

97-2

TABLE of CONTENTS

BACKGROUND	3
PROJECT DESCRIPTION	4
Location	6
Land Use	6
Geology	7
Erosional Characteristics	7
WILDLIFE CONCERNS	7
REHABILITATION WORK	8
Project Implementation	8
Primary Treatments	8
Secondary Treatments	9
NARRATIVE OF EXCAVATION WORK	9
OS1	9
EOS1	10
OS2	10
OS3	10
EOS2(RX)	11
OS4(EOS)	11
RX1	11
OS5	12
DISCUSSION	13
REFERENCE	14
APPENDICES	23

5-7P

LIST OF FIGURES

Appendix 1: Site Location Map

Appendix 2: Project Boundary Map

Appendix 3: Project Layout Map

LIST OF TABLES

Appendix 4: Cost Summary

Appendix 5: Outslope, Export Outslope and Stream Crossing Information

Appendix 6: General Information

BACKGROUND

On new years day of 1997, the north coast of California experienced a storm that triggered significant resource damage to the lands of Redwood National Park (RNP). The source of much of the resource damage was traced to the failure of old logging roads. As part of PL 250-97 congress authorized RNP to remove roads associated with the 1997 storm damage in the same fashion that watershed restoration efforts are currently proceeding within the park.

In 1978 Congress expanded the boundaries of Redwood National Park by approximately 48,000 acres, and authorized the establishment of a watershed rehabilitation program. Prior to park expansion, these lands were the site of intense timber harvest activities and related road construction. Studies indicate these activities cause unnatural and excessive erosion that result in adverse impacts to riparian habitat, anadromous fisheries, and amphibian species (Corn and Bury, 1989; House and Boehne, 1987; Cedarholm et al., 1980; Narver, 1971). The primary goals of the rehabilitation program are to minimize human-induced erosion and speed the natural revegetation process by restoring the hillslope hydrology to conditions that existed prior to human influence.

Since the establishment of the watershed rehabilitation program at RNP, the concept and techniques of reclaiming disturbed lands has evolved. The process of watershed restoration quickly shifted from revegetation efforts to removing potential sediment sources. As more information was gathered concerning sediment sources, the restoration focus was directed at roads as the primary erosion source.

Earlier efforts were aimed at reducing erosion and letting nature take care of the rest. Studies have shown that the complete excavation of stream crossing fill is the most cost effective use of time and funds (Weaver and Sonnevile, 1983). Building on the in-house studies and guided by National Park Service directives, the rehabilitation program has focused on a simple yet fundamental approach in its techniques. By restoring the basic, physical parameters that act as a foundation for the forest ecosystem (at a minimum,

the hydrologic patterns, topsoil and stable slopes), much of the natural healing process has been taken care of.

The removal of this section of the M-8 with the treatment of erosion problems associated with adjacent hillslope ground disturbance is the action most consistent with the Organic Act of 1916, enabling legislation PL 90-545, PL 95-250 Section 101(6), the 1980 General Management Plan, the 1981 Watershed Rehabilitation Plan, and the National Park Service Management Policies. This project will restore natural hydrologic patterns and accelerate the re-establishment of native plant communities. Minimizing resource degradation along this section of the M-Line will act to insure that the visiting public's experience at Redwood National Park is both inspirational and enjoyable.

Much of the terminology used throughout this report has been derived, created or borrowed through a combination of trades, disciplines and experiential moments during the rehabilitation program's evolution. The terms outsliping and recontouring are used simultaneously, meaning a fully recontoured slope following excavation of road fill. When referring to the recovery of topsoil, it is inferred that the topsoil was buried by sidecast or end hauled fill during road construction. The buried topsoil becomes the latent boundary for the excavation. Organics can be either exhumed logs, rootwads and slash or trees and brush that was stockpiled during clearing of the site.

PROJECT DESCRIPTION

The M-8, constructed in the early 1950s by Georgia Pacific Timber Company, was a haul road in Redwood National Park that laid immediately adjacent to Redwood Creek. Multiple timber harvests were conducted during the early 50's and 60's in the project area. The predominant use of tractor yarding resulted in a dense skid road network and major disruption of natural hydrologic conditions, including large gullies and slope failures due to diversions of surface and stream flows, reactivation of dormant mass wasting features, and in a number of failing roads and road-

stream crossings. These conditions have led to an increase in the sedimentation in Redwood Creek, threatened and destroyed old growth redwood trees, and left indelible scars within view of Redwood Creek, above the Tall Trees Grove.

Restoration activities focused primarily on the removal of fill in stream crossings and headwater swales and stabilization of side cast fill by restoring natural hillslope topography and drainage patterns altered by past road construction. Stream crossings were completely excavated, with the goal of uncovering the natural channel bed and banks. Excavated fill was used to re-create natural topography. All side cast fill was recovered and placed along the remaining bench to form a recontoured slope that facilitates natural drainage patterns. The organic and nutrient rich component of the side cast was returned to the surface where reasonably feasible to help speed recovery of native vegetation. Vegetation disturbed during the earth moving phase was stockpiled and evenly dispersed along the finished surface to provide habitat and accelerate natural forest soil development. Methodology for road removal was consistent with past rehabilitation projects, employing heavy equipment for the earth-moving phase. Heavy equipment was contracted to Carl Kjer and Son's, who utilized 2 BE 300 excavators, an International TD 18 and Subcontracted Gary Giannandrea with his Cat D8K.

The slopes above and below this portion of the M-8 (outlined in fig. 2.) were also be evaluated and treated to reduce erosion and enhance ecosystem recovery. The use of tractor yarding during timber harvests resulted in a large network of skid roads and high levels of ground disturbance to these slopes. Skid trail stream crossings, diverted flow and unstable fill identified during detailed geomorphic mapping were included in this contract. Areas of primary interest will be the streams and headwater swales impacted by the skid road network.

Location:

The M-8 left the M line approximately one half mile above the mouth of Tom McDonald Creek and goes to the mouth of Bridge Creek. The 97-2 section of the M-8 road was located within the inner gorge of Redwood Creek in some of the most unstable and erodible terrain in the entire park. This terrain is characterized by soils that are prone to gullying and landscapes that exhibit large scale mass wasting. This terrain has the greatest potential for slope instabilities where roads and skid trails cross steep slopes and wet soils located in headwater swales or along inner gorge slope positions.

The M-8 road is located on north east facing slopes along the inner gorge of Redwood Creek , one half mile up stream from the Tall Trees Grove (figures 1 and 2). The M-8 is 100 to 200 feet above Redwood Creek and runs to the mouth of Bridge Creek. The M-8 stay roughly on contour at an elevation of 200 feet. The slopes typically range from 25% to 90%, are densely vegetated with predominantly 35 year old second growth redwood, residual old growth redwood, maple, tan oak, alder and Douglas fir trees.

The boundaries for the mapped area, (including watershed rehabilitation Unit 97-3), follow the boundaries of the original select cut unit associated with the M-8 road. These boundaries follow the ridge above the M-8 and the gravel bar of Redwood creek, from Bridge Creek to Station 57+10.

Land use:

The M-8 was constructed by the Georgia Pacific Lumber Company as a haul road for timber harvesting operations in the early 1950's. The slopes associated with the M-8 road were predominately select logged. A portion of the hillside was cable yarded from the ridge. A number of high lead chokers were exhumed during excavation, suggesting that some cable yarding extended downslope, near the M-8.

Geology:

The geology of the area tended to be inconsistent along the M-8 corridor, frequently changing from Redwood Creek Schist to ancient stream terrace deposits.

Erosional Characteristics:

The primary erosion processes of concern along the M-8 were failing road fills along the hillslopes above Redwood Creek. The most frequently observed erosion processes were similar to those seen along the M-line associated with the Redwood Creek Trail. Road fills failed as debris torrents, often scouring below original ground as torrent flowed.

WILDLIFE CONCERNS

Heavy equipment work was delayed until after September 15, so as to remain in compliance with USFWS regulations regarding marbled murrelets. Heavy equipment work was halted before November 20, to prevent any damage to the recently listed coho salmon habitat, as prescribed by NMFS.

REHABILITATION WORK

Project implementation

Mapping, layout, survey and contract preparation for the lower M-Line and M-8 took place between May and July of 1997. The project intended to remove over 5700 feet of the M-8 as well as 2500 feet of the lower M-Line and 1650 feet of a spur road along Tom McDonald Creek (M-9). Due to unforeseen circumstances, only the M-8 portion of the contract was completed. The lower M-Line and spur were subsequently incorporated into the following years contract (98-2).

Primary treatments

The project was planned as nearly all outslowing or export outslowing (figure 3.). The only significant stream crossing had blown out many years prior, leaving minimal fill on the banks. The stream crossing was prescribed as an EOS, but in retrospect, should be discussed as an RX since we had to rebuild the crossing to access the M-8. Additionally, bid item 7 should be recharacterized as a RX. All crossings were excavated to original ground surfaces (as close as possible). All woody material (logs, rootwads, large slash..) exhumed during excavation along with trees cleared before excavation, were scattered across the finished surface or placed in the finished stream channel.

All Outslowing and Export Outslowing attempted to recreate pre-logging landforms. Excavations consistently searched for original topsoil material, root flares of buried stumps and buried woody material.

Secondary treatments:

No secondary treatments for erosion control were prescribed for this contract. The disbursement of woody debris on the finished slope could theoretically be considered a secondary treatment. The wood scattering was prescribed for multiple reasons including, but not limited to: erosion control, salamander and small mammal habitat, diversity of microclimatic factors and soil building nutrients for revegetation and a more natural aesthetic.

NARRATIVE OF EXCAVATION WORK

The Contractor, Carl M Kjer and Sons moved on site a BE300 excavator (with a thumb) and a TD 20 dozer (straight blade / winch), for the purposes of completing the road removal work as described in the contract ~~1443CX8480-97-005~~. They brought in another BE300 later in the job. Gary Giannandrea was hired as a subcontractor with his D8K dozer (semi-u blade and winch). The equipment began brushing the site on the 2 of October. Actual excavation work began on October 8, at OS1 (bid item 3). Equipment work was completed at M-8 station 57+10 (bid item 10) on the 18 of November.

The Kjer's had two operators on site during production periods from October 8 till October 30. Paul Mincks operated the BE 300, and Chris Kjer ran the TD 20. Gary Giannandrea moved in November 3. The additional BE 300 was moved in November 5. At that point, both Paul and Chris operated excavators.

OS1:

The outsloping included in OS1 (Bid Item 3) covered over 2200 feet of road. An additional 200 feet of outsloping was tacked on before station 00+00 (post layout). The thought on having such a along bid item was that all the fill could be stored with in a 250 foot push from the excavation location. The maximum push was stated in the plan sheets. Unfortunately, as the excavations proceeded, the contractor felt that this was too great a departure from traditional outsloping specifications. In retrospect, it would have been much cleaner to have broken the reach into more bid items, allowing better definition in production rates and site characteristics.

EOS1:

The reach through EOS1 (Bid Item 4) was very ambiguous before road reconstruction for access. Most of the road bench had melted away (this should have been a clue) since initial construction. The slopes above and below were irregular, sparsely vegetated (dominated by alder and sword fern) and teaming with immergent water. No clear definition of original ground and fill contact was discernable for most of reach.

As the access road was widened, it became apparent that the entire EOS was sheared black schist. Based on this discovery, the preferred action was changed to removing as much material as physically possible, blending finished slopes into present topography and enhancing present flow courses.

OS2:

The reach through OS2 (Bid Item 5) held much of the fill from EOS1 as well as the fill from OS2. A spring was identified during excavation near station 36+00, where a lower road (apparently used to access Redwood Creek) merged with the M-8. After the first winter, it appears that the actual morphology of the spring was misinterpreted. There still seems to be some fill, or deposited material above the M-8.

OS3:

The excavation for much of OS3 (Bid Item 6) was extremely difficult. Most of the fill from station 39+00 to 41+00 had failed in the New Years 1997 storm. A majority of the fill that we were after was perched on the edges of the remaining bowl of the failure. The interior of the bowl had some seepage, creating a wet, mucky working environment.

As the excavation proceeded, we determined that the original ground surface had been somewhat deeper than estimated. This change in excavation depth required all fill in that portion of the Bid item to be exported either down station to OS2 or up station to a skid road above the remainder of OS3.

EOS2(RX1):

This piece of road and landing was thought to be a small swale, at most, during layout. No flow course was obvious from geomorphic mapping, although a small stream channel existed above the landing. The excavation found a bedrock ledge just below the outboard edge of the M-8, where the exhumed channel simply dropped of (waterfall fashion) into Redwood Creek. The channel excavation proved to be much wider and deeper than estimated. A number of buried stumps and large logs were uncovered. All fill was placed either into a through cut skid road near the top of the landing, or onto the remaining landing surface, recreating a subtle ridge.

OS4(EOS):

The road reach through OS4 (Bid Item 8) ran from the edge of the channel excavation at EOS2 to a slight through cut with a group of old growth Redwood trees on the outboard edge. The landing above and three merging skid roads were thought be almost completely cut into original ground. The skid roads were not prescribed for removal due to the minimal amount of fill used for their construction. In hindsight, the presence of the up slope roads, disguised the original land form enough to prevent us from determining the actual under laying conditions. The excavation became an exploratory effort as the topsoil we were following began to dive, rather than climb as we were expecting. The outslope became a full export of nearly all fill back to the upper portion of the landing and upper skid roads. During the exploration, we were forced to re-move fill that had been placed on the lower portion of the landing on 3 different occasions.

RX1:

The stream crossing RX1 (Bid Item 9) had blown out many years before this project. Approximately 80% of the fill had already been scoured away, leaving the channel bottom very close to original grade. The

estimated excavation design called for removing remnant fill on the right and left banks, and possibly some material from the channel bottom, if latent indicators were found.

The right bank of RX1 yielded far less fill than estimated. Topsoil was discovered a few feet below the road surface. At this point in the excavation, it was impractical to rebuild the crossing in order to supplement fill for finishing the right bank. Fill placement against the cutbank on the right slope was not expected to reach the top of the cutbank. Given the shortage of fill, the final grading looks much better than was expected.

The final channel morphology of the excavated RX1 did not seem to be appropriate. Over the past few years, there has been a trend towards loading excavated channels with large woody debris. The channel associated with Bid Item 7 was finished in this manner, and looks very good. During the bottom excavation of RX1, we kept hitting large boulders and rock outcrops. Disregarding any indications from the rock, we excavated as much fill as possible, and tossed large wood material into the channel. Being a rocky channel, it was relatively narrow. As wood was drop into the channel, the logs and trees tended to align themselves with the flow course. The woody material never looked quit right, but leaving the rest to nature, we moved ahead with removing the M-8. After subsequent visits since the first winter, it has become obvious that this was naturally a rock controlled channel. Little, if any wood needed to be placed in the system. The moral of this story seems to be: consistency may be good, but not all channel will benefit from any one technique.

OS5:

The outslope reach of OS5 (Bid Item10) was similar in character to OS1, in that it required the shifting fill within the bounds of the OS reach. Anticipating an abundance of fill from RX1, we prematurely placed fill from OS5 in an up station fill. When it was discovered that there was not as much fill at RX1, fill had to be brought back to portions of OS5 in order to recreate the hillslope.

DISCUSSION

Various aspects of this portion of the M-8 removal bare enlightenment (for those us who are less than all knowing). The inner gorge of Redwood Creek contains a plethora of soil types and mass movement features. The only consistency in geomorphic features along the M-8 corridor is the inconsistency. Landforms tended to change every few hundred linear feet along the corridor. Steep rocky slopes, gentle rolling slopes leading to near vertical drops, moderate slopes of highly mobile material, random step and riser topography, broad swales and tight v-notch channels occur willy-nilly.

Although not much help in determining underlying morphology, species diversity does seem to be a consistent delineator of disturbed ground. Area dominated by alder, young redwood and fir trees tended to define cut and fill ground. Areas with tan oak and relatively sparse brush represent original slopes. The vegetation typing worked very well for defining boundaries, but still lacks any inference to the depth of fill.

REFERENCES

- Cedarholm, C.J., L.M. Reid, and E.O. Salo, 1980. Cumulative effects of logging road sediment on salmonid populations in the Clearwater River, Jefferson County, Washington. In: Salmon-spawning gravel: a renewable resource in the Pacific Northwest? Proceedings of the conference. Seattle, Washington. Contribution No. 543, College of Fisheries, University of Washington. 35p.
- Corn, P.S., and R.B. Bury, 1989. Logging in western Oregon: responses of headwater habitats and stream amphibians. *Forest Ecology and Management*. 29: 39-57.
- House, R.A. and P.L. Boehne, 1987. The effect of stream cleaning on salmonid habitat and populations in a coastal Oregon drainage. *Western Journal of Applied Forestry*. 2(3):84-87
- Narver, D.W., 1971. Effects of logging debris on fish production. In: Krygier, J.T. and J.D. Hall, eds. Forest land uses and stream environment: Proceedings of the symposium. Corvallis, Oregon. Oregon State University, Continuing Education Publications. P.100-111.
- Tangen, L., personal communication. Arcata Redwood Company, Orick California.
- Weaver, W.E., Seltenrich, M.S., Sonnevill, R.A. and Babock, E.M. 1982. The use of cost-effectiveness as a technique to evaluate and improve watershed rehabilitation for erosion control, Redwood National Park. P. 341-360, in: *Watershed Rehabilitation in Redwood National Park and Other Pacific Coastal Areas: Proceedings of a Symposium* (Arcata Calif. August 24-28, 1981). Center for Natural Resources Studies, 360 p. Sacramento Calif.

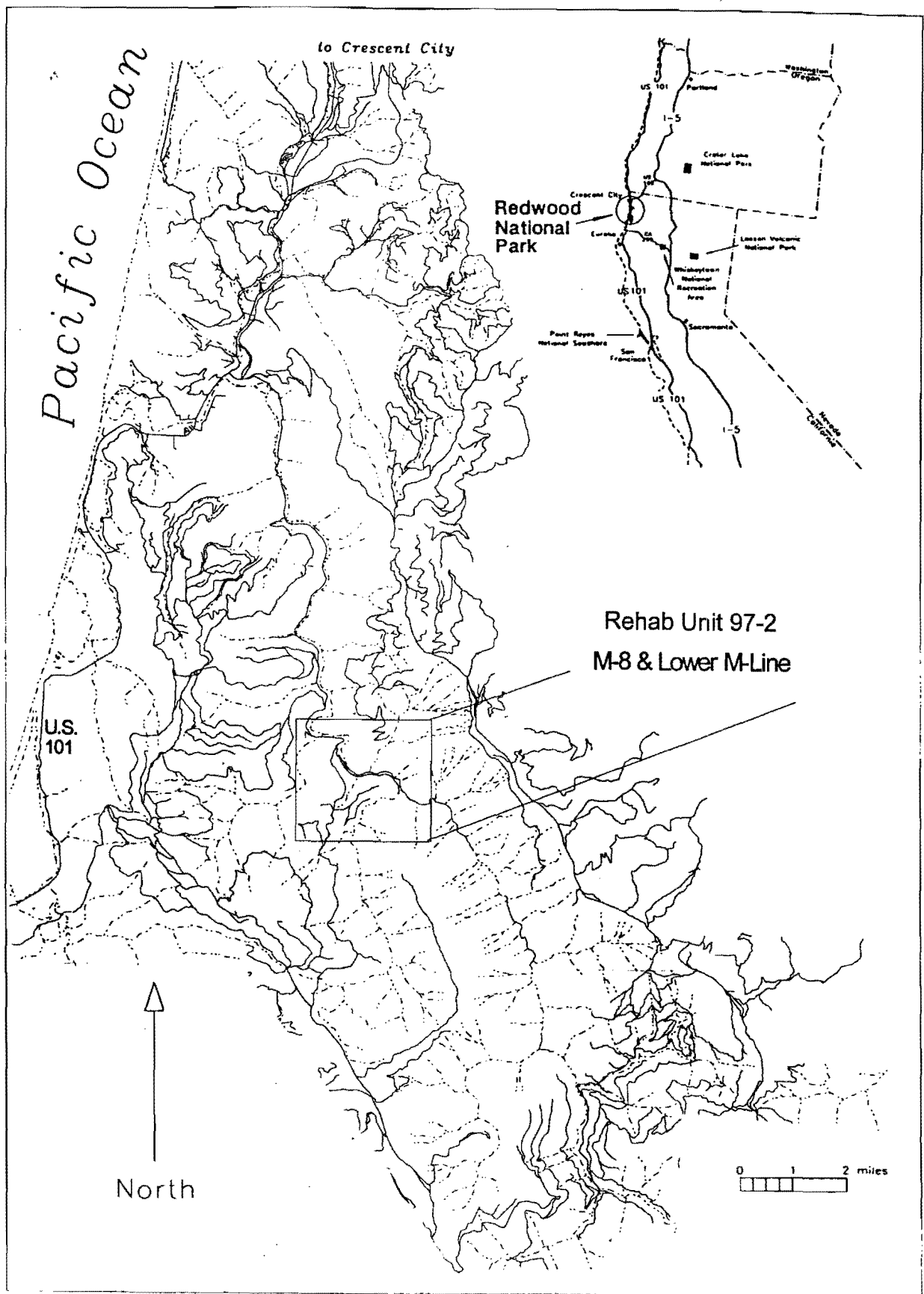


Figure 1: Site Location Map

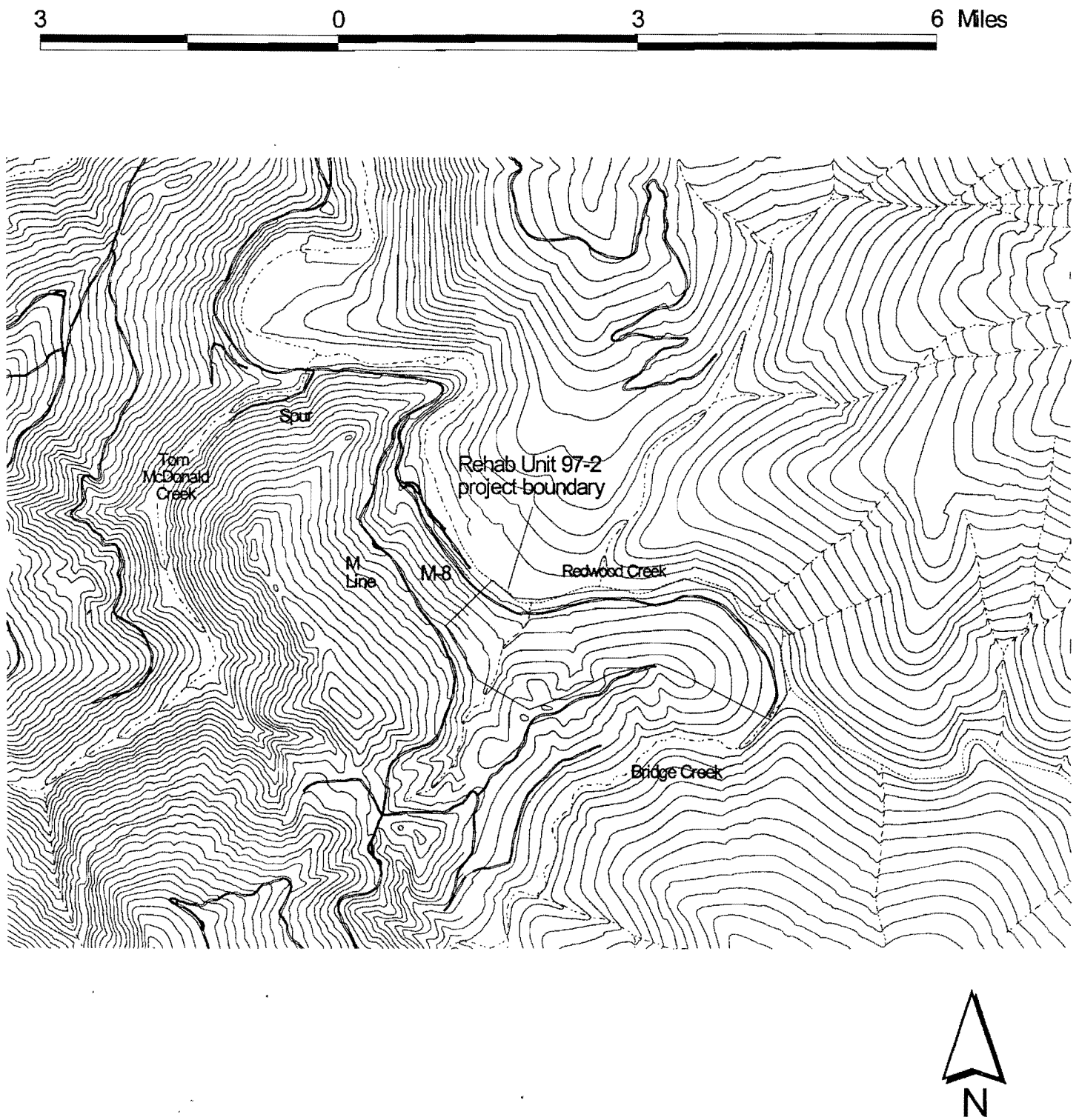


Figure 2. Project boundary for M-8 (97-2) road removal.

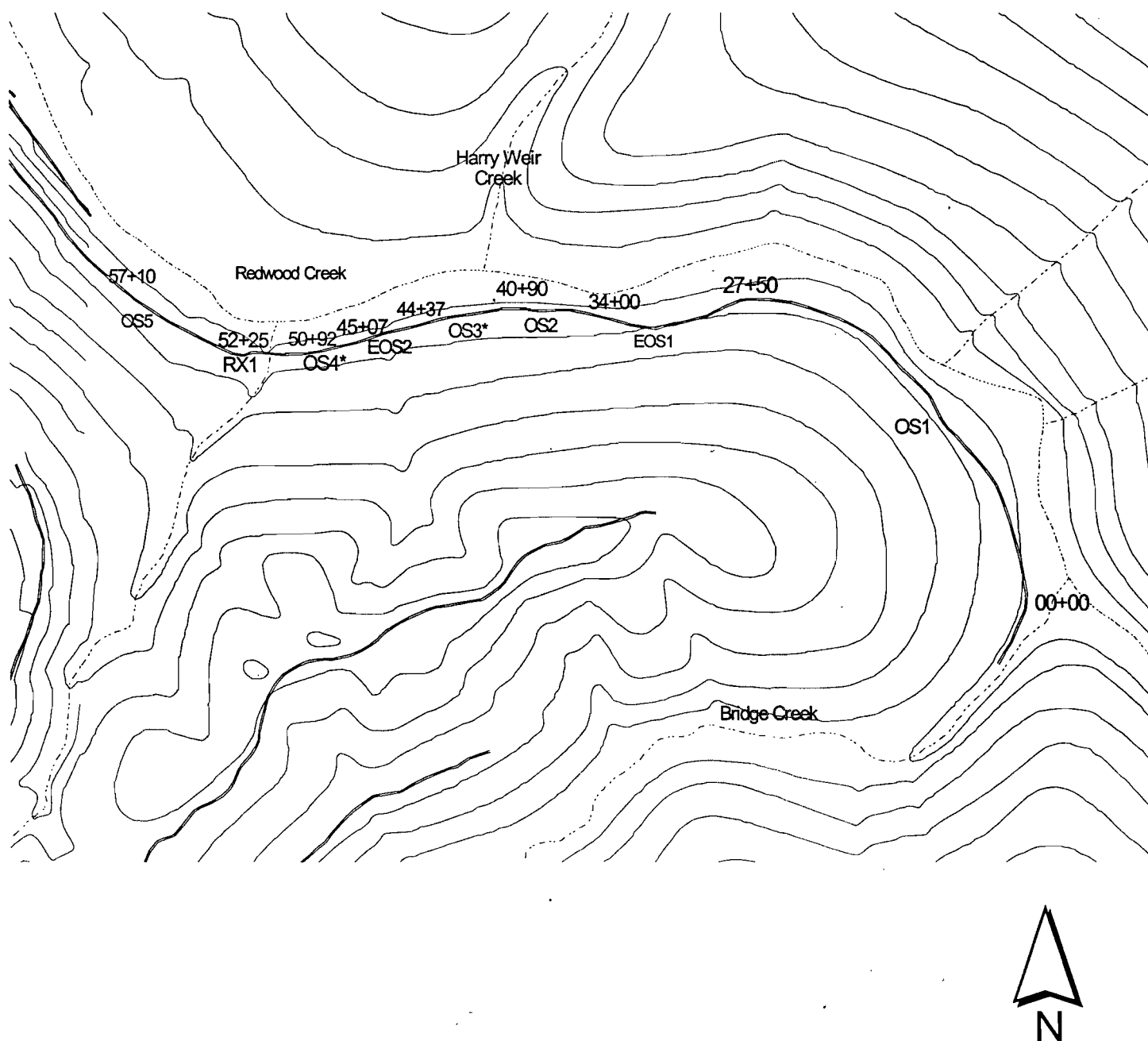


Figure 3. Project layout for M-8 (97-2) road removal.

Appendix 4: Cost Summary

Heavy Equipment Costs

Description	total length	total volume	yd ³ /s/ foot	\$/ft	HE contract cost	H.E.R.E. cost
OS	4125	23766	6	\$12.73	\$52,531.74	\$71,743.75
OS*	932	7454	8	\$28.71	\$26,756.80	\$28,059.75
EOS	720	6697	9	\$29.51	\$21,248.01	\$149,275.50
RX	133	2652	20	\$59.81	\$7,955.06	\$5,529.00
					\$108,491.61	

Total Contract Cost total = \$119,580.47

Project Planning Costs

Survey**/Contract total = \$22,390.20
--

97-2 total project cost = \$141,970.67

*portion of Bid Item was exported

**includes brushing

Appendix 5: Time and Material Summary for Outslope, Export Outslope and Stream Crossing prescriptions

Bid Item		length	dirt moved (yd ³)	hours				total hours	production yd ³ /hr	H.E.R.E. cost	H.E.R.E. \$/YD
				BE300t	BE300	D8K	TD20				
3	OS	2950	17027	189			189	378	45	\$56,700.00	\$3.33
5	OS	690	3361	21.5	20	16.75		58.25	58	\$9,022.25	\$2.68
6	OS*	347	1464	12	14.25	18.25		44.5	33	\$6,985.25	\$4.77
8	OS*	585	5990	47	39.5	48.5		135	44	\$21,074.50	\$3.52
10	OS	485	3378	12	12	14.5		38.5	88	\$6,021.50	\$1.78

Bid Item		length	dirt moved (yd ³)	hours				total hours	production yd ³ /hr	H.E.R.E. cost	H.E.R.E. \$/YD
				BE300t	BE300	D8K	TD20				
4	EOS	650	2312	18.5	8.5	3.5		30.5	76	\$4,634.50	\$2.00
7	EOS	70	4385	19.5	30.75	16.5		66.75	66	\$10,293.00	\$2.35

Bid Item		road length	dirt moved (yd ³)	hours				total hours	production yd ³ /hr	H.E.R.E. cost	H.E.R.E. \$/YD
				BE300t	BE300	D8K	TD20				
9	RX	133	2652	13.5	10	12		35.5	75	\$5,529.00	\$2.09

Appendix 6:General Information

Bid Item		dirt moved (yd ³)	hours				total production		H.E.R.E	H.E.R.E.	negotiated Costs
			BE300t	BE300	D8K	TD20	hours	yd ³ /hr	cost	\$/YD	
1	move in	n/a									\$5,000.00
2	move out	n/a									\$5,000.00
3	OS	17027	189			189	378	45	\$56,700.00	\$3.33	\$39,053.67
4	EOS	2312	18.5	8.5	3.5		30.5	76	\$4,634.50	\$2.00	\$8,093.23
5	OS	3361	21.5	20	16.75		58.25	58	\$9,022.25	\$2.68	\$6,721.14
6	OS*	1464	12	14.25	18.25		44.5	33	\$6,985.25	\$4.77	\$5,491.31
7	EOS	4385	19.5	30.75	16.5		66.75	66	\$10,293.00	\$2.35	\$13,154.78
8	OS*	5990	47	39.5	48.5		135	44	\$21,074.50	\$3.52	\$21,265.49
9	RX	2652	13.5	10	12		35.5	75	\$5,529.00	\$2.09	\$7,955.06
10	OS	3378	12	12	14.5		38.5	88	\$6,021.50	\$1.78	\$6,756.93
									\$120,260.00		\$118,491.59

skidding of logs (\$167*4hr)= \$668.00
removal of culvert= \$420.88

* Portion of bid item was exported

Grand Total \$119,580.47

H.E.R.E. Costs based on \$150/hr for the BE300 and TD20, \$167/hr for the D8K.