordinate	Y coordinate
U06.6966	1	409154	4501037
U06.6966	2	409149	4501015
U06.6966	3	409238	4500794
U06.6966	4	409250	4500767
U06.6966	5	409264	4500737
U06.6966	6	409218	4500767
U06.6966	7	409122	4500857
U06.6966	8	409017	4501053
U06.6966	9	408974	4501096
U06.6966	10	408944	4501108
U06.6966 Spur 1	16	408922	4500986
U06.6966 Spur 1	17	408940	4500976
U06.6966 Spur 1	18	408983	4500958
U06.6966 Spur 1	19	409029	4500932
U06	1129	406266	4503590

Universal Transverse Mercator (UTM) coordinates for Road Intersections and Passes

Intersection Name		X coordinate	Y coordinate
BLM parking lot/ SF Elk trail		403588	4505238
Start of U06.6966		408565	4501927
U08/Elk River Road		403624	4505193

Appendix A2

Coordinates for Site Locations and Pertinent Road Intersections for the Salmon Creek Watershed

2004 - 2005 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, Humboldt County, CA

Appendix A2. Universal Transverse Mercator (UTM) coordinates for sites treated in the Salmon Creek watershed, 2004-2005 South Humboldt Bay Coastal Resources Protection Project – Headwaters Forest Reserve, Humboldt County, California			
Road Name	Site #	X coordinate	Y coordinate
R14	142.9		
R14	143		
R14	143.2	0407398	4497751
R14	144	0407473	4497762
R14	144.1	0407437	4497778
R14	144.2	0407436	4497747
R14	145	0407432	4497888
R14	145.1	0407360	4497942
R14	145.2	0407352	4498054
R14	145.3	0407396	449801
R8	109	0409493	4496733
R8	121	---	---
R8	121.1	0409517	4497255
R8	121.2	0409599	4497267
R8	122		
R8	122.1	0409961	4497182
Universal Transverse Mercator (UTM) coordinates for Road Intersections and Passes			
Intersection or Pass Name		X coordinate	Y coordinate
N09/R8		0409493	4496733
S1/R14		0407142	4497927
Salmon Pass		0406982	4497387
Alicia Pass		0408966	4496616
R10/R8		0409882	4497436
R15/S1		0407011	4497705

Appendix B

Excavation Volumes and Erosion Volumes by Road for Sites Treated in the 2004-2005 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, Humboldt County, CA

Appendix B1. As Built Future Erosion and Excavation Volumes, by Road, in the South Fork Elk River Watershed, for Sites Treated in the 2004-2005 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, Humboldt County, California

Site #	Road	Problem Type	Sediment Delivery Volume (cubic yards)	Actual Excavation Volume[1] (cubic yards)
1*	U06.6966	spring	787	1,317
2*	U06.6966	spring	1	330
3*	U06.6966	stream crossing	238	555
4*	U06.6966	spring	8	30
5	U06.6966	stream crossing	1,776	3,730
5.1	U06.6966	stream crossing	70	420
6	U06.6966	stream crossing	345	960
7	U06.6966	landslide	190	640
8	U06.6966	stream crossing	129	510
9	U06.6966	stream crossing	410	660
10	U06.6966	spring	42	100
16*	U06.6966 Spur 1	gully	8	85
17*	U06.6966 Spur 1	stream crossing	1,818	3,214
18	U06.6966 Spur 1	stream crossing	120	250
19	U06.6966 Spur 1	stream crossing	47	710
1129	U06	stream crossing	1,129	1,990
Totals		**16**	**7,118**	**15,501**

[1]. Excavation volumes for sites do not include additional treatments to the road bench between sites.

Appendix B2. As Built Future Erosion and Excavation Volumes, by Road, in the Salmon Creek Watershed, for Sites Treated in the 2004-2005 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, Humboldt County, California

Site #	Road	Problem Type	Sediment Delivery Volume (cubic yards)	Actual Excavation Volume[1] (cubic yards)
142.9	R14	landslide	1,981	2,830
143	R14	stream crossing	581	1,980
143.2	R14	stream crossing	549	1,630
144	R14	stream crossing	352	1,210
144.1	R14	landslide	181	360
144.2	R14	stream crossing	45	200
145	R14	stream crossing	1,729	5,640
145.1	R14	landslide	894	2,330
145.2	R14	stream crossing	481	3,110
145.3	R14	stream crossing	129	790
121	R8	stream crossing	347	1,158
121.1	R8	stream crossing	1,317	3,800
121.2	R8	landslide	90	150
121.5	R8	stream crossing	1,476	6,360
122	R8	stream crossing	167	840
122.1	R8	landslide	330	440
Totals		**16**	**10,649**	**32,828**

[1]. Excavation volumes for sites do not include additional treatments to the road bench between sites.

Appendix C

Photo Pages for Sites Treated as Part of the 2004-2005 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, Humboldt County, CA

Appendix C1

Photo Pages for Sites on the U06.6966 Road, South Fork Elk River Watershed

2004-2005 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, Humboldt County, CA

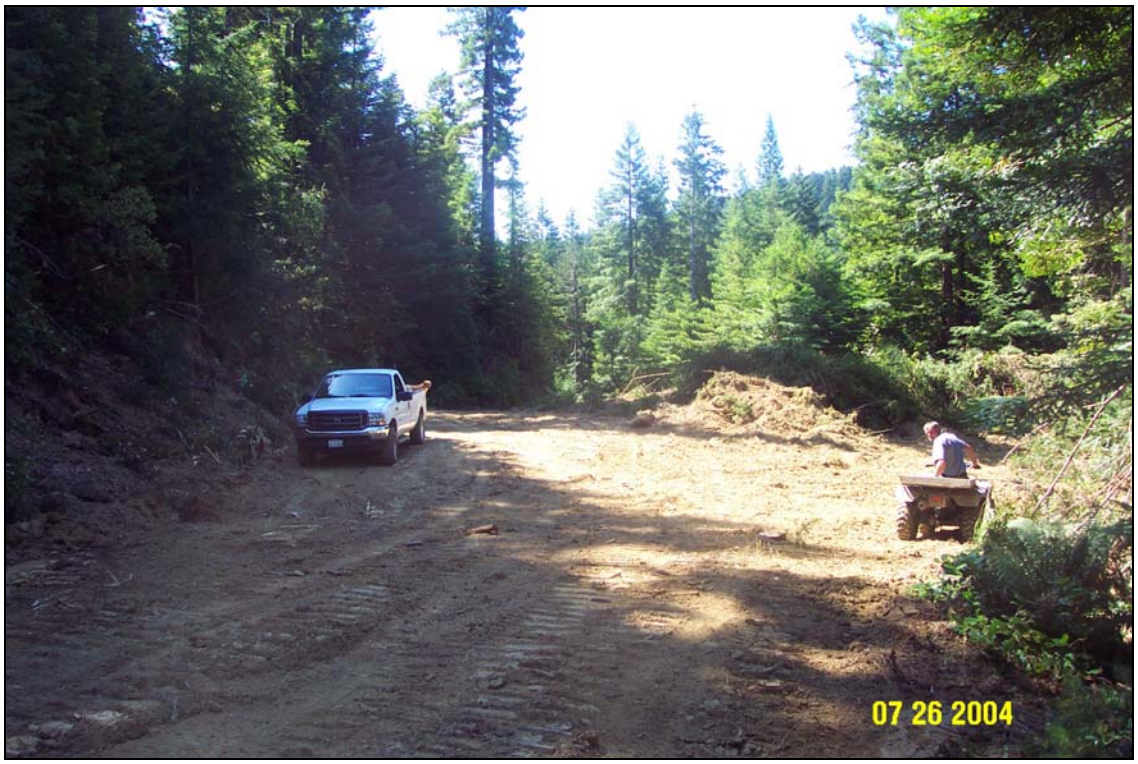


Photo #1. Site #1, U06.6966 Road, pre-treatment. Landing buried stream valley which had actively enlarging sinkholes. Site #2, another stream crossing, is located on the far side of the landing near the center of the photo.

Photo #2. Site #1, U06.6966 Road, post-treatment. Spoils were stockpiled on the left side of the crossing and covered with slash to protect the surface from rain-splash. Straw mulch was placed along the sides of the excavated channel to help catch fines generated from the fresh surface. The excavator and dozer are working on site #2, in the upper left of the photo.

Photo #3. Site #2, U06.6966 Road, a near origin stream crossing in progress. The view is from the top of the crossing looking downstream. The excavator, digging out the fill burying the stream valley, is placing the spoils approximately at the location of the dozer, which then back bladed the material down the road off the to the left of the picture in a stable location.

Photo #4. The same stream crossing as it looked after going through one winter. The view is from the lower end of the excavation looking upstream to the top.

Photo #5A. Site #3, stream crossing on the U06.6966 Road, pre-treatment. View is from the right side of the crossing looking toward the left road approach. Prior to treatment, the stream had been diverting down the left road, causing a long gully down the hillslope below. Note the tree trunk in the upper right corner of the picture for comparison with the photo below.

Photo #5B. The same stream crossing, post-excavation. The view is similar to the last photo. Abundant springs along the cutbank of the left road approach forced excavated road fill to be endhauled to a stable spoil disposal area using dump trucks. Note the left road has been completely outsloped , with slash placed on the freshly excavated surfaces except for a small "trail" along the upper most side of the disturbed area.

Photo #6. Site #3, U06.6966 Road, post-treatment. View is from the top of the excavation looking down to the bot. This picture was taken in May, 2005 after the site had gone through it's first winter, post treatment. The channel is showing almost no signs of adjustments.

Photo #7. Site #4, another near origin stream crossing, pre-treatment. The view is from the right road approach looking across the crossing toward the upper portion of site #5, a stream crossing located within the landing and switchback where the distant truck is parked in the photo.

Photo #8. Stream crossing #4, U06.6966 Road, immediately after treatment, located where the man in the photo is standing. The view is from above the top of the excavation looking downstream. Note the excavator working on the lower portion of stream crossing site #5 near the center of the photo.

Photo #9. Stream crossing #4 located in the lower half of the photo, and the upper portion of site #5 in the upper center of the photo, both after going through their first winter post-treatment. Compare this photo with Photo #7, pre-treatment with a similar view.

Photo #10. Stream crossing site #5 in the foreground, and stream crossing site #4 in the upper right of the photo, both pre-treatment. Site #5 was located within a tight switchback in the road and involved a long excavation and thousands of cubic yards of road-fill that had to be end-hauled from the work site.

Photo #11. The upper portion of site #5, almost one year after treatment. The view is similar to the previous photo.

Photo #12. The lower portion of stream crossing #5, U06.6966 Road, in progress. The view is from the upper segment of the old switchback looking downslope toward the bot (hidden from view by the pile of material in the center of the photo). The lower road approach meets the site in the right-center of the photo.

Photo #13. The lower portion of Site #5, after the first winter, post-treatment. The view is similar to the previous photo, only from the left side of the excavated swale-still looking downstream to the bot. The stump in the left side of the photo was unearthed from the pile of fill shown in the photo above.

Photo #14. Site #6, stream crossing on the U06.6966 Road, pre-treatment. View is from the left road approach looking across the crossing toward the right approach. Note large old-growth Redwood stump located in the upper right side of the photo, at the apex of the bend in the road, for comparison in the photo below.

Photo #15. Site #6, post treatment, almost one year later. The view is similar to that in the photo above, only closer to the crossing. Note stump in the upper right of the photo.

Photo #16. Another shot of Site #6, U06.6966 Road, post-treatment after one winter. View is from the right side slope near the top, looking downstream toward the bot.

Photo #17. Site #6, post-treatment after one winter. View is from the left side slope near the lower end of the excavation, looking downstream toward the bot. Note the convex upward shape of the channel bottom as it approaches the bot, generally not the shape that is desired. A straight line or concave upward profiled is preferred, removing all fill. In this case, the excavator hit bedrock which controlled the resultant profile and should likely result in minimal channel adjustments.

Photo #18A. Site #7, a potential landslide on the U06.6966 Road, pre-treatment. View is from the left side of the site looking beyond across the site toward the right approach. The upper reaches of the north fork of the Little South Fork Elk River is located directly below the site. Note the over-steepened edge of the road at the bend approximately center-right in the photo. A portion of the road bench had already failed and delivered to the creek at the base of the inner-gorge slopes below, but additional unstable material remained perched with potential to deliver additional sediment into the stream.

Photo #18B. Site #7, almost one year after treatment. View is similar to the above photo. The edge of the road was pulled back and some of the material was stockpiled upon the cutbank to create a complete outslope.

Photo #19. Site #8, stream crossing on the U06.6966 Road, pre-treatment.

Photo #20. Site #8 almost one year after treatment. View is similar to the photo above. A swale was excavated to direct spring flow toward the lower end of site #8, and is located just beyond the slash pile in the center of the photo.

Photo #21. Site #8, stream crossing on the U06.6966 Road, almost one year after treatment. Picture taken from near the bot looking upstream. The new stream channel shows very little signs of adjustments.

Photo #22. Excavated swale catching spring flow on right approach to site #8., approximately one year after treatment. Site #8 is obscured just beyond the slash pile in the top-center of the photo.

Photo #23. Site #9, almost one year after treatment. Picture taken from the top end of the excavation, looking downstream to the bottom end (bot) of the excavation.

Photo #24. Site #9, almost one year after treatment. Picture taken from the lower end of the excavation above the right side-slope, looking upstream at the top of the excavation.

Appendix C2

Photo Pages for Sites on the U06.6966 Spur 1Road, South Fork Elk River Watershed

2004-2005 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, Humboldt County, CA

Photo 1. U06.6966 Spur 1 Road, Site #19, stream crossing, pre-treatment. The picture was taken from the left road approach looking across the crossing down the right road approach.

Photo 2. U06.6966 Spur 1 Road, Site #19, stream crossing, post-treatment almost one year later. The view is similar to the above photo, except taken from closer to what used to be the inboard edge of the road. Straw mulch was placed on the excavated side slopes near the channel bottom and slash placed on disturbed road surfaces to protect them from rainsplash.

Photo 3. Stream crossing Site #18 approximately one year after decommissioning. Picture was taken from above the left side slope near the upper end of the excavation with the downstream end of the excavation (the bot) on the left side of the photo.

Photo 4. Stream crossing Site #18 approximately one year after decommissioning. Picture was taken from above the right side slope near the upper end of the excavation looking toward the bot.

Photo 5. U06.6966 Spur 1 Road, Site #17, stream crossing, pre-treatment. The picture was taken from the right side of the terminal landing on this road that buried the original stream valley. The downstream end of the crossing is on the right side of the photo. Note the quad in the top center-left of the photo on the left road approach.

Photo 6. Stream crossing Site #17 approximately one year after decommissioning. View is similar to the photo above and was taken from above the right side slope near the middle of the excavation looking toward the slash covered left road approach. The upstream end of the excavation is in the upper left corner of the photo.

Photos 7A and 7B. U06.6966 Spur 1 Road, Site #17, stream crossing, pre- and post-treatment. The picture was taken from approximately the middle of the original landing surface, looking downstream. The bottom photo was taken after the site had gone through its first winter post-excavation.

Photos 8A and 8B. U06.6966 Spur 1 Road, Site #16, stream crossing, pre- and post-treatment. The picture was taken from approximately the top, looking downstream. The bottom photo was taken after the site had gone through its first winter post-excavation.

Appendix C3

Photo Pages for Site #1109, Stream Crossing Upgrade on the U06 Road, South Fork Elk River Watershed

2004-2005 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, Humboldt County, CA

Photo 1. U06 Road, Site #1129, stream crossing, during-its upgrade. The picture was taken from the left road approach looking across the crossing toward the right road approach. The excavator is removing fill from the stream valley upstream of the inlet and loading the spoils into dump trucks to be endhauled to a stable spoil disposal area nearby.

Photo 2. The same stream crossing during treatment. The photo was taken from just downstream of the top, looking downstream. The excavator is sitting just upstream of the inboard side of the crossing, cleaning out stored sediment from the stream valley. The gray material in the new channel bottom is siltstone bedrock of the Wildcat Formation, a rather soft but indurated material.

Photo 3. U06 Road, Site #1129, stream crossing, during-treatment. The picture was taken from a stump on the right sideslope of the stream valley upstream of the crossing. The view is looking downstream through the excavated road prism during the last stages of excavating the trench that the culvert was placed in. Note again the gray material in the center of the photo indicating the operator has reached natural bedrock in this area.

Photo 4. Site #1129 during the crossing upgrade. The excavator has cleaned out the trench to the natural stream grade and is ready for the culvert installation.

Photo 5. U06 Road, Site #1129 during the crossing upgrade. The excavator is placing the first section of culvert. View looking downstream from approximately the location of the soon to be installed culvert inlet.

Photo 6. U06 Road, Site #1129, stream crossing, post-treatment. The picture was taken from the right side-slope above the culvert inlet looking downstream toward the inlet in the foreground and the lowered stream crossing. Note the siltstone bedrock surfaces in the channel banks and bottom just upstream of the inlet.

Photo 7. Site #1129, stream crossing, post-treatment. The picture was taken from the outboard edge of the road at the crossing looking downstream toward the outlet. Note how the culvert outlet extends beyond the base of the fillslope to reduce the potential for any material that might slough off the fillslope to come to a rest before reaching the stream. The outlet discharges flow onto bedrock.

Photos 8 and 9. U06 Road, site #1129, post-treatment. Top photo show picture of the upstream extent of the channel excavation upstream from the crossing. The bottom photo shows part of the excavated channel as well as the new culvert inlet in the upper right of the photo. Both photos show the gray, slick surface of the Wildcat siltstone bedrock which controlled the depth of the channel excavation.

Appendix C4

Photo Pages for Sites on the R14 Road, Salmon Creek Watershed

2004-2005 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, Humboldt County, CA

Photos 1A and 1B. R14 Road, site #142.9, landslide, pre- and post-treatment. The picture was taken from a landing on the left side of the site. Road fill, sidecast during road construction activities, was slumping and threatening to deliver to a large Class 2 stream directly downslope. View is from the left side of the site. Site #143 stream crossing is located near the end of the site at the large Redwood tree in the top-center of the photos.

Photos 2A and 2B. R14 Road, site # 143 stream crossing, pre- and post-treatment. The picture was taken from above cutbank immediately to the right of the crossing. Note the lower and upper portions of the stream crossing have been excavated in the lower photo. A small road prism remains to allow future equipment access beyond this site. The remainder of this road is slated for decommissioning in summer 2006. Road fill, sidecast during road construction activities, was slumping and threatening to deliver to a large Class 2 stream directly down-slope. Site #142.9 is visible to the left of the Redwood tree in the top-center of the photo.

Photos 3 and 4. R14 Road, site #143.2, pre and post treatment. The lower portion of this site had been excavated treated as part of an earlier decommissioning project the previous year. The upper portion of this site had a large break-in-slope with fill over-steepened and saturated above the road. The upstream portion of this site was excavated to the natural channel grade.

Photos 5A and 5B. R14 Road, site #144, pre and post treatment. This site had also been partially excavated as part of an earlier decommissioning project the previous year. Additional fill was excavated from the crossing and a temporary culvert and downspout installed to pass flow through the crossing. Site #144.2, a small stream crossing site, located in the top center of the photos (where the person is standing in the lower photo) was likewise partially treated with additional fill excavated from the road prism itself through the crossing.

Photos 6A and 6B. R14 Road, site #144, pre and post treatment. View is approximately from the top of the excavation. Note the right road approach has been completely re-contoured in the lower photo. The entire road prism beyond this site was completely re-contoured between sediment delivery sites, funded by the BLM. All sites and road reaches from this site to the beginning of the road, is slated for completion in summer 2006.

Photos 7A and 7B. R14 Road, site #144.1, landslide, pre- and post-treatment. View is from the right end of the site, looking back towards site #144 stream crossing in the distance. Note the site has been completely outsloped, by placing some of the spoils against the cutbank.

Photos 8A and 8B. R14 Road, site #145, pre and post treatment. View is approximately from the top of the excavation. Note the large woody debris, unearthed during the excavation, was placed upon the side slopes both as a protective layer as well as to catch any material that might slough off. Note the old growth stumps in the lower photo. The previously buried stumps provide guidance to the excavator operator to help locate the original ground surface.

Photos 9A and 9B. R14 Road, site #145, pre and post treatment. View is approximately from the bottom of the excavation. Note the large old growth tree that is resting in the upper portion of the site. The tree had fallen prior to decommissioning activities due to a cutbank slide on the side of the crossing. Note the person, located in the center of the bottom photo, for scale.

Photos 10A and 10B. R14 Road, site #145.1, another landslide site, pre- and post-treatment. View is from the right end of the site. Again, note the site has been completely outsloped.

Photos 11A and 11B. R14 Road, site #145.2, pre and post treatment. View is from the top of the excavation. Note the slash and woody debris generated at the site are placed upon the freshly excavated surfaces. Note the person, located in the lower right corner of the bottom photo, for scale. Site #145.1 was located on the left road approach to this site.

Photos 12 and 13. R14 Road, site #145.2, post treatment. The views are from the lower end of the site, looking up to the top of the excavation.

Photos 14A and 14B. R14 Road, site #145.3, pre and post treatment. This was the farthest site out the road, located a short distance before the terminal landing. The lower portion of this site had been partially excavated as part of an earlier decommissioning project the previous year.

Appendix C5

Photo Pages for Sites on the R8 Road, Salmon Creek Watershed

2004-2005 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, Humboldt County, CA

Photos 1A and 1B. R8 Road in the Salmon Creek watershed. Site #121, a stream crossing, pre- and post-treatment. The picture was taken from the right road approach looking across the crossing. Note the new plastic culvert and downspout installed as a temporary crossing until the road can be completed, slated for decommissioning in summer, 2006. This site is located on steep inner-gorge slopes directly above Salmon Creek.

Photos 2A and 2B. R8 Road, site #121.1, a stream crossing, pre- and post-treatment. The picture was taken from the right road approach looking across the crossing. A culvert was installed at this site to pass flow for the winter. This was the last site treated on this road, before the onset of wet weather conditions closed down heavy equipment operations. Most of the work on this site took place above the road.

Photos 3A and 3B. R8 Road, site #121.1 during, and post-treatment. The view is from the road looking towards the top of the excavation. Note the large woody debris unearthed during the excavation was placed on the sideslopes to help catch any material that might slough off from an especially springy side slope. The large old-growth Redwood root ball visible in the top photo was unearthed during excavation of fill from the stream valley above the road. These can be used for in-stream fisheries projects incorporating large wood.

Photos 4A and 4B. R8 Road, site #121.1 during, and post-treatment. The view is from near the top of the excavation looking down to the road. Note the inlet of the new culvert and the large critical dip installed until the crossing can be fully decommissioned

Photos 5A and 5B. R8 Road, site #121.2, a landslide site during, and post-treatment. The view is from near the right end of the site looking back towards the start of the site, located where the quad is sitting in the top photo. This site had been partially treated as part of a different project the previous year. Note the road has been completely outsloped by excavation and endhauling most the material off-site, with a small portion placed upon the cutbank to complete the outslope.

Photo 6A and 6B. R8 Road, site #121.5, a stream crossing, pre- and post-treatment. The picture was taken from the left road approach looking across the crossing. Note the abundance of large woody debris unearthed during the excavation, placed on the newly excavated side slopes.

Photo 7A and 7B. R8 Road, site #121.1, during- and post-treatment. The view is from near the top of the excavation looking down to the road.

Photos 8 and 9. R8 Road , site #121.5 during-treatment. As the excavation progresses, the excavator gets deeper and more difficult to access by dump truck, so earthen ramps are constructed (top photo) to allow continued access by the dump trucks. On the R8 Road, there was a scarcity of adequate spoil disposal areas on the road itself, so most spoils were endhauled off-site to a stable storage location.

Photo 10A and 10B. R8 Road, site #122, a stream crossing, pre- and post-treatment. The view is from just above a low cutbank on the left road approach near the crossing. Upstream is to the right in the photos.

Photo 11A and 11B. R8 Road , site #122, during- and post-treatment. The view looking downstream from just below the top of the excavation. Note the dump truck in the top photo, marking the location of the road prism.

Photos 12 and 13. R8 Road, site #122, post-treatment. The photos were taken from near the bottom of the excavation looking upstream to the top of the excavation. A large hard-rock "knocker" controlled the depth of the excavation near the lower end of the site, creating a

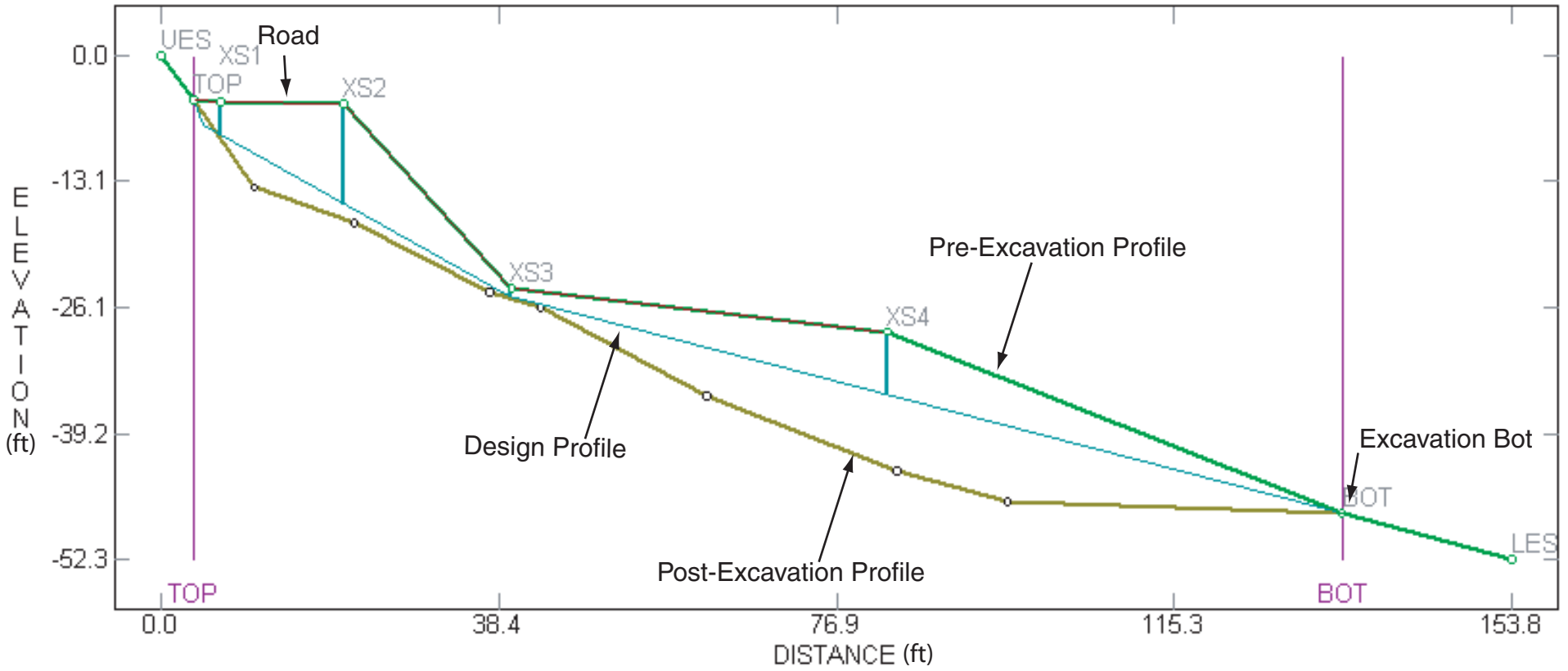
convex shaped channel bottom profile. Usually, excavated stream channel profiles should be straight-line or concave-up, except in situations like this where natural hard points control the resulting shape.

Photo 14A and 14B. R8 Road, site #122.1, a landslide site, pre-, and post-treatment. The view is from the left end of the site looking towards the right end of the site. The site was completely mulched with rice straw due to it's proximity to the creek. This site had been partially treated as part of a different project the previous year, but still contained potential to deliver sediment to mainstem Salmon Creek, located immediately below the site. Note the road has been completely outsloped.

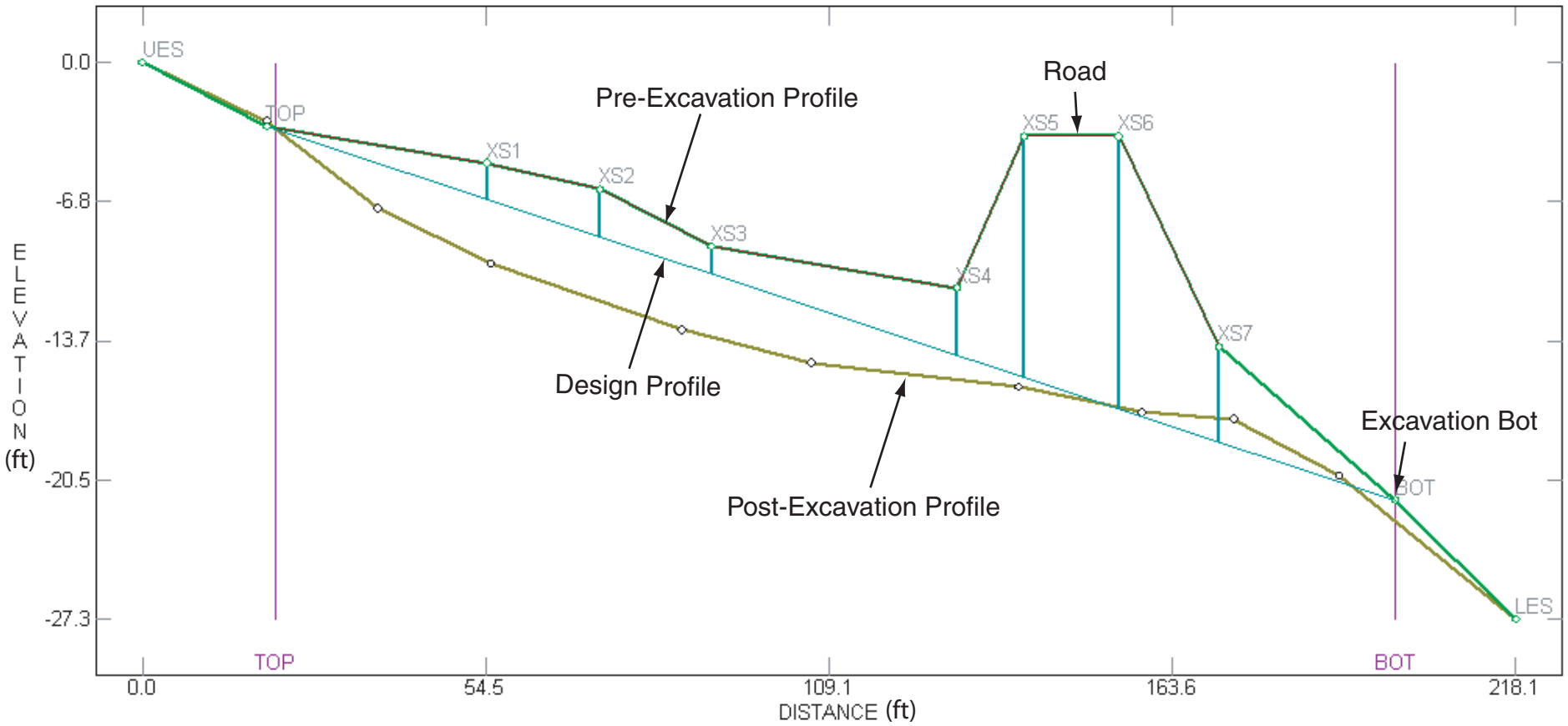
Appendix D

Sample "As-Built" Profiles for Stream Crossing Sites Treated as Part of the 2004-2005 South Humboldt Bay Coastal Resources Protection Project, Headwaters Forest Reserve, Humboldt County, CA

Salmon Creek Watershed, R14 Road, Site #145.3 - Stream Crossing Pre- & Post-Excavation Profiles



Salmon Creek Watershed, R8 Road, Site #122 - Stream Crossing Pre- & Post-Excavation Profiles



Salmon Creek Watershed, R8 Road, Site #121.5 - Stream Crossing Pre- & Post-Excavation Profiles