

Ken's file

SUMMARY REPORT

Rehabilitation Unit 86-1

M-7/M-7-5 Roads

Bridge Creek Basin

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INTRODUCTION

The M-7 road, unit 86-1, is on the west side of Redwood Creek about 8.5 air miles southeast of Orick. (Map A). The road crosses Bridge Creek about 1.8 miles upstream from its confluence with Redwood Creek. Relief ranges from a high of 2,720 feet on Rodger's Peak to a low of 280 feet on Bridge Creek at the M-7 bridge. The elevation of the road treated this year varies from 730 feet at the M-7-5/M-7-5-1 junction to 320 feet at the upstation (western) end. The drainage area above the M-7 bridge is 8.7 square miles, making Bridge Creek the second largest drainage within the Park. The mapped area of about 50 acres, most within the inner gorge, includes slopes of generally moderate steepness that average 40%, but some of the slopes below the road exceed 70% (Map C).

The slopes above the M-7, on both sides of the bridge, are underlain by a soft, friable dark gray to black schist. This schist, commonly called sheared black schist (SBS), is part of the schist of Redwood Creek, which in turn is a part of the Franciscan Assemblage (Hardin et al, 1982). Soils above the SBS have been mapped as Elfcreek, Devils Creek, and water saturated colluvium. Soils out of the inner gorge, near the M-7-5-1/2 road and up to the M-7-5-1 road, are of the Ahpah and to a lesser extent Coppercreek series (Popenoe and Martin, Soils of the M-7 Road At The Bridge Creek Crossing, Nov., 1985).

The M-7/M-7-5 is a major rock surface haul road. The M-7 designation changes to the M-7-5 at the M-7-4 junction (Map D). Road removal began on the M-7-5 at the M-7-5-1 road junction where last years' 85-2 IFB contract ended. Work proceeded along the road and ended after 0.9 miles at a location above the left bank of Bridge Creek. This reach also included about 150 feet of the M-7-4, an unrocked secondary haul road that was removed as part of the endhauling outcropping immediately upslope. The remainder of the M-7-4, which follows the course of Bridge Creek for nearly a mile and lies very close to the creek, had already failed to a point beyond cost effective rehabilitation. In addition part of the M-7 treated in 1980 was reentered to pull back the left bank of a crossing and to outslope about 70 feet of the road above the left bank (Map D).

An additional excavation site involved the removal of about 1,700 yd³ of fill and landslide deposits on the M-7 at the junction of the M-7-1. A small landslide had removed a section of the road during the February 1986 storms, so at the start of heavy equipment work a D-8 bulldozer filled in the cavity with material from the adjacent road bench in order to provide access to the main treatment area.

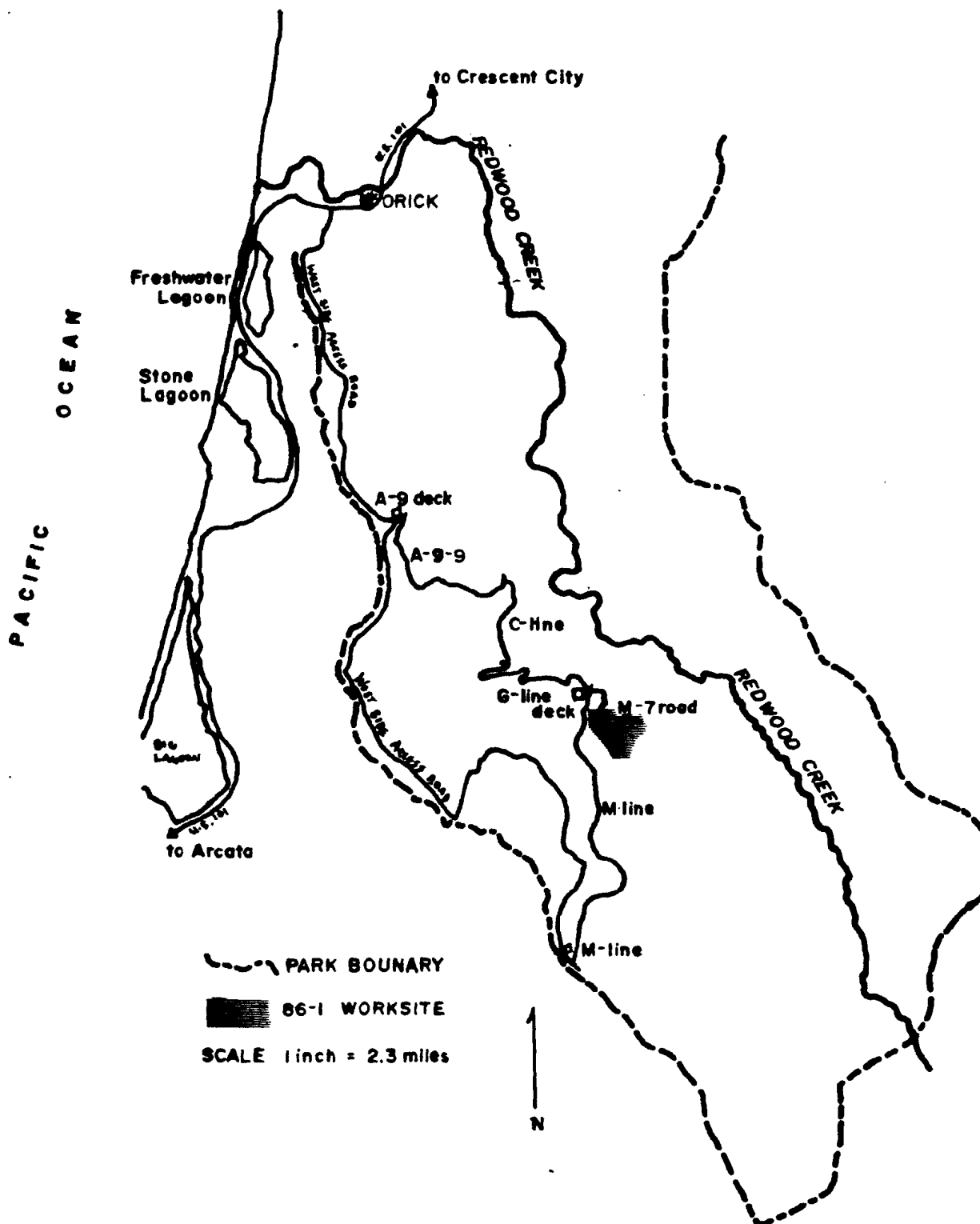
Other roads above the right bank of Bridge Creek had been treated in 1980, 1981, and 1984. Information on these projects can be obtained from Summary Reports 80-6, 81-4, and 84-8.

To summarize, the grand total cost for the M-7, 86-1 rehab site was \$201,656.89 (Table 1). Total heavy equipment costs were \$177,149.25 or 88% of the grand total.

M-7 ROAD WATERSHED REHABILITATION UNIT

86-1 SITE LOCATION MAP

MAP: A



LAND USE AND EROSION HISTORY

Logging operations in this part of Bridge Creek began, based on historical aerial photos, sometime after 1954 and before 1962 with the removal of logjams and windfalls lying in and alongside the creek. According to Leslie, 1980, access to the creek in 1956 may have been either by an old M-7 bridge or by a road several miles upstream, probably the M-4. In any case the 1962 aerial photos show that the M-7 road had been constructed from the M-Line down to the creek at a logjam and near the location of the present bridge. Two more logjams are visible on the 1962 photos along with a washout on a crossing on the M-7, a tributary to Rodgers Creek (stream no.1 of Map B).

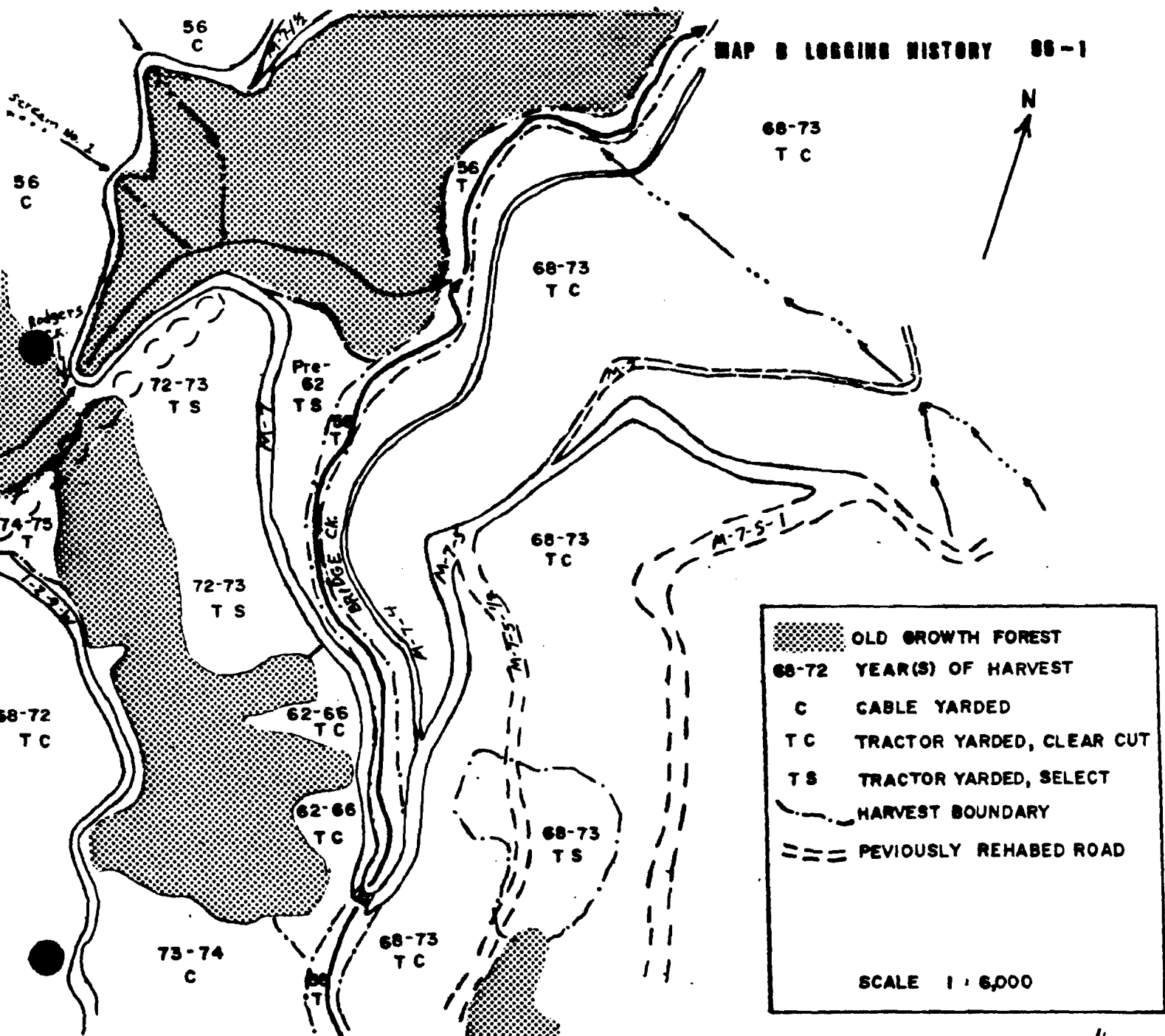
The impact of the December 1964 storm can be seen as a removal or burial of streamside vegetation. Road crossing failures on stream no.1 occurred on the M-Line and probably on the M-7. Most of the road reach is in shadows on the 1966 photos, but it's very likely the inner gorge section of the M-7 was destroyed in the 1964 storm. However most of the area surrounding this year's site and below the M-Line had not yet been logged; no roads had been constructed above the right bank. Therefore damage to the creek was probably less than that of later storms.

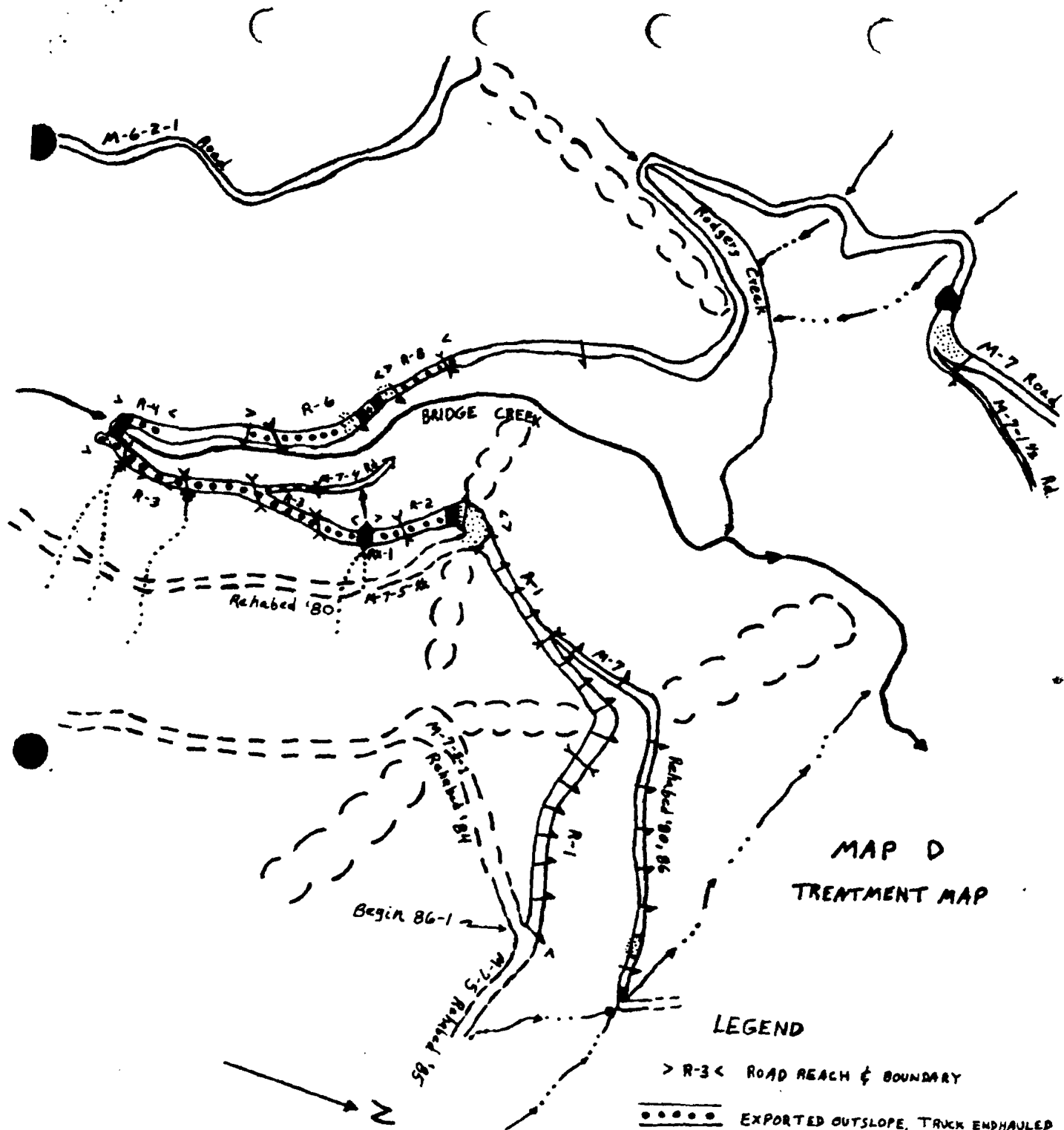
Logging above the right bank of Bridge Creek began in 1968 or 1969 with the construction of the log bridge and the M-7-4 and M-7-5 roads. By the summer of 1973 most of the hillslope above the right bank had been clear cut using bulldozers to yard the timber. A few of the less desirable trees were left standing. The M-7-5-1/2 road was extended almost a mile south between 1973 and 1974 to provide access to timber upstream of the mapped area.

The largest amount of sediment delivery to the creek and resultant damage to salmonid habitat followed the March 1972 storms. Aerial photos taken in early March show that the bridge was seriously damaged with a logjam leaning against the structure. Recent logging below the M-7-4 had removed trees down to the creek and portions of that road had failed. A section of the M-7 constructed across a flood terrace (Road Reach R-6) was inundated and washed away. The aggraded channel caused more bank instability which was probably worsened in the storms that occurred later that month.

The 1975 photos show continued deterioration of the M-7-4 causing additional delivery of sediment to the creek.

A large area above the right bank is within a landslide/earthflow feature that extends several hundred feet upslope as indicated by fresh scarps of 1-2 feet that apparently formed after the roads in this area were removed. The first order streams that cross the treated road reach flow intermittently and are not very deeply incised due to mass movement features that cut off channel development. For a detailed discussion of the erosion features and a more extensive logging history above the right bank, see summary reports 80-6 and 81-4.





EROSION CONTROL REHABILITATION WORK

Evaluation Phase

The mapping phase began in the winter of 85/86 and, along with aerial photo interpretation, took about 8 person days. Much of the mapping on the slope above the right bank had been completed in 1980/81 as part of the removal of the M-7-5-1/2, M-7-5-1, M-7-5-1¹/2 and M-7-5-2 roads. Prescription, planning (including peer review), and surveying involved an additional 46 person days (Table 1).

The inner gorge portion of the M-7 road removed this year was so close to Bridge Creek that even a small localized fill failure from the road would very likely reach the creek and cause further damage to Steelhead habitat. Since the soil is unstable due in part to the relative impermeability of the sheared black schist, heavy outslloping of the entire road prism was prescribed. Wet and/or failed cutbanks precluded local storage, so the spoil had to be truck endhauled a mean distance of 1.6 miles one-way to the G-Line Deck, the nearest large capacity fillsite.

Heavy Equipment Phase

Introduction

Nearly all of the Primary rehabilitation work was done by heavy equipment rental under the direction of Park rehab personnel. The only primary treatments the labor crew was involved with were cutting cables and setting chokers on the logs pulled from the bridge (Table 1).

Table 3 lists the heavy equipment used on this site and provides weekly hours and cost totals for each piece of rented equipment (but not the NPS grader). As can be seen not all the truck drivers worked the entire 9 weeks. Martin, for instance, broke down after working 18 hours, and never returned. Lesina quit after the 6th week to work on the Highway 101 bypass. This was convenient because it eliminated the need to lay one of them off, as only 5 were needed by that time.

Heavy Equipment Application

The excavating equipment consisted of one of two Caterpillar D-8 bulldozers with winches and a Case 980-B hydraulic excavator with a 1 yd³ bucket. The bulldozers were owned by Twin Parks Lumber Company. Both operators were very good and had previous experience working for the Park. The excavator operator, a former Park employee, was new but he quickly became a skilled operator. The rented machine however, was old and suffered 39 hours of downtime during the season which caused about 162 hours of truck standby time (Table 4). An hydraulic excavator (John Deere 690-B) from the M-5 area (86-3) was

"borrowed" after one breakdown during the 7th week. The operator was Larry Lambert and he worked 4.75 hours before returning via lowboy.

Most of this year's site was prescribed as an exported outslope (EOS). As many as 6 dump trucks were used to transport a total of 29,150 yd³ of material to the G-Line Deck. (A few loads were placed on the G-6 crossing that was being repaired and along the M-Line where some culverts were to be replaced.) The trucks began arriving during the second week after the M-7 was improved and after the first blade endhailed outsliping (R-2 and M-7 outslope) and cross-road drains (R-1) were completed.

Improvement on the M-7, which began on July 9 of the first week, consisted of the D-8 brushing vegetation along the road to allow two-way traffic and making turnouts where the road was narrow. The G-Line Deck was smoothed out and a water bar was removed on the lower M-Line. In addition the small landslide near the M-7-1¹/₂ mentioned earlier was filled in. All these items are lumped under Access Costs in Table 4. Two days before the dump trucks started a 3800 gallon self-drafting water truck and the Park Service's Cat 130-G road grader arrived to put a smooth surface on the road.

The bottom of the cuts on the EOSs were anywhere from 10 to 45 feet below the road bench and the top of the cuts were in the inboard ditch or at the base of the cutbank. The deepest cuts were made on road reach R-3, resulting in an average excavation of 15.2 yd³/linear foot of road (Table 6). The cat would cut down and push the material to a pile where the excavator would load it in the dump trucks. The push was sometimes in excess of 200 feet but the excavator was loading off a pile placed there at the end of the previous day or before the trucks started working. The excavator spent about 82% of its time loading the trucks during the time the cat and excavator were working together. The remaining time was spent, mostly before or after truck hours, in digging in places inaccessible to the cat and in digging drains to channelize flow from the many seeps above the road. One day of truck standby without operator was needed on R-3 near the bridge to push a ramp of dirt upon which the excavator could load.

The cat/excavator team worked very well until work had gotten close to the bridge during the 8th week. Then lack of pushing and maneuvering room for the cat resulted in too much standby time. Upstation work couldn't be done without interfering with the dump trucks. The cat did some brushing on the M-Line for the road grader, and then was moved off the site to do 3 previously mapped skid trail crossing excavations totaling about 300 yd³ above the B-5 road in the drainage basin of Tom McDonald Creek. Also accomplished were some inboard ditch work on the B-5 and a waterbar installation above the road. These costs are listed as B-5 Area Work in Table 4, Miscellaneous costs. After finishing these tasks the cat was transported by lowboy to assist in the removal of the A-9-7 road, site 86-7. The lowboy costs were split between the two sites.

For the next two weeks the excavator dug all the material and loaded the 5 trucks that were then working. As the flood terrace (R-6) was excavated many large stumps and logs were encountered. These were stored near the top of the cut. The decision was made to increase the depth of cut and to increase the length of treated road of R-6. The bottom of the excavation was within 1-2 feet

above the summer channel level, and the finished slope profile was concave up rather than a straight line grade. Since the terrace deposits were sure to be remobilized during a moderate flood, and the material was within reach by the excavator, the material was removed. As the excavation proceeded a lower bench was made so the trucks could be loaded at the same level as the excavator. Later, during the 11th week, the straight blade cat pulled from the channel some organics that could have deflected flow against the opposite bank. Larger logs and stumps were left alone either because they were too big or because they were providing plunge pools and shelter for the fish. About 550 yd³ were excavated by the cat using locally dry sections of the cutbank for storage (Table 7). The total yardage removed from R-6 increased from a pre-work estimate of 750 yd³ to over 5,000 yd³.

The last scheduled day of truck work on EOS reach R-8 was Friday of the 10th week. However during the early afternoon, about an hour after the D-8 returned to the site, a stop work order was received after a computer detected a shortage of funds in the rehab account. The problem was resolved later, but the trucks were released a few hours early leaving only the road bench along R-8 intact. The bench appears stable so far, and it may hold up until it can be removed within the next couple of years. If the bench does fail, the material is not likely to reach the creek due to the distance and slope (< 50%)

One of the last tasks was the removal of the log bridge. It was decided that this could best be accomplished after the truck show was finished. This was done to avoid more standby costs and to avoid the possible scarring of the road bench before the trucks were released. There were about 200 feet of untreated road reach just upstation from the bridge where it traversed a large resistant knocker, and this provided a flat surface on which to transport the logs. About 20 logs from the bridge were placed along this stretch and along the cutbank of R-6. All the sill logs were removed except for the lower sill log on the left bank which was kept there in the hope of stabilizing the excavated slope above it. The logs averaged 40 feet in length and 3 feet in diameter.

Heavy Equipment Cost and Evaluation

Heavy equipment costs for each type of treatment are summarized in Table 2. As can be seen, the majority (74.5%) of heavy equipment costs and yardage involved the truck EOS. Individual road treatment reaches for the truck and blade EOSs are listed in Tables 6 and 7 respectively. The one stream crossing is listed in Table 8.

Fillsite costs for each treatment reach in Tables 6 and 8 were derived by totaling fillsite costs for all truck and cat fillsite work and dividing this total by the total yardage brought to the fillsite (29,150 yd³) to get \$2.7359/yd³. This figure was then multiplied by the yardage of each treatment reach to obtain a prorated fillsite cost for that reach.

Unit costs for the truck EOSs range from \$3.79 (R-8) to \$5.98/yd³ (bridge) and average \$4.69/yd³. These costs do not include discussion, breaks, standby, etc., which are tabulated separately in Table 4. Road reaches R-2 and most of R-3 were done using the cat and excavator. The bridge EOS and reaches R-4 to R-8 were done with the excavator. The unit costs are not that much different.

The bridge EOS was expensive because the excavator had to dig 2 passes to reach to the logs and had to make 180° turns to load the trucks. Also for a time only 3 trucks were running during this reach due to breakdowns. Five trucks were running on R-8 and the round trip distance was over a half mile less than at the bridge. The average turn-around time for this site was 22-23 minutes.

Excavation rates (yd³/piece hr) correlate with the unit costs. A pc-hr is the total time spent on a worksite for both pieces of excavating equipment--the cat and excavator. The rates range from 31 to 95 yd³/pc-hr. for truck endhailed work and 42 to 89 yd³/pc-hr for blade endhailed work.

The volume weighted statistics for blade and truck endhauling and a synopsis are included in Table 5. One of the cats listed (usually the straight blade D-8) was kept at the fillsite in preparation for work in the M-5 area. While waiting for work to start it was used when needed to smooth the earth piles accumulating on the deck. This was done generally once or twice a week. Having a second cat there was very convenient in that the operator working on the M-7 could drive his own vehicle to the fillsite. Although equipment time was paid for a half hour each way, the Park was only otherwise charged for engine time and no standby costs were charged. The second cat was also used for excavating when the first cat broke down. This resulted in an undetermined savings in standby costs that would have accrued waiting for repair.

After the trucks arrived the road grader was used for a few more days during the third and fourth weeks to keep the road in good condition. The grader costs are included in Table 4, Miscellaneous Costs. The grader was used sporadically over the next few weeks on the M-Line road, but these costs aren't included in the table as this work was considered a maintenance duty and not rehabilitation work.

The water truck was used through the 10th week to keep the dust down and the road smooth. Most of the water was obtained from Rodgers Creek on the M-7. When working with the grader on the M-Line, it was drawn from the pond near the M-Line gate.

It soon became apparent that there was not enough road to keep the water truck busy when the NPS grader wasn't working, yet the truck was needed both in the morning and afternoon because any portion of the road exposed to the sun soon became dusty. An agreement was reached with the operator so that he would work an 8 hour day and have 1 hour of standby with operator each day the grader was not working. On those days the grader was working on the M-Line, the water truck worked 10-11 hours per day. Since the water truck was part of the rehab budget, the costs of watering the M-Line are included in Table 4.

A self-drafting truck was needed this year, yet a smaller capacity model would have been more suitable for this site.

As mentioned Miscellaneous Costs (Table 4) cover expenses not included in worksite costs. A brief explanation of some of the items follows.

Mobilization for the dump trucks meant travel time to and from their residence or business address to the work location paid at their normal haul rate for 2 1/2 hours each way. Travel costs were times paid for equipment to move

between different work locations, including time spent moving the cat on a lowboy. The excavator standby costs were due to having the machine wait during part of the final week to determine if it would be needed elsewhere. As can be seen breaks and discussion costs were quite extensive due to the many pieces of equipment on the site.

In conclusion the unit costs compare fairly closely to past rehab sites using dump trucks for hauling similar distances, for example the upper G-Line, 85-3. The work proceeded quite smoothly and efficiently except for the excavator breakdowns.

Labor Intensive Phase

The categories under this phase are listed in Table 1. Brushing was needed so cross-sections could be surveyed to determine volumes to be excavated. Also a small foot bridge made of boards and logs was constructed so the survey team could quickly get past the road failure at the M-7-1¹/₂ on trail bikes.

Park laborers, Redwoods United (RUI), and Youth Conservation Corp (YCC) were responsible for distributing and spreading approximately 514 bales of straw. Straw mulch was prescribed for all disturbed ground. Some parts of R-3 wound up with a very thin covering due to the increased depth of cut over original estimates. One pickup load was moved from the pile at the bridge to the effected area, but this resulted in too much equipment idle time and so was not repeated.

Hours and costs are further broken down in Table 9, Straw Mulch Summary. The per bale cost of \$3.14 included purchase, delivery, and unloading. When the labor cost of distribution and spreading are included, the cost rises to \$7.77 per bale.

Rock armor treatment consisted of lifting 1 to 2 yd³ road rock left behind by the equipment and taking it to a couple of large drains within R-3 EOS. These rocks, generally less than 1 foot in diameter, were placed along the bottom of 2 drains to reduce headcutting of the lower end of the drains.

Documentation Phase

After heavy equipment work was over the site was surveyed so cross-sections could be redrafted to determine volumes. Photo points were reshot before the winter rains. Cost tabulation, drafting, and report writing were done over the next year, as time allowed.

TABLE 1

SUMMARY COSTS OF EROSION CONTROL REHABILITATION WORK UNIT 86-1, M-7 ROAD

Task	R.N.P. Employees		Heavy Equipment	Redwoods			Total Task	% Total	Total Phase	Phase
	Technical	Laborers	Rental	United	YCC	Materials	Costs	Cost	Cost	%
EVALUATIONS									\$5,098.00	2.6
PHASE										
Mapping	\$750.00						\$750.00	0.4		
Prescriptions.	(8 per. days)									
Planning and Documentation	\$4,348.00						\$4,348.00	2.2		
	(42 per. days)									
HEAVY EQUIPMENT									\$184,707.28	91.6
PHASE										
Primary treatment	\$7,558.03		\$142,456.25				\$150,014.28	74.4		
	(91 per. days)									
Secondary treatment			\$223.12				\$223.12	0.1		
Misc. costs			\$34,469.88				\$34,469.88	17.1		
LABOR INTENSIVE PHASE									\$6,731.77	3.3
Primary treatment		\$250.00					\$250.00	0.1		
Straw mulch		\$1,930.50		\$99.96	\$351.75	\$1,613.96	\$3,996.17	2.0		
Rock Placement		\$390.00			\$60.30		\$450.30	0.2		
Brushing/Access		\$1,743.75		\$291.55			\$2,035.30	1.0		
DOCUMENTATION									\$5,119.84	2.5
PHASE										
Cost Analysis and Report	\$5,119.84						\$5,119.84	2.5		
	(54 per. days)									
COLUMN TOTALS	\$17,775.87	\$4,314.25	\$177,149.25	\$391.51	\$412.05	\$1,613.96	GRAND TOTAL =100%		\$201,656.89	

Rehab Unit 86-1
Table 2
Rehabilitation Work Cost Summary

HEAVY EQUIPMENT WORK:

Primary Treatments

Treatment	Worksite Quantity	Total Quantity	Total Cost \$	Average Cost Per Worksite Quantity \$	Average Unit Cost \$	Unit Cost Range \$
Haul Road Crossings	1 site	973 yd ³	4,548.99	4,548.99/site	4.68/yd ³	4.68/yd
Exported Outslope (T) ¹	2,483 ln.ft.	28,177 yd ³	132,087.01	53.20/ln.ft.	4.69/yd ³	3.79-5.98/yd ³
Exported Outslope (B) ¹	450 ln.ft.	2,900 yd ³	4,036.12	7.87/ln.ft.	1.39/yd ³	1.11-2.34/yd ³
Bridge Removal	1 site	20 logs	346.50	346.50	346.50	346.50
Crossroad Drains	0.35 road miles	23 drains	1,437.63	3,541.80/road mile	59.03/drain	24.75-70.00/drain

Secondary Treatments

Mulch	99.00	(D-8 moved 16 bales: 10 to M-70S, 6 to R-1)
Rock Armor	124.12	(D8=0.5 hr; 980-B= 0.75 hr both near bridge)
Miscellaneous (Table 4)	34,469.88	
Total Heavy Equipment Cost	177,149.25	

LABOR INTENSIVE WORK:

Primary Treatments

Bridge Removal	250.00
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Secondary Treatments

Mulch	3.6 acres	514 bales	3,996.17	1,110.05/acre	7.77/bales
Rock Armor			450.30		

Other Treatments

Brushing and Access	2,035.30
Total Labor Intensive Cost	6,731.77

GRAND TOTAL COST 183,881.02

(T) = Truck End-hauled; (B) = Blade End-hauled

TABLE 3. Weekly Work Summary, 86-1 M-7 Road

Dates Week#	Equipment:	D-8	980-B	Truck ¹	Truck	Truck	Truck	Truck	Truck	Truck	H ₂ O Truck
	Owner or Op:	Franke	Burnson	Brownlow	Cossairt	Green	Hake	Lesina	Martin	McBroom	Towe
	Reg. Rates:	\$99/hr.	\$99.50/hr.	\$41.50/hr.	\$43.00/hr.	\$43.00/hr.	\$39.50/hr.	\$43.00/hr.	\$40.00/hr.	\$41.50/hr.	\$45.00/hr.
	Stby w/Op:	\$58.88/hr.	\$55.75/hr.	\$26.75/hr.	\$27.50/hr.	\$27.50/hr.	\$31.94/hr.	\$27.50/hr.		\$28.25/hr.	\$31.01/hr.
	Stby w/o Op:	\$40.12/hr.	\$43.75/hr.	\$14.75/hr.	\$15.50/hr.	\$15.50/hr.	\$7.56/hr.	\$15.50/hr.		\$13.25/hr.	\$14/hr.
7/9-7/11 1	Reg. Hrs. Cost	28.75 2,846.25									
7/15-7/18 2	Reg. Hrs. Cost	38 3,762.00	31 3,084.50	17.5 726.25			19.75 780.13	19.5 838.50		19.5 809.25	30.5 1,372.50
7/21-7/25 3	Reg. Hrs. Cost	53.5 5,296.50	53.25 5,298.38	41.5 1,722.25		45.5 1,956.50	43 1,698.50	42.5 1,827.50	18 720.00	43 1,784.50	48.5 2,182.50
7/28-8/1 4	Reg. Hrs. Cost	49 4,851.00	49.75 4,950.12	45 1,867.50	20 860.00	45 1,935.00	45 1,777.50	45 1,935.00		38.5 1,597.75	45 2,025.00
8/4-8/8 5	Reg. Hrs. Stby w/Op. Cost	50.5 4,974.75	51.75 5,149.12	41.25 1,725.26	42.5 1,841.25	43.5 1,884.25	43.5 1,734.22	42.5 1,841.25		43.5 1,819.37	44.5 2,064.52
8/11-8/15 6	Reg. Hrs. Stby w/Op Stby w/o Op Cost	53.75 5,321.25	40.5 4,029.75	26 1,411.00	26 1,462.00	26 1,462.00	26 1,343.00	26 1,569.50		26 1,411.00	35.5 1,833.54
8/18-8/22 7	Reg. Hrs. Stby w/Op Cost	51 5,230.33	46.75 ² 4,575.62	35 1,619.69	36.25 1,816.63	38.25 1,816.63	38.25 1,170.50			20.75 1,037.68	42.5 2,160.58

Table 3, continued 86-1 M-7

Dates Week#	Equipment:	D-8	980-B	Truck ¹	Truck	Truck	Truck	Truck	Truck	Truck	H ₂ O Truck
	Owner or Op:	Franke	Burnson	Brownlow	Cossairt	Green	Hake	Lesina	Martin	McBroom	Towe
	Reg. Rates:	\$99/hr.	\$99.50/hr.	\$41.50/hr.	\$43.00/hr.	\$43.00/hr.	\$39.50/hr.	\$43.00/hr.	\$40.00/hr.	\$41.50/hr.	\$45.00/hr.
	Stby w/Op:	\$58.88/hr.	\$55.75/hr.	\$28.75/hr.	\$27.50/hr.	\$27.50/hr.	\$31.94/hr.	\$27.50/hr.		\$28.25/hr.	\$31.01/hr.
	Stby w/o Op:	\$40.12/hr.	\$43.75/hr.	\$14.75/hr.	\$15.50/hr.	\$15.50/hr.	\$7.56/hr.	\$15.50/hr.		\$13.25/hr.	\$14/hr.
8/25-8/29	Reg. Hrs.	26.25	49	33	47	47	47				46.5
8	Stby w/Op	12.25									4
	Cost	3,320.03	4,875.00	1,369.50	2,021.00	2,021.00	1,856.50				2,216.54
9/2-9/5	Reg. Hrs.		29.25	28.5	29	29	29			45.5	29.5
9	Stby w/Op			8.5	9	9	9			9	11
	Cost		2,910.38	1,410.13	1,494.50	1,494.50	1,432.96			2,001.25	1,595.05
9/8-9/12	Reg. Hrs.	12	48.5	47.5	47.5	47.5	47.5			45.5	29.5
10	Stby w/Op			4	4	4	4			4	5
	Cost	1,188.00	4,825.75	2,078.25	2,152.50	2,152.50	2,004.01			2,001.25	1,595.05
9/16-9/18	Reg. Hrs.	17.5									
11	Stby w/o Op		30								
	Cost	1,732.50	1,312.50								
9/22-9/24	Reg. Hrs.	21									
12	Cost	2,079.00									
Column Totals		40,601.61	41,011.12	13,929.83	11,647.88	14,722.38	14,337.32	8,011.75	720.00	11,918.55	17,051.34
Lowboy for D-8:		467.00									
Lowboy for 980-B:		528.00									
Lowboy for 690-B:		160.00									
GRAND TOTAL HEAVY EQUIPMENT COSTS -					\$175,106.78						

¹Truck costs include MoveIn/Out @ 2.5 hours each way.²Includes 8 hours for Larry Lambert's John Deere 690B @ \$90.00/hr.

Rehabilitation Unit 86-1

Table 4

Miscellaneous Heavy Equipment Rehabilitation Cost

Task	Task Cost \$	Equipment Hours hr			% of Total Heavy Equipment Cost
		W	T	X	
Mobilization (Lowboy) (D-8, 980-B, 690-B)	1,155.00				0.7
Mobilization (Dump & water trucks)	1,582.50				0.9
Access	2,598.75	26.25			1.5
Travel	3,190.38	25		7.5	1.9
Grader (NPS @ \$50/Hr)	2,025.00				1.1
Truck stby w/operator (due to 980-B downtime)	4,669.34		162.25		2.6
Truck stby w/operator (due to D-8 downtime)	83.98		3		<0.1
Truck stby w/o operator	780.48		56		0.4
D-8 stby w/operator	902.61	15.25			0.5
980-B stby w/o operator	1,312.50			30	0.7
Discussion	3,183.72	8	50	5.25	1.8
Breaks	8,737.62	18.5	99.5	20	4.9
Water Truck M-Line work	2,317.50		51.5		1.3
Brushing M-Line	618.75	6.25			0.3
B-5 Area Work	1,311.75	13.25			0.7
Totals	34,469.88	112.5	422.25	62.75	19.3

W: Caterpillar D-8H bulldozer with winch

T: 4 to 6 10-12 yd³ Dump Trucks and a 3800 gal water truck

X: Case 980-B hydraulic excavator with 1 yd³ bucket

Rehab Unit 86-1

Table 5

Heavy Equipment Volume Weighted Statistics

Volume -Weighted Statistics	Blade- Endhauling Fill	Truck Endhauling Fill
Cost/Volume	\$1.39	\$4.69
Endhaul Distance	136 feet	1.6 mi. one way
Volume/Equipment Hours	71 yd ³ /pc-hr	51 yd ³ /pc hr
Yardage Total	2,900 yd ³	29,150 yd ³

Synopsis

- Operators:** J. Franke, J. Jackson on bulldozers @ \$99.00/hr; W.D. Burnson on hydraulic excavator @ \$99.50/hr; seven dump truck drivers and one water truck operator listed in Table 1. Avg. 4-5 dump trucks working @ avg. cost of \$42/hr.
- Equipment:** Two well maintained Caterpillar D-8H 46A winch bulldozers with experienced operators. One cat equipped with U blade and used for most of truck-endhauling work. Other cat equipped with a "straight" blade and wide (28") tracks and used for most of blade-endhauling work. Hydraulic excavator operator new but proficient. Excavator (Case 980-B w/1 yd³ bucket) had 39 hours downtime not reflected in above figures. One of above cats used @ fillsite - charged for engine time only.
- Endhauling:** Road surface for dump trucks smooth and well watered with many turnouts where narrow. Slight uphill grade towards fillsite, but trucks maintained 13-15 mph when loaded. Avg. distance to fillsite: 1.6 mi.
- Excavation:** Fill generally free of small organics. Large organics on left bank in terrace deposit. Sheared black schist in some locations wet.

Rehab unit 86-1
Table G
Exported (Truck Endhauling) Outslowing Summary

Station	Excavated Volume yd ³	Total ¹ Cost \$	Fillsite ² Cost	Unit Cost \$/yd ³	Equipment Hours			Linear Feet of Road ft.	Volume Per Linear Foot of Road yd ³ /ft.	Mean Truck Endhaul Distance mi. (one way)	Excav. Rate yd ³ / pc -hr
					U	S	X				
(R-2) 18+04	3,921	17,996.30	10,727.30	4.59	38.75		34.5	396	9.9	2.0	54
(R-3) 22+60	17,057	83,376.65	46,665.52	4.89	87.75	79	203 ³	1,125	15.2	1.9	40
(BR) 33+50	429	2,566.68	1,173.68	5.98			14	60	7.2	1.8	31
(R-4) 33+92	773	3,432.19	2,114.82	4.44		2	11.25	155	5.0	1.5	58
(R-6) 39+83	4,837	20,322.72	13,233.34	4.20			71.25	507	9.5	1.4	68
(R-8) 45+80	1,160	4,392.47	3,173.59	3.79			12.25	240	4.8	1.3	95
TOTAL OR AVERAGE	28,177	132,087.01	77,088.25	4.69	126.5	81	346.25	2,483	1 13	1.6	51

U: Caterpillar D-8H bulldozer with winch and U blade

S: Caterpillar D-8H bulldozer with winch, 28" tracks, and straight blade

X: Case 980-B hydraulic excavator with 1 yd³ bucket

Averages are volume weighted

Excavation rate is volume excavated divided by the total combined number of equipment hours.

¹Total Cost: Total excavating equipment cost plus fillsite cost.

²Fillsite Cost: Cost of Dump Trucks, and fillsite bulldozer (D-8) work calculated @ 2.7359/yd³

³4.75 Hours of this total done using John Deere 690B hydraulic excavator w/7/8 yd³ bucket @ \$90/Hr

Rehab Unit 86-1

Table 7

Exported (Blade Endhauling) Outslowing Summary

Station	Excavated Volume yd ³	Total Cost \$	Unit Cost \$/yd ³	Equipment Hours			Linear Feet of Road ft.	Volume Per Linear Foot of Road yd ³ /ft.	Mean Blade Endhaul Distance ft.	Excav. Rate yd ³ / pc-hr
				U	S	X				
M-7 OS	350	521.02	1.49	1.5		3.75	70	5	200	67
(R-2) 18+04	300	346.50	1.16	3.5			100	3	125	86
(R-6) 43+00	550	1,287.00	2.34		13		200	2.8	120	42
Landslide exc on M-7	1,700	1,881.00	1.11		19		80	21.3	100	89
Total or Average	2,900	4,036.12	1.39	5	32	3.75	450	6.4	136	71

U: Caterpillar D-8H bulldozer with winch and U blade

S: Caterpillar D-8H bulldozer with winch, 28" tracks and straight blade

X: Case 980-B hydraulic excavator with 1 yd³ bucket

Averages are volume weighted

Excavation rate is volume excavated divided by the total combined number of equipment hours.

Rehab Unit 86-1

Table 8

Haul Road Stream Crossing Excavation

Station	Excavated Volume Yd ³	Total ¹ Cost \$	Fillsite ² Cost \$	Unit Cost \$/yd ³	Equipment Hours			Mean Truck Endhaul Distance mi.	Excavation Rate yd ³ /pc-hr
					U	S	X		
22+30	973	4,548.99	2,661.99	4.68	7	-	12	2.0	51
Total or Average	973	4,548.99	2,661.99	4.68	7	-	12	2.0	51

U: Caterpillar D-8H bulldozer with winch and U blade

S: Caterpillar D-8H bulldozer with winch, 28" tracks, and straight blade

X: Case 980-B hydraulic excavator with 1 yd³ bucket

Averages are volume weighted.

Excavation rate is volume excavated divided by the total combined number of equipment hours.

¹Total Cost = total excavating equipment cost plus fillsite cost.

²Fillsite Cost = cost of dump trucks, water truck and fillsite bulldozer (D-8) work calculated @ \$2.7359/yd³.

Rehab Unit 80-1

Table 9

Straw Mulch Summary

	Number of Bales	RNP		RUI		YCC		TOTAL COST \$	COST per BALE \$
		Person Hours	Cost \$	Person Hours	Cost \$	Person Hours	Cost \$		
Materials	514	~20	1,013.96 ¹	--	--	--	--	1,013.96	3.14
Distribution	514	80	780.00	--	--	--	--	780.00	1.52
Spreading	514	118	1,150.50	12	99.96	105	351.75	1,602.21	3.12
TOTAL	514	198	3,544.46	12	99.96	105	351.75	3,996.17	7.77

RNP: Redwood National Park, Resource Management labor crew

RUI: Redwoods United Incorporated labor crew

YCC: Youth Conservation Corps

¹Cost includes purchase, delivery, and unloading.