

**Y-Line Rock Pit #1
Rehabilitation Project**

Unit 89-4

Louise E. Johnson

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INTRODUCTION

Public Law 95-250 (March 27, 1978) directed that a rehabilitation program be developed for some 48,000 acres in the Redwood Creek basin of Redwood National Park. Before these lands were added to the park in 1978, timber harvesting and related road construction had adversely influenced erosion rates, sediment deposition, and water quality within the entire basin. It is these problems that are being addressed in the rehabilitation program. The purpose of the rehabilitation program is to minimize man-induced erosion within Redwood National Park and to encourage the return of a natural pattern of vegetation. Ultimately the efforts should result in the restoration of natural ecosystems to a condition similar to what would have existed without disturbance by man. (Redwood National Park, Watershed Rehabilitation Plan, April 1981.)

The Y-Line rock pit #1, unit 89-4, is located in the Devils Creek drainage (a major tributary to Redwood Creek) approximately 25 miles from Orick. The 1989 K&K watershed rehabilitation project needed 500 yd³ of rock to armor three stream crossing excavations, and the Y-Line rock pit was the only available rock source remaining in the park. Therefore, the decision was made to haul 2¹/₂ years supply of rock to the K&K road and then stockpile the remaining quarried rock at the B-Line deck, and then close down and restore the rock pit. Prior to recontouring and restoration efforts, 2,800 yd³ of rock was produced and hauled out of the rock pit. Of this total, 1,030 yd³ of rock was hauled to the FY89 and FY90 K&K watershed rehabilitation project areas, and 1,770 yd³ of rock was hauled to the B-Line deck to be stored for future use elsewhere in the park.

The rock pit was then recontoured and 1,200 yd³ of dirt was hauled in a distance of one mile from a log landing located at the end of the Y-Line haul road. This material was spread approximately one foot deep across the upper third of the rock pit. Straw mulch was applied at a 4000 lbs/acre application rate, and tree seedlings will be planted. Approximately 8 acres of rock pit was restored. The heavy equipment work was completed for \$77,004.97 under hourly heavy equipment rental agreements. Of this total, approximately \$35,000 is billable to the FY89 and FY90 K&K watershed rehabilitation projects. Table 1 summarizes all rehabilitation work costs which total \$ 90,014.11, and Table 2 summarizes each heavy equipment rehabilitation treatment average unit costs.

REHABILITATION UNIT 89-4 SUMMARY

UNIT NAME: Y-Line Rock Pit #1

PROJECT LEADER: Louise Johnson

LOCATION DESCRIPTION: T8N R2E S9 (Map A, pg.5) on the Panther Creek, CA, 7.5 minute topographic series map, and RNP81 1:6000 color photo # 6-6. Located in the southwest section of the Devils Creek drainage basin, a west side tributary of Redwood Creek, approximately 25 miles upstream from Orick, CA.

TOTAL UNIT ACREAGE: 8

MILE OF ROAD TREATED: 0

INCLUDES: Quarrying and transporting 2,800 yd³ of rock, of which 1,030 yd³ was hauled to the K&K rehabilitation projects for FY89 and FY90. The rock pit was then recontoured and outsloped, and 1,200 yd³ of dirt was imported from a landing on the Y-Line haul road, and spread approximately one foot in depth over the finished rock pit outsloping. Straw mulch was applied at a 4000 lbs/acre application rate, and tree seedlings will be planted.

TOTAL REHABILITATION PROJECT COST: \$ 90,014.11 (Table 1, pg.4)

GEOLOGY DESCRIPTION: The rock pit is composed of a tectonic block of metavolcanic rock, and the surrounding area is underlain by the Redwood Creek schist unit of the Franciscan assemblage (Harden, et al, 1982).

GEOMORPHIC DESCRIPTION (Map B, pg.6): Gently sloping upper west, southwest facing ridge top along the south fork of Devils Creek. Elevation of 2000 feet. Rock pit slopes are 15%-45%.

SOIL DESCRIPTION: Soils of the Y-Line rock pit are classified by Popenoe (1985) as Slidecreek with Trailhead soils being predominant on the surrounding schist bedrock terrain.

LAND USE/LOGGING HISTORY: The rock pit area was surveyed by A. Smith and found not to be archaeologically sensitive. The area adjacent to the Y-Line rock pit was logged in 1957.

EROSION FEATURES: Erosion processes on the upper ridge slopes of Devils Creek are minimal. Fluvial processes are the dominant form of erosion which consist of concentrated runoff along the exposed rock pit surfaces and access roads which have resulted in the formation of rills.

Rehabilitation Work Summary continued on next page.

Unit 89-4 Summary, continued

REHABILITATION WORK SUMMARY¹(pg.7): HOURLY Project (RFQ Contract)

I. Total Heavy Equipment Cost: \$ 77,004.97 (Table 2, pg.11)

Heavy Equipment Used:

Caterpillar D8H ripper bulldozer @ \$139.50/hour (J. Jackson)

CASE 220 excavator @ \$169.00/hour (W. Larkin)

Nine 10yd³ Dump Trucks @ \$43.30-\$44.29/hour

<u>Types of Treatment</u>	<u>Total Cost</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Rate</u>
Quarrying & Sorting	\$ 20,601.12	2,800 yd ³	\$ 7.36/yd ³	21 yd ³ /PH
Loading Dump Trucks	6,084.00	2,800 yd ³	2.17/yd ³	78 yd ³ /PH
Hauling Rock to K&K	24,963.27	1,030 yd ³	24.24/yd ³	2 yd ³ /PH
Hauling Rock to B-Line	6,947.10	1,770 yd ³	3.92/yd ³	11 yd ³ /PH
Recontouring Rock Pit	4,638.38	8 acres	580.00/A	--
Dirt Importation	4,807.32	1,200 yd ³	4.01/yd ³	19 yd ³ /PH
Other Equip. Costs (Table 3, pg.12)	5,446.38	--	--	--
Move In & Out	3,517.40	--	--	--

II. Total Labor Intensive Cost: \$ 7,823.14 (Table 4, pg.13)

Labor Intensive Work Summary:

Brushing: Type = road widening for dump truck traffic

Total miles = 1.5

Total Cost = \$ 4,746.64

Unit Cost = \$ 3,170.00/mile

Straw Mulch: Number of Bales = 250

Total Acreage Covered = 5

Total Cost = \$ 3,076.50

Unit Cost = \$12.31/bale

Other: none

DISCUSSION¹: Refer to text, page 10.

¹ Detailed in report text.

Table 1

REHABILITATION WORK COST SUMMARY
Unit 89-4: Y-Line Rock Pit #1

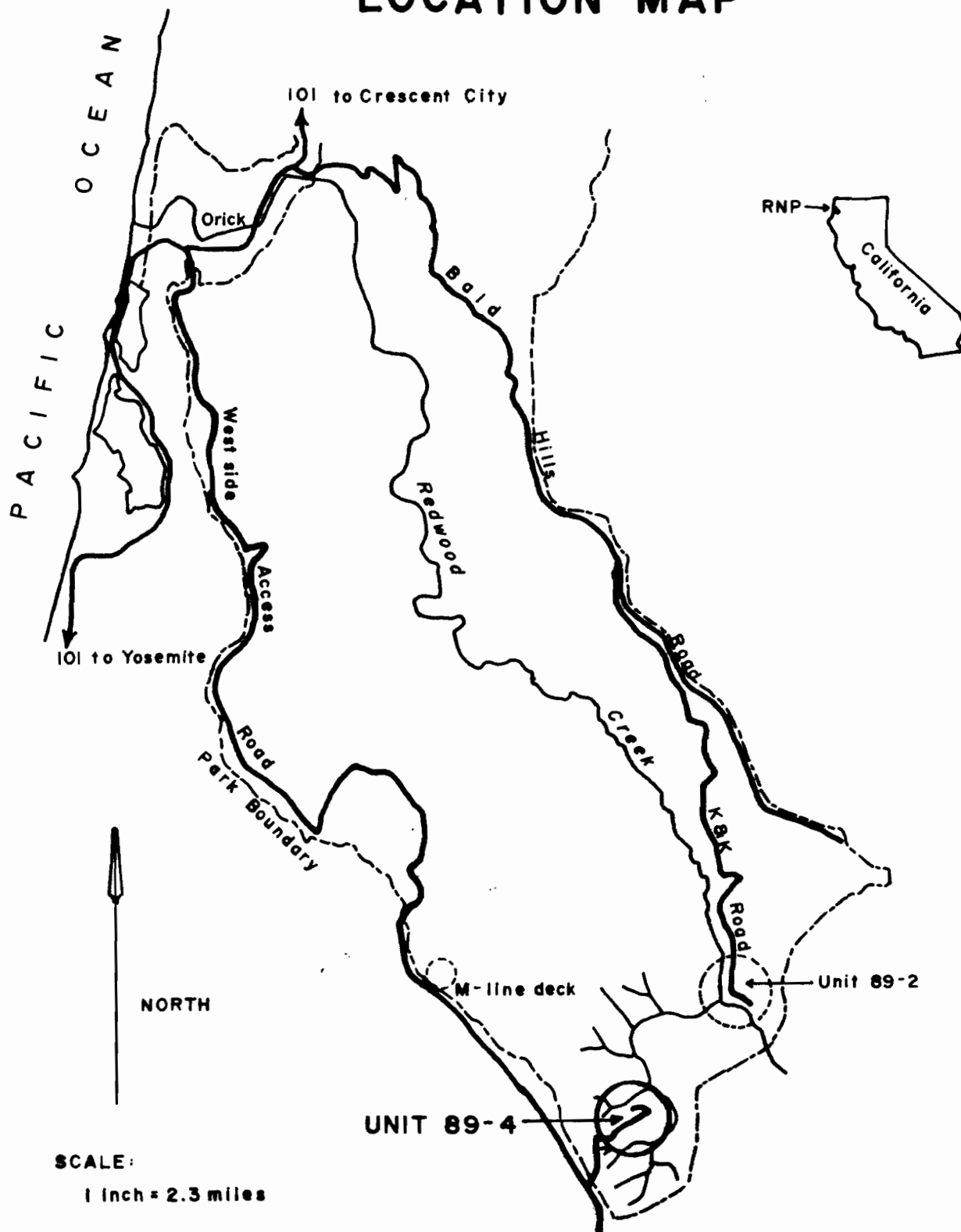
<u>Treatment</u>	<u>Quantity</u>	<u>Total Cost</u>	<u>Average Unit Cost Per Quantity</u>
HEAVY EQUIPMENT WORK:			
<u>Primary Treatments</u> (Table 2)			
Rock Quarrying and Transport	2,800 yd ³	\$ 58,595.49	varies
Restoration of the Rock Pit	1,200 yd ³	9,445.70	varies
<u>Other Expenses</u> (Table 3)	--	<u>8,963.78</u>	--
TOTAL HEAVY EQUIPMENT COST =		\$ 77,004.97	

LABOR INTENSIVE WORK: (Table 4)			
<u>Secondary Treatments</u>			
Straw	192 P-Hrs 250 Bales	3,076.50	\$12.31/bale
<u>Miscellaneous</u>			
Brushing	460 P-Hrs 1.5 mile	<u>4,746.64</u>	--
TOTAL LABOR INTENSIVE COST =		\$ 7,823.14	

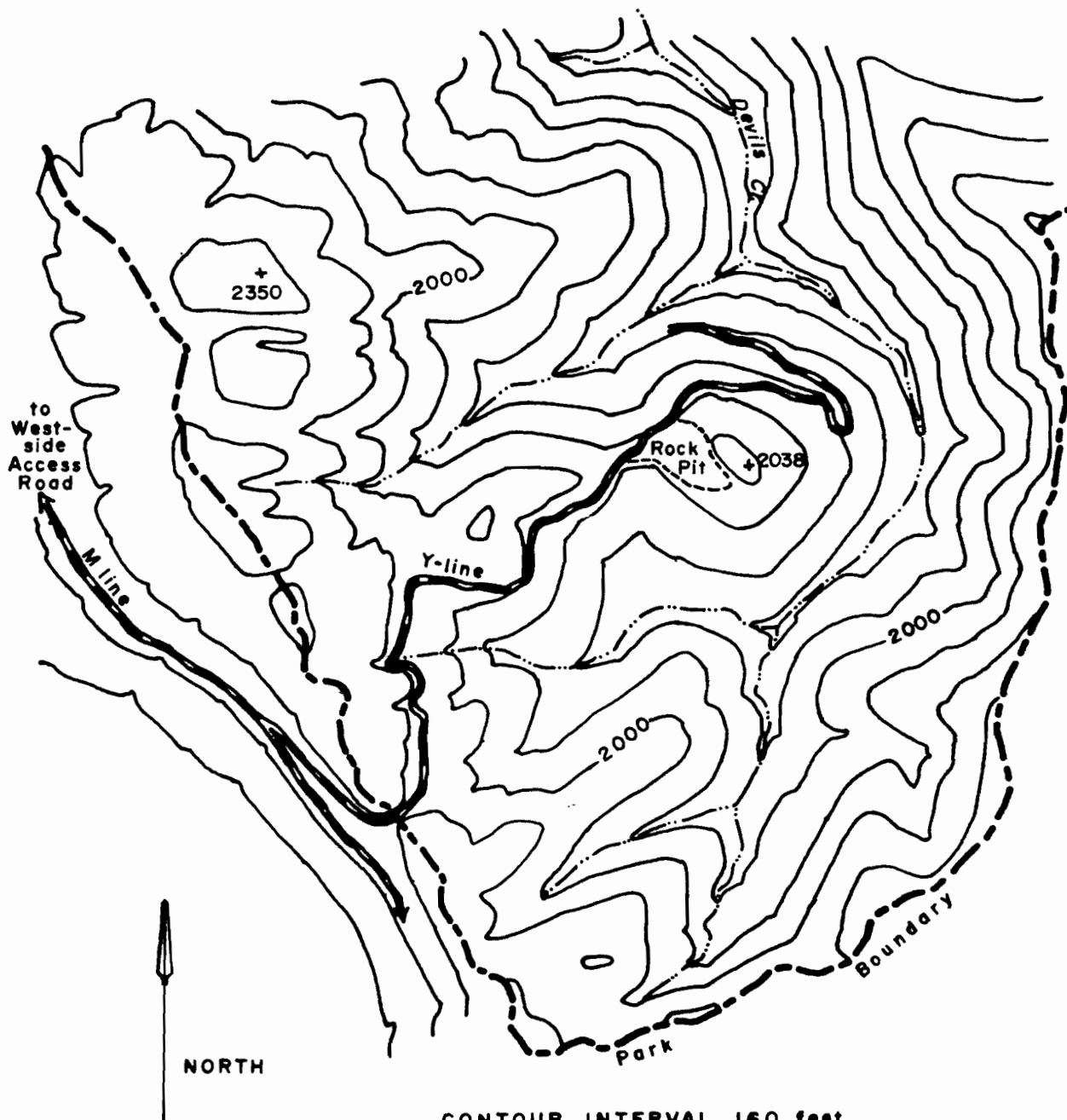
TECHNICAL WORK:			
	<u>Person Hours</u>		
<u>Evaluation</u>			
Prescriptions	52	751.00	
Surveying	16	235.00	
<u>Supervision of Work</u>			
Heavy Equipment	218	3,171.00	
<u>Documentation</u>			
Photo Points	18	260.00	
Cost Analysis and Report	57	<u>769.00</u>	
TOTAL TECHNICAL WORK COST =		\$ 5,186.00	

GRAND TOTAL COST =		<u>\$ 90,014.11</u>	

MAP A WATERSHED RESTORATION UNIT 89-4 LOCATION MAP



MAP B
WATERSHED RESTORATION
UNIT 89-4
TOPOGRAPHIC MAP



CONTOUR INTERVAL 160 feet

SCALE 1:24,000

0 1/2 1 mile

REHABILITATION WORK

Rehabilitation work focused on quarrying rock from the Y-Line rock pit #1 for rehabilitation stream crossing channel riprap and for future road rock needs. The final treatment was to restore the rock pit to a condition similar to the surrounding natural terrain as best as possible given the severely impacted condition of the pit. This included complete recontouring of the pit slopes and importing dirt from a log landing on the Y-Line haul road to help accelerate revegetation on this harsh site.

Redwood National Park's watershed rehabilitation and erosion control program is divided into four work phases: 1) Evaluation, 2) heavy equipment, 3) labor intensive, and 4) documentation.

Evaluation Phase

The evaluation phase for unit 89-4 included prescribing rehabilitation treatments which were accomplished by using heavy equipment and labor intensive work crews, and completing volumetric surveying at the log landing and the rock pit. Table 1 shows a detailed cost breakdown for the technical work completed in the evaluation phase. Prescriptions and surveys were completed between March 1989 and May 1989, and involved approximately 7 person days to complete. Work was completed by L. Johnson and D. Short.

Heavy Equipment Phase

The heavy equipment phase included completion of all primary rehabilitation work including quarrying and sorting rock, loading and transporting the rock, and final restoration of the rock pit. Total heavy equipment cost was \$77,004.97, and is summarized in Table 2. A total of 2,800 yd³ of rock was produced and transported from the rock pit, and 1,200 yd³ of dirt was imported into the pit from a log landing one mile away at the end of the Y-Line haul road.

The heavy equipment phase of the rehabilitation work on unit 89-4 was done under hourly heavy equipment rental agreements (under a RFQ contract). One bulldozer, one hydraulic excavator and nine dump trucks were utilized on the unit. The bulldozer was a Caterpillar D8H with a "U"-blade and rippers (\$139.50 per hour), owned and operated by John Jackson. The hydraulic excavator was a CASE 220 with a 3 cubic yard bucket (169.00 per hour), owned by Twin Parks Lumber Company and operated by Wendell Larkin. The nine dump trucks were all 10 cubic yard trucks bid at the PUC rate of \$44.29 per hour, except two which were at \$43.30 and \$43.50 per hour. The truck owners were Duran Trucking, Hake's Ditching and Excavating, William Richards, Wes Green Landscaping, McGaughey Enterprises, Dennis Haddad, Rod Lesina Trucking, Dale Lesina, and Lyle McGaughey.

Heavy equipment work began on May 9, 1989, and took 13 days to complete (totaling 1,072.25 hours of combined heavy equipment time).

Rock Quarrying, Sorting and Transporting

The first phase of the rehabilitation work in the rock pit was to produce enough stream armor-sized rock (riprap = ave. 2-foot diameter) for FY89 K&K watershed rehabilitation project, and possibly for FY90 rehabilitation rock needs on the K&K. If quarrying went well and was proceeding along at a cost effective rate, additional rock was to be produced and trucked to the B-Line deck to be stored for future rock need in the park. The final phase of rehabilitation work in the rock pit was the restoration of the pit itself (discussed below). Producing useable sized rock went extremely well, so much so, that enough rock was produced for FY89 and FY90 K&K rehabilitation project needs, plus an additional stockpile of riprap-sized and road-sized rock at the B-Line Deck. A total of 2,800 yd³ was produced, of which 1,030 yd³ went to the K&K, and the remaining 1,770 yd³ went to the B-Line deck (of which 860 yd³ is of riprap-sized rock and 910 yd³ is of road rock-sized cobbles). Table 2 summarizes the average unit costs for all heavy equipment rehabilitation treatments completed on unit 89-4.

The quarrying method used was relatively simple. No blasting of the bedrock was required since it was well fractured and mixed. The material (rock mixed with dirt) was pushed to the excavator by the D8 bulldozer. The dozer only worked in areas where there was a high concentration of useable sized rock, and avoided the remaining areas where vegetation was well established. While the dozer pushed the mixed piles of dirt and rock to the excavator, it simultaneously recontoured the pit by filling in lows or cutting down ridges and leaving behind a relatively uniform slope. These mixed rock with dirt piles were mounded up within reach of the excavator. The excavator then sorted through the piles by using its bucket to sift through and separate the riprap-sized rock into a stockpile, and then cobble-sized rock was sorted out and stockpiled separately and the remaining spoils (none useable material) was then used to outslope the rock pit. The upper zone of the rock pit was the only area quarried. It was an area that already had rock piles scattered about and had the highest concentration of useable rock visible on the surface.

The use of the hydraulic excavator was not originally prescribed (a track-mounted loader was originally requested), but the excavator turned out to be the ideal piece of equipment for quarrying, sorting rock into stockpiles of two size classes (cobble and riprap), and for loading dump trucks. An excavator is much quicker since it can turn 360 degrees while staying stationary. The rock sorting went extremely well using the excavator. The excavator was able to stay in one location and sort the dozer pushed rock piles on one side while creating stockpiles of rock on the other side. The excavator was then able to sit on top of its rock stockpiles and load the rock directly into the dump trucks. During the course of the day the excavator could sort rock on one side, and sit on its stockpile and load trucks without having to reposition its tracks. A very efficient method of loading trucks.

Nine ten cubic yard dump trucks were used to transport the rock to the K&K haul road and five were used to haul rock to the B-Line deck stockpile location. Round trip times to the K&K haul road and B-Line deck were 5.5 hours (100 miles) and 50 minutes (12 miles), respectively. Refer to the memorandums documenting the disappearance of crushed aluminum culvert on the west side and the colorful conversations with D. Haddad.

Restoration of the Rock Pit

The final treatment was to restore the rock pit to a condition similar to the surrounding natural terrain as best as possible given the severely impacted condition of the rock pit. This included complete recontouring of the pit slopes utilizing the D8 bulldozer and importing dirt, from a log landing on the Y-Line haul road, to help accelerate revegetation on this harsh site. All of the recontouring work was completed by the D8 bulldozer while pushing rock piles to the excavator and during truck loading times. The upper face of the rock pit was carved/bladed downhill to the middle level to help fill in a low spot and to mix in more dirt with the predominantly rockier middle level of the pit. (This area was not quarried due to the large coherent blocks of bedrock which would have required blasting to produce useable-sized rock.) The finished outslope of the rock pit is convex with a gentle (10-25%) upper slope area tapering into a steeper (25-50%) slope down to the mid-road access level of the pit which has not been rehabilitated yet.

To help accelerate revegetation on this extremely dry site, 1,200 yd³ of dirt was imported to the pit from a log landing on the Y-Line haul road. The excavator pulled the edge fill material from the landing and directly loaded the fill into the dump trucks. Five trucks hauled the dirt one mile (one-way) to the rock pit where the bulldozer spread the dump piles out across the upper slopes of the finished outsloped pit to an average depth of one foot. All access roads into the pit were ripped and drained. Straw mulch was applied to the disturbed surfaces and seedlings will be planted. If possible in the future, the application of compost would be very beneficial to help revegetation on this site.

Other Rehabilitation Costs

Table 3 summarizes all miscellaneous expenses associated with rehabilitation unit 89-4. These include paid breaks, travel between worksites, paid down time not in excess of one quarter hour, moving straw bales, moving logs and decking them, and move in and out expenses for all eleven pieces of heavy equipment. Total miscellaneous expenses came to \$8,963.78.

The Y-Line rock pit has been used as a storage site for salvaged logs from past rehabilitation projects, and a location to mill and split these logs into slabs and fence posts. Numerous logs were scattered all over the middle level of the pit and they needed to be decked out for a future move to the A-9 deck closer to Orick.

Approximately half the number of straw bales used (125) on the unit were transported to the top of the rock pit using an old dump truck bed skid sled which was first used in 1981 to transport straw to worksites on Counts Hill Prairie which were not accessible by truck. The skid sled has also been used to transport compost into rehabilitated rock pit areas. This method could be used again at the Y-Line rock pit when and if compost can be delivered. The park's newly acquired CASE bulldozer could be used to tow the sled up into the pit and then spread the compost.

Labor Intensive Phase

The Labor intensive phase involved brushing the Y-Line haul road, and the distribution and application of straw mulch to the rock pit slopes. Brushing involved manual brush clearing along the outboard and inboard edge of the Y-Line haul road for approximately 1.5 mile. This was needed to improve visibility and provide better passing areas for the dump truck traffic. The road had not been brushed for 4 years. Brushing was completed between March 27, 1989, and May 3, 1989. Redwood National Park (RNP) and Redwoods United Inc. (RUI) work crews completed the brushing job for a total cost of \$4,746.64, involving 460 person hours.

Straw mulch was applied to prevent surface erosion and aid revegetation on the freshly disturbed ground at the Y-Line rock pit. The total area disturbed by rehabilitation efforts and treated with straw mulch was 5 acres, and a 4000 lbs/acre application rate was used. Several acres were not treated with straw mulch due to the difficulty in getting the bales to those steeper locales. The total number of straw bales used on the unit was 250 bales, costing \$962.50. The straw bales were distributed and spread by Redwood National Park (RNP) labor crews, totalling 192 person hours and costing \$2,114.00. The total cost for straw mulch on unit 89-4, was \$3,076.50, with an overall unit cost of \$12.31 per bale (Table 4).

Documentation Phase

Following completion of the heavy equipment rehabilitation work, photo points were retaken, cost data was compiled, and the annual report was prepared. Total cost of this phase was \$1,029.00, totaling 7.5 person days to complete. Work was done by L. Johnson and J. Wood, and was completed by January 1990.

DISCUSSION

The quality and cost effectiveness of the rehabilitation work completed on unit 89-4 by the heavy equipment operators and labor intensive work crews was excellent. The combination of the D8 bulldozer and CASE 220 hydraulic excavator worked extremely well together and for the production of the rock from the pit. A particular success was the use of an excavator for sorting rocks into the different size class piles. This turned out to be much more efficient method than the use of a track mounted loader with a 4-in-1 type bucket.

The remaining mid-level rock pit surfaces need to be ripped and all roads into and including the lower level pit can be completely outsloped to complete the total restoration of the entire rock pit. The application of compost would be very beneficial to areas which contain a higher percent of rock on the finished recontoured surfaces. Also there are 3 or 4 truck loads of logs which need to be transported to the A-9 deck prior to rehabilitation of the remaining Y-Line haul road.

Table 2

SUMMARY OF AVERAGE COSTS OF HEAVY EQUIPMENT REHABILITATION TREATMENTS
Unit 89-4: Y-Line Rock Pit #1

Treatment	HOURS:			Total Cost	Volume	Unit Cost
	D8R	220	DT's ¹			
Quarry & Sorting Rock	70.75	63.50	--	\$20,601.12	2,800yd ³	\$7.36/yd ³
Loading Trucks with Rock	--	36.00	--	6,084.00	2,800yd ³	2.17/yd ³
Hauling Rock to the K&K ²	--	--	565.50	24,963.27	1,030yd ³	24.24/yd ³
Hauling Rock to B-Line Deck ³	--	--	158.00	6,947.10	1,770yd ³	3.92/yd ³
Recontouring the Rock Pit	33.25	--	--	4,638.38	--	--
Importing Dirt	6.75	10.50	47.50	4,807.32	1,200yd ³	4.01/yd ³
SUB-TOTAL =	110.75	110.00	771.00	68,041.19	--	--
Other Rehab. Expenses ⁴	18.75	16.75	--	5,446.38	--	--
Move In & Out	--	--	45.00	3,517.40	--	--
TOTALS =	129.50	126.75	816.00	<u>\$77,004.97</u>		

¹ D8R @ \$139.50/hour, 220 @ \$169.00/hour, DT's @ \$43.30-44.29/hour.

² The combined total cost for the rock on FY89 and FY90 K&K watershed rehabilitation projects is \$34,783.10. This includes quarry and sorting at \$7.36/yd³, loading the dump trucks at \$2.17/yd³, and transporting the 1,030yd³ of rock to the K&K at \$24.24/yd³, with a total unit cost of \$33.77/yd³.

³ The combined total cost for the rock stockpiles at the B-Line Deck is \$23,806.50. This includes quarry and sorting at \$7.36/yd³, loading the dump trucks at \$2.17/yd³, and transporting the 1,770yd³ of rock to the B-Line deck at \$3.92/yd³, with a total unit cost of \$13.45/yd³.

⁴ Refer to Table 3 for a complete listing of all other rehabilitation costs.

Table 3

OTHER REHABILITATION WORK COSTS FOR HEAVY EQUIPMENT
Unit 89-4: Y-Line Rock Pit #1

Category	Equipment Hours ¹			Total Cost
	D8R	220	DT's	
Paid Breaks	6.25	6.50	--	\$ 1,970.38
Discussions	3.75	4.25	--	1,241.37
Travel Between Worksites	1.00	5.00	--	984.50
Paid Down Time	.25	.50	--	119.38
Move Logs from Pit ²	1.00	.50	--	224.00
Moving Straw Sled ³	2.75	--	--	383.63
Road Improvements ⁴	3.75	--	--	523.12
Move In & Out:				
Dump Trucks (9)	--	--	45.00	1,984.15
D8R bulldozer	--	--	--	770.75
220 excavator	--	--	--	762.50
TOTALS =	18.75	16.75	45.00	<u>\$ 8,963.78</u>

¹ D8R @ \$139.50/hour, 220 @ \$169.00/hour, DT's @ \$43.30-44.29/hour.

² The Y-Line rock pit has been used as a storage site for salvaged logs from past rehabilitation projects, and a location to mill and split fence posts. Numerous logs were scattered all over the mid-level of the pit and they needed to be decked out for a future move to the A-9 deck closer to Orick.

³ Approximately half the number of straw bales used on the unit were transported to the top of the rock pit using an old dump truck bed skid sled which was towed behind the bulldozer.

⁴ The access roads in the rock pit required improvements prior to being used by the dump trucks.

Table 4
LABOR INTENSIVE COSTS
Unit 89-4: Y-Line Rock Pit #1

Work Types	Type of ¹ Laborers	Person ² Hours	Total Cost	Quantity	Unit Cost
Secondary Treatments:					
Straw Distribution	RNP	47.5	\$ 535.04	250 bales	\$ 2.14
Straw Application	RNP	144.5	1,578.96	250 bales	6.32
Straw Acquisition	--	--	962.50	250 bales	3.85

Total Secondary Treatments =			\$3,076.50		\$12.31 (ave)

Miscellaneous Treatment:					
Brushing ³	RNP	355.0	3,911.96	--	--
	RUI	104.5	834.68		

Total Miscellaneous Treatments =			\$4,746.64		

TOTAL LABOR INTENSIVE COSTS =			<u>\$ 7,823.14</u>		

¹ RNP = Redwood National Park, RUI = Redwoods United Inc.

² Wages used to determine costs for RNP employees include benefits. All person hours and costs include round trip travel time.

³ Brushing involved manual brush clearing along the outboard and inboard edge of the Y-Line haul road for approx. 1.5 miles. This was needed to improve visibility and provide better passing areas for the dump truck traffic. The road had not been brushed for 4 years. Brushing was completed between March 27 and May 3, 1989.

THE END



89-4 PP3 Pre H.E. Y-line Rock Pit 5/10/89 LEJ 35mm



89-4 PP3 Post H.E. Y-line Rock Pit 6/13/89 LEJ 35mm



89-4 PP5B Pre H.E. Y-line Rock Pit 5/10/89 LEJ 35mm



89-4 PP5B Action Y-line Rock Pit 5/10/89 LEJ 28mm



89-4 PP5B Post H.E. Y-line Rock Pit 6/13/89 LEJ 28mm



89-4 PP7 Pre H.E. Y-line Rock Pit 5/10/89 LEJ 35mm



89-4 PP7 Post H.E. Y-line Rock Pit 6/13/89 LEJ 35mm



89-6 PP4A Pre H.E. OS 2 Deck 35mm



89-6 PP4A Post OS 2 Deck 10/30/89 MBN 35mm



89-6 PP5 Pre H.E. RX3/FS 7/3/89 LEJ 28mm



89-6 PP5 Post H.E. RX3/FS 10/3/89 MBN 28mm



89-6 PP11 Pre H.E. OS4 Road 7/3/89 LEJ 28mm



89-6 PP11 Post H.E. OS4 Road 10/30/89 MBN 28mm



89-6 PP14 Pre H.E. RX6 7/3/89 LEJ 28mm



89-6 PP14 Pre H.E. RX6 7/3/89 LEJ 28mm



89-6 PP19 Pre H.E. OS5 7/3/89 LEJ 28mm



89-6 PP19 Post H.E. OS5 10/30/89 MBN 28mm