

UPPER BOYES CREEK ROADS
REHABILITATION PROJECT

Unit 89-1

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INTRODUCTION

Watershed rehabilitation work for Units 89-1 and 89-6 was performed in conjunction with construction of the U.S. Highway 101 Bypass Project. With the completion of this construction project, several miles of old, abandoned, and unmaintained logging roads would have been isolated within many regions of Redwood National Park. Special Use Permit 8480-221, authorizing highway construction on park lands, required the State Department of Transportation to rehabilitate roads that would be isolated by highway construction to National Park Service standards. In April, 1989, Redwood prepared and submitted a complete rehabilitation plan to Caltrans for rehabilitation of those roads. The National Park Service and Department of Transportation entered into an agreement (Memorandum of Agreement #8480-9-8004) to reimburse Redwood for performing the heavy equipment and labor intensive portions of this work. Units 89-1 and 89-6 were completed under this agreement.

The majority of Unit 89-1 is located within the Boyes and Big Tree creek drainages, both tributary to Prairie Creek (Map A). Several short road segments were also treated in the northern portions of the highway project which drain into Ah Pah Creek, and are shown only in Map D. Unit 89-1 included roughly 620 acres of mostly cut-over land with a total of 4.3 miles of logging haul roads. Of the total road mileage treated, Upper Boyes Creek Road accounted for 2.5 miles; Network A accounted for 0.75 mile; roads north of Cal-Barrel Road accounted for 1.0 mile.

The total rehabilitation cost, including all preparatory work, was \$98,080. Of this total, heavy equipment and labor intensive work cost \$70,897 and \$5,959, respectively, accounting for 78% of the total project cost. Field investigations, planning, supervision and documentation accounted for the remaining \$21,224, or 22%. A total of 29,440 yds³ of fill was excavated primarily from stream crossings. E.P. Johnson (hydraulic excavator) and John Jackson (D-8, ripper and winch) performed the heavy equipment work under hourly rental contracts.

REHABILITATION UNIT 89-1 - SUMMARY

UNIT NAME: Upper Boyes Creek Roads

PROJECT LEADER: Bundros

LOCATION DESCRIPTION: Boyes and Big Tree drainages, tributaries to Prairie Creek.
T11N, T12N, R1E, R2E, S6,37 (Map A, pg. 4)

TOTAL UNIT ACREAGE: 620

MILES OF ROAD TREATED: 4.2 miles
(Primary and secondary roads)

TOTAL REHABILITATION PROJECT COST: \$98,080 (Table 1, pg. 9)

GEOLOGY DESCRIPTION: Gold Buff Formation caps the Franciscan Formation in many parts of unit.

GEOMORPHIC DESCRIPTION: Area occupies middle and upper hillslope regions. Total relief is 1000 feet; elevations range from 600-1600 feet. Hillslope steepness average 45%, often exceeding 50% within drainages and mid-hillslope areas steepened by Lost Man Fault. Streams are intermittent and perennial, deeply incised, often bedrock controlled.
(Map B pg. 6)

SOIL DESCRIPTION: Coppercreek (Franciscan) and Empire (Gold Bluff) are the most common soil types; Atwell soils common within drainages. For complete description, refer to report by Popenoe, May, 1988, "Soils of the Highway 101 Bypass Watershed Rehabilitation Units."

LAND USE/LOGGING HISTORY: Timber harvest and road building began in the early 1950's. By 1954, most of the south facing hillslopes of May Creek had been clearcut and cable yarded; road building had been limited to the broad valley bottom of May Creek and to the ridges separating Boyes and May creeks. Most of the remaining timber in both drainages had been clearcut and tractor yarded by 1965. Road building was concurrent with timber harvest. In the mid-slope regions of Boyes Creek, hillslopes were so steep that landings were often constructed within active streams. (Map C, pg. 7)

EROSION FEATURES Stream diversions from road and skid trail construction initiated the majority of the erosional processes on this unit. Each crossing had been originally constructed as a "Humboldt Crossing" and nearly each one contributed to a road prism failure, of varying size, some distance down-road. Stream diversions also undermined many of the already undercut road cut-banks. Material from cutbank failures was commonly sidecast from the road and left perched above streams. Stream diversions and road failures continued with each major storm until the time of rehabilitation.

REHABILITATION WORK SUMMARY: Hourly Rental

I. Total Heavy Equipment Cost: \$70,897 (Table 1, pg. 9)

Heavy Equipment Used: Kobelco K909LC Mark II hydraulic excavator (1.36 yds³) and Caterpillar D8H dozer with winch and rippers (contractor switched these in the field).

#	<u>Types of Treatment</u>	<u>Total Cost</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Rate</u>
29	Haul Road Stream Xings	\$45,280	24,760 yds ³	\$1.83/yd ³	55 yd ³ /PH
485 ft.	Exported Outslope	\$2348	2180 yds ³	\$1.08/yd ³	93 yds ³ /PH
1060 ft.	Standard Outslope	\$3161	2500 yds ³	\$1.26/yd ³	86 yds ³ /PH
	Rip Roads	\$1033	1.1 mi.	\$939/mile	532 ft./PH
	Cross Road Drain	\$1113	980 ft.	\$1.14/ft.	103 ft./PH
	Miscellaneous	\$14,161	* - *	* - *	* - *
	Move In/Out and About	\$3920	* - *	* - *	* - *

II. Total Labor Intensive Costs - \$5959 (Table 1, pg. 9)

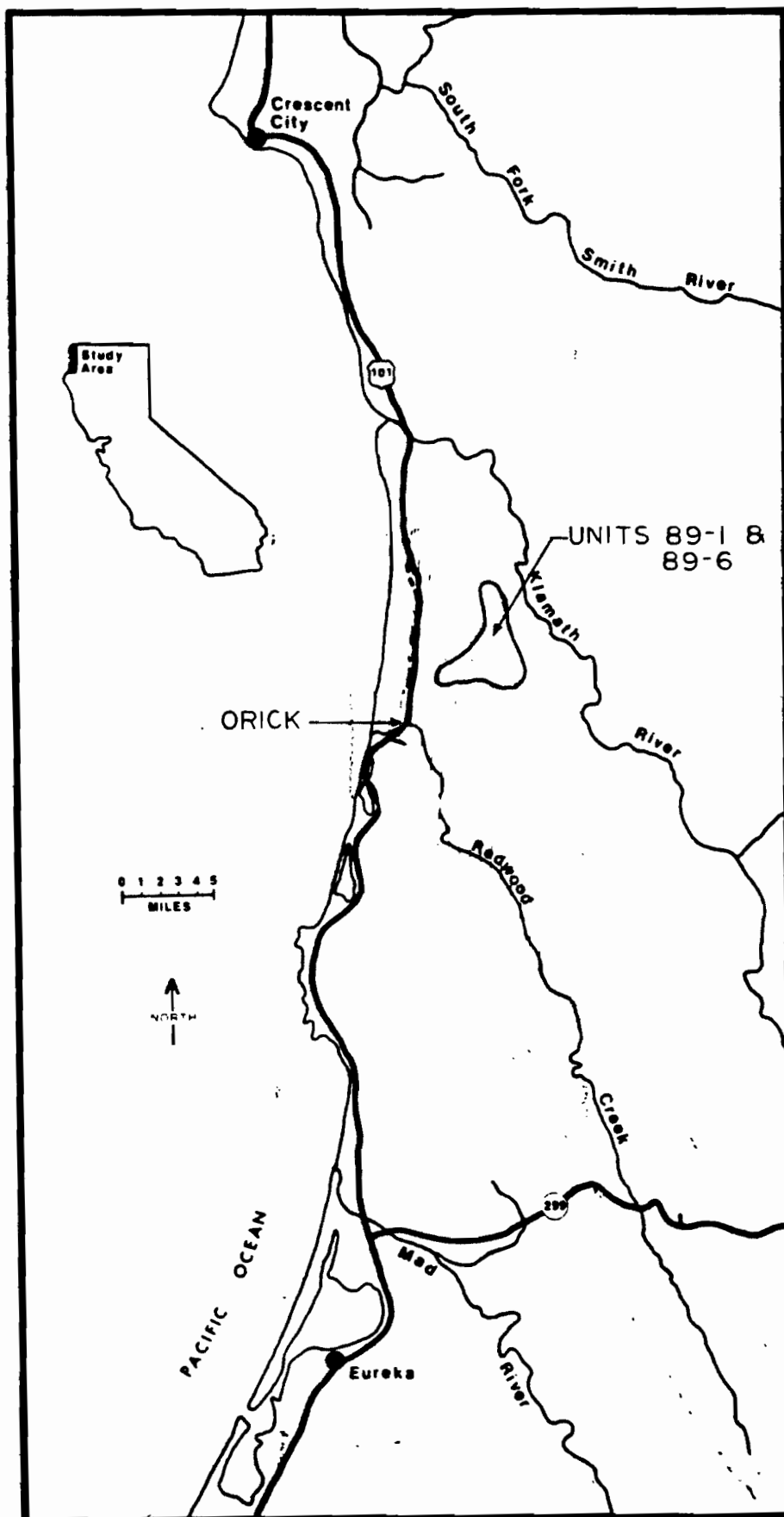
Straw Mulch:	Number of Bales	310 bales
	Total Area Covered	4.3 acres
	Total Cost	\$3170
	Unit Cost	\$10.23/bale

Brush Work Sites:	\$2787
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DISCUSSION (pg. 14): A complete description of work site conditions, heavy equipment and methodology is detailed in the summary report for this unit. In general, heavy equipment work progressed smoothly with no significant breakdowns or delays. Most all of the haul road stream excavations were difficult to complete because of the amount of large organic debris and saturated material contained within these fills. The higher than usual unit costs for stream excavations reflect the difficult nature of these crossing excavations.

MAP A - LOCATION UPPER AND LOWER BOYES C
REHABILITATION UNITS 89-1 & 89-6

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REHABILITATION UNIT

Description of Unit

Unit 89-1 occupies the middle and upper hillslope regions of the Boyes and Big Tree creek drainages (refer to Map B). Total relief is 1000 feet, with elevations ranging from 600 feet to 1600 feet. Hillslope gradients average 45%, but often exceed 70% when nearing streams.

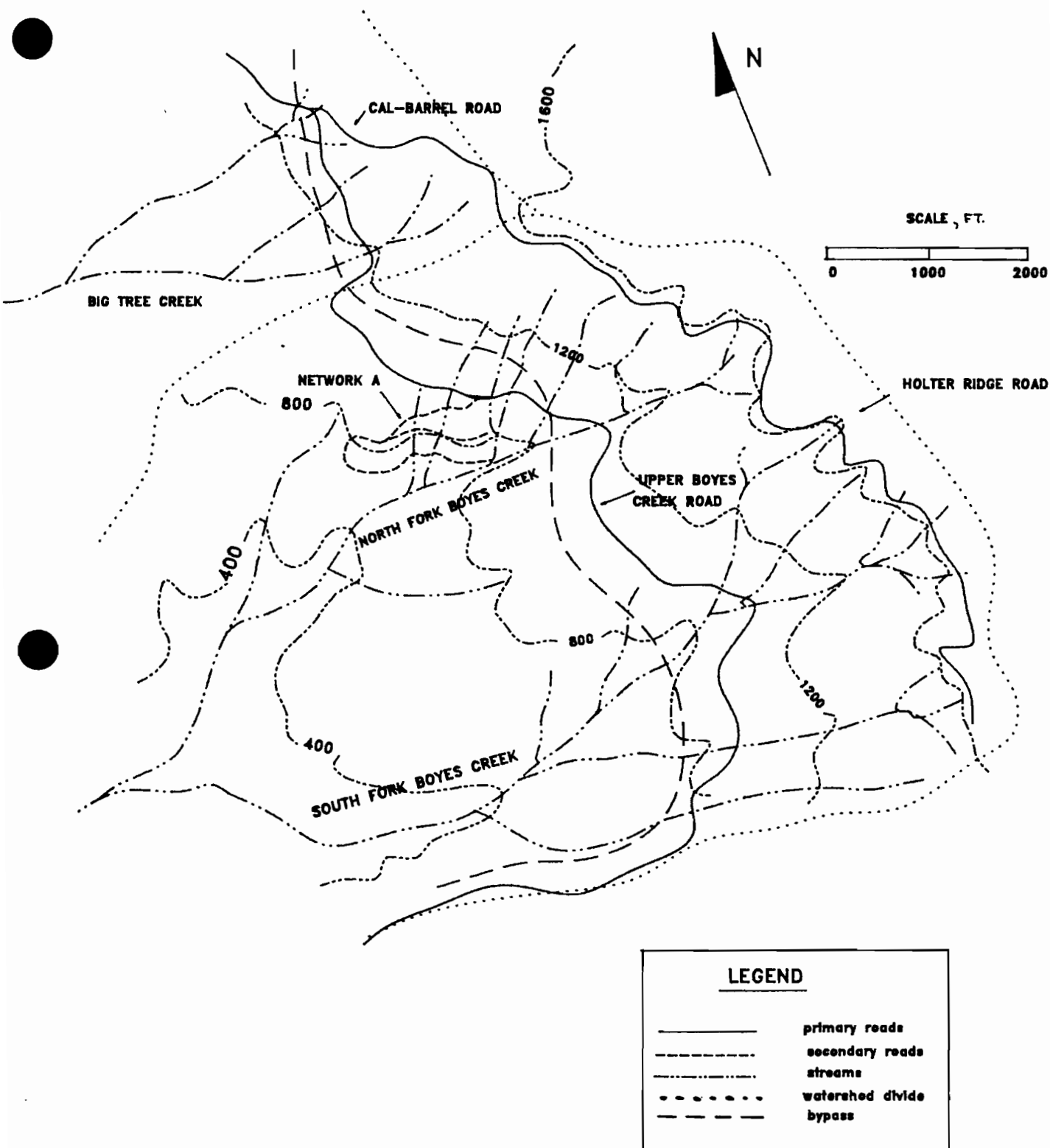
As this unit occupies a middle to upper hillslope position, stream valleys are often narrow, deeply incised and contain steep (50%-85%) side slopes. Intermittent streams range from 6 acres to 20 acres in size, while perennial streams range from 20 acres to 75 acres in drainage area. Stream gradients often exceed 30% in these headwater regions where bedrock is the most common form of channel armor.

The Gold Bluff Formation caps the Franciscan Formation throughout most of the ridge top elevations of this rehabilitation unit where hillslope gradients average 35%-40%. The Franciscan Formation is exposed in the steeper mid-slope regions where gradients average 50%-55%. The Gold Bluff lacks competent material and is prone to both surface and deep-seated erosional processes. In contrast, the Franciscan Formation contains relatively competent material containing massive sandstone outcrops which may have a tectonic origin. These tectonic blocks are found in many of these mid-slope drainages where stream gradients exceed 30%. Here, hillslope gradients commonly exceed 50%, possibly a result of thrust faulting from the Lost Man Fault identified by Kelsey and Cashman (1983). Typical of the Franciscan, highly sheared or weathered materials are commonly found along stream-side locations. Coppercreek (along with variants) soils are the most common soil type of the Franciscan Formation. Atwell soils are common within drainages. Empire (along with variants) are the most common soils found within the Goldbluff. The soils report by Popenoe, May, 1988, "Soils of the Highway 101 Bypass Watershed Rehabilitation Unit" details the descriptions of soils found on both 89-1 and 89-6 rehabilitation units.

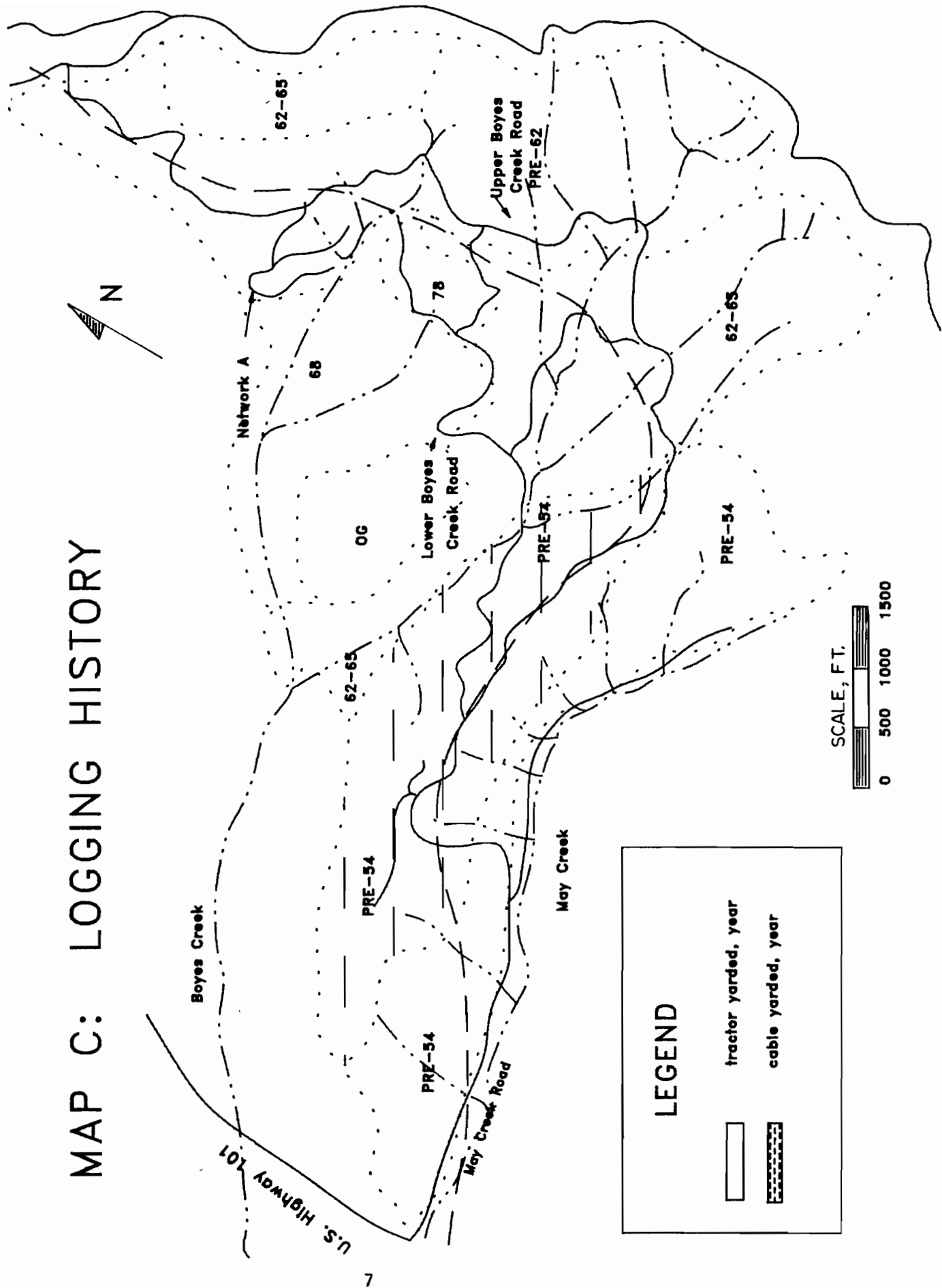
Timber Harvest and Erosion History

Timber harvest and road building started in the early 1950's. By 1954, most of the south facing hillslopes of May Creek had been clearcut and cable yarded. Road building had been limited to the broad valley bottom of May Creek and to the ridges separating Boyes and May creeks. The next major thrust of timber harvest occurred in the early 1960's, and, by 1965, most of the remaining timber in both drainages had been clearcut and tractor yarded.

Road building was concurrent with timber harvest. Initially, roads were pioneered to obtain access to the cut units. While timber was being felled and yarded to frequent and small landings, roads were improved to the many landing locations. In the mid-slope regions of Boyes Creek, hillslopes were so steep that landings were often constructed within the valley bottoms (active stream channels) by dumping stumps and "cull" logs into streams and burying them with dirt. Map C summarizes road building and timber harvest in the Boyes and May creek drainages.



MAP C: LOGGING HISTORY



Stream diversions from road and skid trail stream crossings initiated the majority of the accelerated erosion on this unit. Upper Boyes Creek Road had a nearly continuous grade, often exceeding 5% and reaching as much as 20% in some areas. As a result, stream diversion potentials remained high up to the time of rehabilitation.

Each stream crossing had been originally constructed as a "Humboldt Crossing." At some point following construction, twenty-inch diameter well casings had been installed in many of the crossings. Nevertheless, nearly every crossing had diverted its stream from its channel during a major storm, causing a road prism failure, of varying size, some distance down-road. Diverted streams not only initiated mass wasting of road fill and gulling on the hillslopes, but also gullied road and inboards ditch areas which further undermined already unstable road cut-banks. Following major storms, the failed cut-bank material was commonly sidecast from the road and left perched above streams. Stream diversions and road failures continued with major storms up until the time of rehabilitation.

EROSION CONTROL REHABILITATION WORK

Preparatory Work

Special Use Permit 8480-221, dated April 18, 1984, allowed the state of California to construct the U.S. 101 Bypass on park lands. It contained special provisions that required the state to rehabilitate roads, utilized by the state or its contractor, that would be isolated (abandoned) by highway construction. The permit further required that rehabilitation meet Park Service standards. As construction progressed and isolation of roads neared, a generalized rehabilitation plan with cost estimate was prepared and submitted to Caltrans describing the level of treatment that Redwood National Park would apply to these roads. This plan (A General Rehabilitation Plan for National Park Service Roads Severed by the U.S. Highway 101 Bypass Project, Gregory J. Bundros, August, 1988) was later refined and submitted to Caltrans with a final cost estimate (A Rehabilitation Plan for National Park Service Roads Severed (Isolated) by the U.S. Highway 101 Project, Gregory J. Bundros, May, 1989). As Redwood had the experience and expertise in watershed rehabilitation, Caltrans entered into an agreement (Memorandum of Agreement 8480-9-8004, dated December 15, 1989) with Redwood to reimburse the park for implementing/supervising the heavy equipment and labor intensive phases of this work. The final plan required Caltrans to complete part of this work in areas where potential conflicts existed between our work schedule and the primary contractors' work schedule. Because of its size, this area was divided into two rehabilitation units, 89-1 and 89-6.

The majority of field mapping and prescription work for both rehabilitation units was performed in 1988, by Greg Bundros, at a scale of 1:2400. Mapping was completed in 1989, with the assistance of Louise Johnson, Mike Kenning, Darci Short and Dave Steensen, requiring a total of 900 person-hours. Greg Bundros was the project leader for Unit 89-1. Louise Johnson was the project leader for Unit 89-6. Table 1 summarizes all costs for Unit 89-1 and includes costs for heavy equipment work, site evaluation, supervision, and labor intensive work.

Table 1
REHABILITATION WORK COST SUMMARY
Unit 89-1: Upper Boyes Creek Roads

<u>Treatment</u>	<u>Work Site Quantity</u>	<u>Total Cost</u>	<u>Average Unit Cost</u>	<u>Average Rate: Quantity Per Piece Hour</u>
HEAVY EQUIPMENT WORK:				
<u>Primary Treatments</u>				
Stream Crossings	24,760 yd ³	\$45,161	\$1.82/yd ³	55 yd ³ /ph
Exported Outslope	2180 yd ³	2348	\$1.08/yd ³	93 yd ³ /ph
Outslope	2500 yd ³	3161	\$1.26/yd ³	86 yd ³ /ph
Rip Roads	5850 ft	1033	\$950/mi	0.10 mi/ph
Cross Road Drains	980 ft	1113	\$1.14/ft	103 ft/ph
<u>Move-In/Out</u>	3 pieces	\$3700	--	--
<u>Intra-Unit Move</u>	2 pieces	\$220	--	--
<u>Miscellaneous</u> (Table 5)		<u>\$14,161</u>	--	--
TOTAL HEAVY EQUIPMENT COST=		<u>\$70,897</u>		

-LABOR INTENSIVE WORK				
<u>Secondary Treatments</u>				
Straw (Table 6)	310 bales	\$3172	\$10.23/ea	--
<u>Miscellaneous</u>				
Brush Work Sites	3 sites	<u>\$2787</u>	--	--
TOTAL LABOR INTENSIVE COST=		<u>\$5959</u>		

TECHNICAL WORK				
<u>Evaluation</u>				
Mapping		\$4344		270 person-hours
Prescription & Planning		4461		300 person-hours
Survey & Design		3387		300 person-hours
Contract Preparation		487		30 person-hours
<u>Supervision of Work</u>				
Heavy Equipment Work		\$5570		370 person-hours
<u>Documentation</u>				
Photos		\$1434		140 person-hours
Cost Summary Report		<u>1541</u>		95 person-hours
TOTAL TECHNICAL WORK=		<u>\$21,224</u>		

GRAND TOTAL COST=		<u>\$98,080</u>		

Heavy Equipment Work

Heavy equipment work began on August 8th and was completed on September 28, 1990. Heavy equipment with operators were secured by hourly rental contracts. E.P. Johnson Construction, Inc. provided a 1.36 yds³ (SAE heaped capacity) Kobelco K909LC Mark II hydraulic excavator for \$119.00/hour. Dave Johnson operated this machine. Mad River Construction provided a Caterpillar D8H with a U-blade and winch for \$83.95/hour. Mad River Construction also provided a set of rippers to be mounted on the same machine, when needed, for \$93.95/hour. This dozer was owned and operated by John Jackson.

Equipment work began with Road Network A, and then completed the section of Upper Boyes Creek Road (UBCR) north of the viaduct to and including the road crossing at Sta. 650+00 (Bypass alignment). The section of UBCR south of the viaduct was completed next. From there, equipment was lowboyed to several short road segments located north of Cal-Barrel Road, in the vicinity of Sta. 830+00.

Complete restoration of hillslope morphology was not the intent of rehabilitation. A multi-disciplinary team review of proposed prescriptions agreed that, because this area had become isolated by the U.S. Highway 101 Bypass, park visitor use would be unlikely, and rehabilitation treatments should focus on erosion control treatments only. Outsloping was prescribed only as an erosion control measure to remove unstable material perched above stream channels.

A total of 29,440 yds³ were excavated from this rehabilitation unit. Of this total, 24,760 yds³ (84% of the total yardage) were excavated from stream crossings at an average unit cost of \$1.82/yd³ (Table 2). Outsloping and exported outsloping averaged \$1.26/yd³ and \$1.10/yd³, respectively (Tables 3 and 4). Only rocked roads were ripped prior to burial or cross-road draining. Upper Boyes Creek Road and road segments near Sta. 830+00 were thoroughly ripped at a cost of \$932/mile. Cross-road drains averaged \$1.14/linear-foot of drain. Of the total heavy equipment cost, stream crossing excavations, outsloping and exported outsloping accounted for 64%, 4% and 3%, respectively. Miscellaneous costs accounted for 20% and are summarized in Table 5.

Labor Intensive Work

Labor intensive work was performed by Redwood National Park and Redwoods United labor crews. The total labor cost was \$5959, or 6% of the total project cost. During the winter months preceding rehabilitation, RNP and Redwood United labor crews brushed stream crossings to facilitate surveying at a total cost of \$2787.

Because of favorable soil and seed source conditions, straw mulch was prescribed only for stream crossing excavations and was applied at a rate of 4000 lbs./acre. Previous to heavy equipment work, RNP labor crews stockpiled straw bales within 50 feet of each work site. RNP labor crews spread 310 bales of straw onto completed work sites as heavy equipment work progressed at a total cost of \$3172, or \$10.23/bale. Table 6 summarizes straw mulch costs.

Table 2

HAUL ROAD STREAM CROSSING COSTS
Unit 89-1: Upper Boyes Creek Roads

Work Site	Hours		Total Cost ⁶	Volume ⁷ yds ³	Unit Cost	Excavation	Average
	D8W	HE				Rate yds ³ /hr	Push Dist. ft
RX1A ¹	15.75	13.25	\$2899	550	5.27	19	100
RX2A ²	2.0	2.0	406	80	5.07	20	100
RX3A ³	0.5	1.25	191	95	2.00	109	40
RX4A ¹	3.0	3.5	668	190	3.52	29	200
RX5A	1.0	0.0	84	85	.99	85	100
RX6A	0.0	.75	89	85	1.05	113	40
RX7A ^{1,4}	5.25	5.25	1065	390	2.73	37	150
RX1B ¹	32.75	29.25	6230	4340	1.43	70	250
RX2B ¹	10.25	9.5	1991	1160	1.72	59	100
RX3B	2.25	2.75	516	230	2.24	46	75
RX4B	2.75	0.25	261	140	1.86	47	75
RX5B ⁵	0.0	1.0	119	50	2.38	50	0
RX6B ¹	21.75	17.5	3908	1720	2.27	44	300
RX7B ¹	12.0	13.25	2584	870	2.97	34	150
RX8B ²	29.75	22.0	5116	4100	1.25	79	300
RX9B	2.75	2.5	528	270	1.96	51	75
RX10B	0.25	0.0	21	30	.70	120	30
RX11B	0.5	0.25	72	60	1.2	80	50
RX12B	1.75	1.25	296	300	.98	100	100
RX13B ²	9.75	9.75	1979	1320	1.51	68	100
RX14B ⁴	2.25	5.25	814	550	1.49	73	200
RX15B ¹	24.0	21.5	4573	2450	1.87	54	175
RX16B	1.25	1.0	224	195	1.16	87	100
RX17B ^{1,4}	8.75	7.25	1597	410	3.89	26	100
RX1N ³	0.0	1.5	178	60	2.97	40	70
RX2N ³	0.0	2.0	238	90	2.64	45	70
RX3N ¹	35	20	5318	3380	1.58	61	200
RX4N ¹	18.25	11.25	2871	1210	2.37	41	250
RX5N	1.75	1.5	325	350	.93	108	50
Totals	245.25	206.5	\$45,280	24,760yd	\$1.83/yd (ave)	55yd/hr (ave)	--

¹Fill contained a high concentration of logs and stumps and was often saturated; unable to fully utilize D8 because of moisture; at times, excavator handles fill more than once.

²Fill contains a high concentration of logs and stumps.

³Excavator works alone handling fill more than once.

⁴Limited workspace; equipment operating inefficiently.

⁵Atypical excavation; excavator constructs trench to divert steamflow.

⁶Caterpillar D8W @ \$83.95/hr; Kobelco K909 hydraulic excavator @ \$119/hr.

⁷Volumes based upon pre-excavation surveys and represent minimum quantities.

Table 3

EXPORTED OUTSLOPE COSTS
Unit 89-1: Upper Boyes Creek Roads

Worksite ³	Hours		Total ¹ Cost	Volume ² yds ³	Unit Cost	Excavation Rate yds ³ /hr	Average Push Dist. ft
	D8W	HE					
EOS2B(220ft)	6.25	4.75	\$1089	1100	.99	100	150
EOS3B(75ft)	3.25	2.75	600	500	1.2	83	150
EOS4B(70ft)	1.25	0.5	164	150	1.09	86	100
EOS1N(120ft)	2	2.75	495	430	1.15	91	150
TOTALS:	12.75	10.75	\$2348	2180yd ³	1.10	93	--

Table 4

OUTSLOPE COSTS
Unit 89-1: Upper Boyes Creek Roads

Worksite	Hours		Total Cost	Volume yds ³	Unit Cost	Excavation Rate yds ³ /hr	Average Push Dist. ft
	D8W	HE					
OS1B(320ft)	3.75	3.5	\$731	770	0.95	106	--
OS2B(50ft)	0.0	2.5	298	180	1.65	72	--
OS3B(60ft)	0.0	1.5	178	200	0.89	133	--
OS4B(200ft)	3.5	3.5	710	410	1.73	59	--
OS1N(220ft)	0.0	6	714	570	1.25	95	--
OS2N(50ft)	1.0	0.5	143	150	0.96	100	--
OS3N(60ft)	0.0	0.5	60	55	1.08	110	--
OS4N(100ft)	0.0	2.75	327	165	1.98	60	--
TOTALS:	8.25	20.75	\$3161	2500yd ³	1.26	86	--

¹Caterpillar D8 with winch @ \$83.95/hr; Kobelco K909 hydraulic excavator @ \$119/ hr.

²Worksites were surveyed for volumes prior to excavation.

³A - Road Network A; B - Upper Boyes Creek Road; N - Roads to the North of Cal-Barrel Road. Roads on this unit averaged 23 ft. in width. On the average, outslope treatments excavated 1/2 of the bench width, while exported outslopes excavated the entire bench.

Table 5

MISCELLANEOUS COSTS FOR HEAVY EQUIPMENT
Unit 89-1: Upper Boyes Creek Roads

Category	Hours		Total Cost
	D8W	HE	
Discussions ¹	11.75	12.25	\$2444
Travel Between Work Sites ²	8.75	16.25	2668
Open and Brush Roads ³	24.25	18.25	4208
Paid Breaks ⁴	17.75	17.25	3662
Standby with Operator ⁵	7.5	11.25	1179
TOTALS:	70.0	76.5	\$14,161

Table 6

STRAW MULCH SUMMARY
Unit 89-1: Upper Boyes Creek Roads

	Number of Bales	RNP Person-Hours	Total Cost	Cost/ Bale
Materials	310	- -	\$1194	\$3.85
Distribution ⁶	310	42	497	1.60
Spread	310	129	1481	4.78
TOTALS	310	171	\$3172	\$10.23

¹Time spent discussing work, equipment scheduling, etc. with operators.

²Travel time between work sites when more than 15 minutes was required.

³Time spent opening/reconstructing roads to gain access, clearing work site of trees and disposing of them into a fill site.

⁴Two 15-minute paid breaks were allowed each work day.

⁵The equipment is on the work site capable of work but, because of equipment sequencing or breakdown, is told to not work and standby.

⁶The cost of transporting straw bales to the rehabilitation unit and placing them in piles within 50 ft. of each stream crossing excavation. Straw was applied at stream crossing excavations only.

SUMMARY

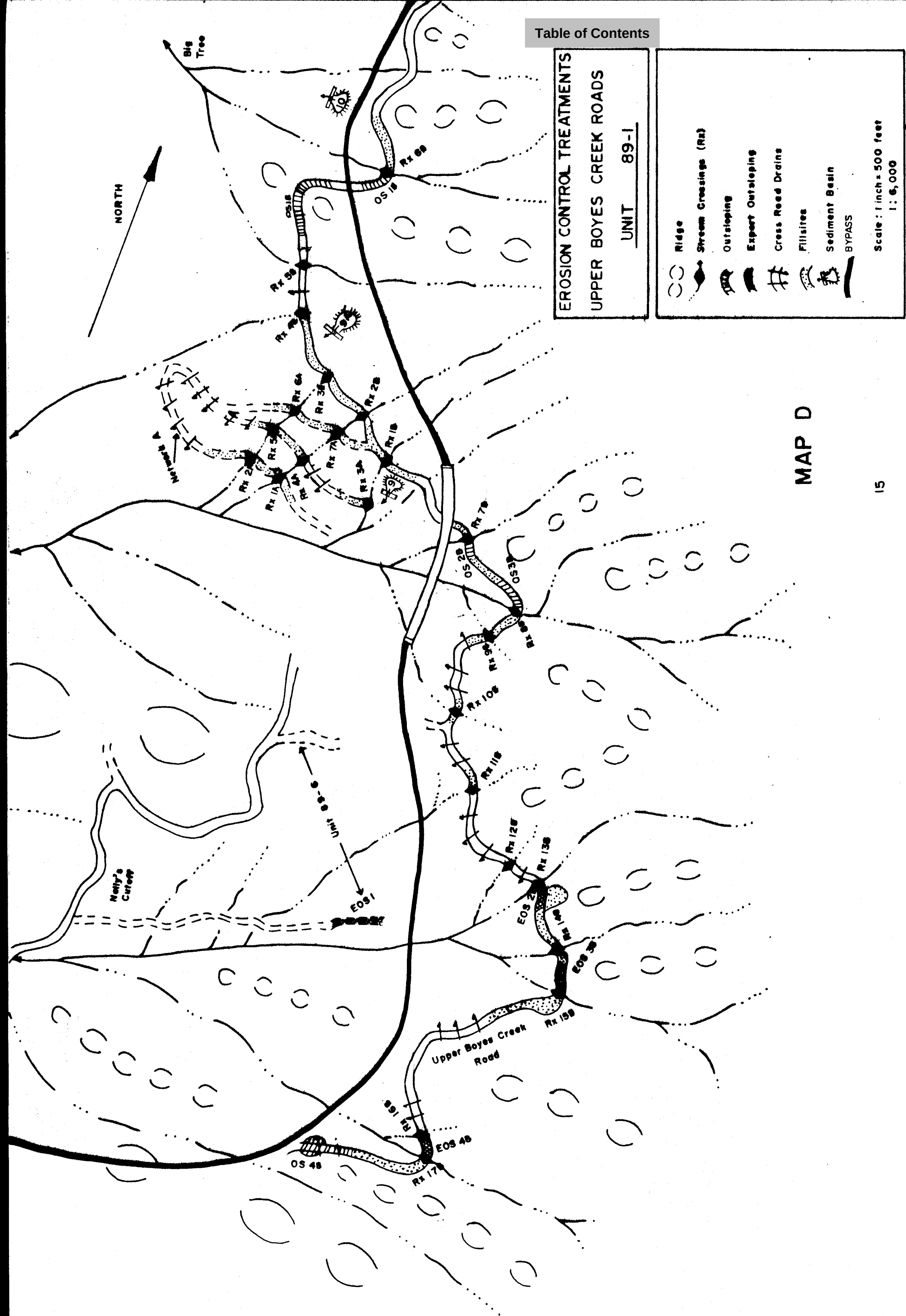
Overall excavation rates for this unit were somewhat lower than expected. This was due partly to the hydraulic excavator operator's inexperience with rehabilitation work, and the unusually poor quality of materials found within several work sites. The excavator operator was an excellent operator - quite experienced with this type of machine. However, he had never performed this type of work and had a difficult time visualizing the finished product (especially at stream crossing excavations) and the work sequence (approach) necessary to complete each job. Also, the hydraulic excavator was slightly under-sized for these excavations. A $1\frac{1}{2}$ yd³- $1\frac{3}{4}$ yd³ capacity excavator may have been more appropriate for this equipment combination.

Stream crossing excavations were complicated by the extraordinary amount of logs and stumps, and saturated material found within most of the crossings. In several of the crossings, the dozer actually got stuck within the fill site because the moisture content of the material was so high. In these cases, the excavator handled some material twice and, at times, performed the final outslope of the fill site instead of the dozer. Stream crossing excavation rates for this equipment combination and size of crossings should have averaged around 60-65 yds³/piece-hour. As can be seen from Table 2, stream crossing excavation rates ranged from 19-120 yds³/piece-hour, and averaged 55 yds³/piece-hour.

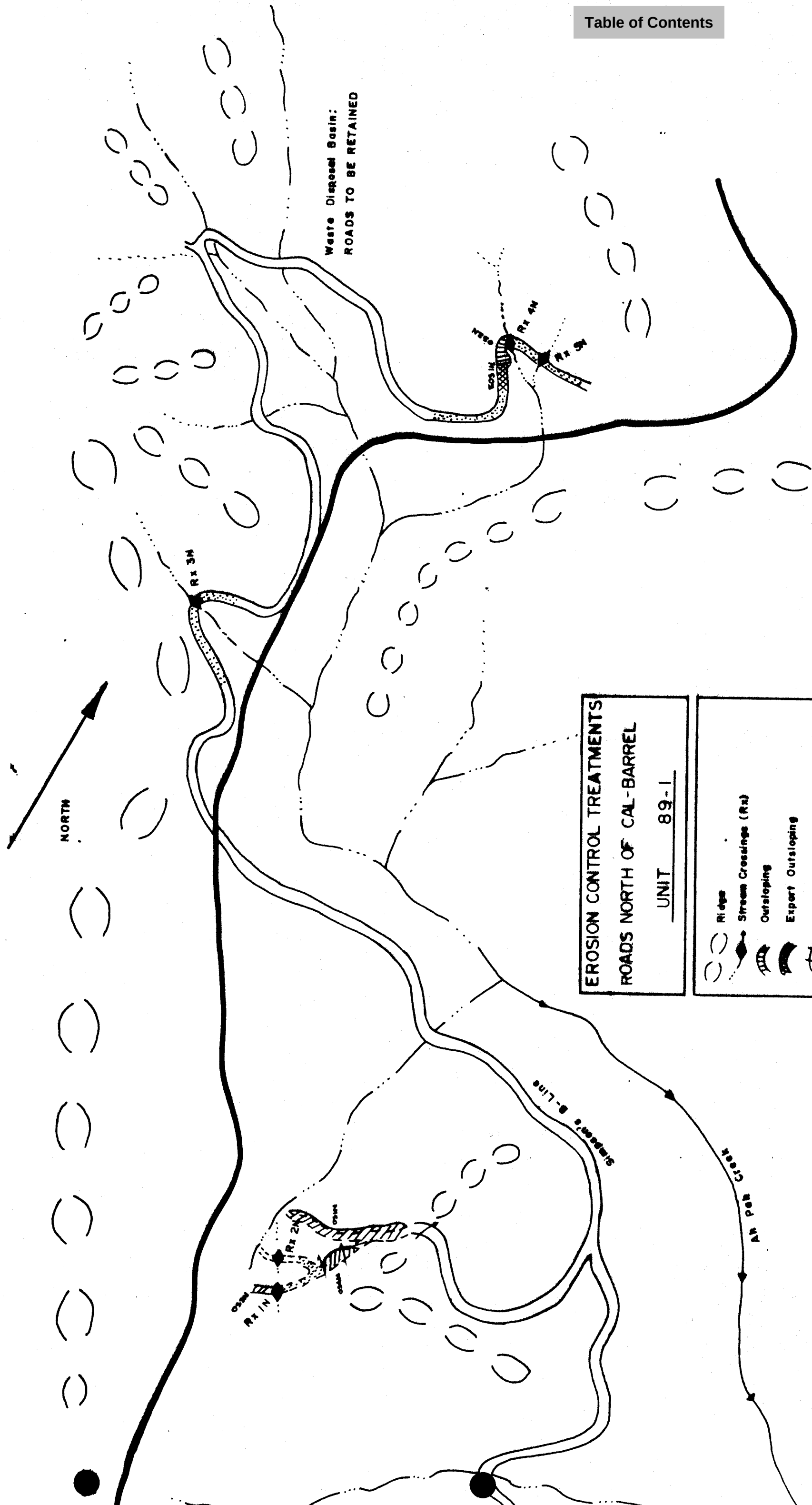
For this combination of equipment, outsloping excavation rates would typically average 100 yds³/piece-hour, or greater. Outsloping rates for this unit ranged from 59-133 yds³/piece-hour, and averaged 86 yds³/piece-hour. This was due partly to the nature of the work sites, and logistics of working around the bypass construction project. The excavation rate at work site OS4N was 60 yd³/hr. This was a steep (30%), narrow skid road; maneuvering the excavator was difficult. The excavation rate at OS4B was 59 yd³/hr. This was the last work site completed on Upper Boyes Creek Road prior to an intra-unit move requiring a lowboy. The dozer spent much of its time waiting because of the lack of work.

In general, this equipment combination worked out quite well. Under more typical work site conditions, the hydraulic excavator would have been somewhat under-sized to operate efficiently with a D8 dozer. However, the organic debris concentrations and moisture content in most of the fills greatly reduced the operating efficiency of the dozer which, in turn, helped reduce their size differences.

The ripper dozer arrangement; i.e., utilizing the same machine for both winch and ripper functions, did not work out well. The timing and logistics of making the change-over in the field greatly complicated equipment scheduling. Unless absolutely necessary, I would strongly discourage this practice in the future.



MAP D



EROSION CONTROL TREATMENTS
ROADS NORTH OF CAL-BARREL
UNIT 89-1

Ridge	Stream Crossings (Rx)
Outslaping	Expert Outslaping
Cross Road Drains	Fillsites
Sediment Basin	BYPASS

Scale: 1 inch = 500 feet
1:6,000

MAP E



PP2 Upper Boyes Crk 89-1 7-6-89 35mm RX15 GJB



PP2 Upper Boyes Crk 89-1 12-2-89 35mm RX15 JFW



PP5 Upper Boyes Crk 89-1 7-6-89 35mm RX8 GJB



PP5 Upper Boyes Crk 89-1 12-2-89 35mm RX8 JFW



PP6A Upper Boyes Crk 89-1 7-6-89 35mm RX8 GJB



PP6A Upper Boyes Crk 89-1 12-2-89 35mm RX8 JFW



PP8 Upper Boyes Crk 89-1 7-6-89 35mm RX6 GJB



PP8 Upper Boyes Crk 89-1 12-2-89 35mm RX6 JFW



PP9 Upper Boyes Crk 89-1 7-6-89 35mm RX3 GJB



PP9 Upper Boyes Crk 89-1 12-2-89 35mm RX3 JFW