

REDWOOD CREEK SUMMER STEELHEAD RECOVERY PROJECT

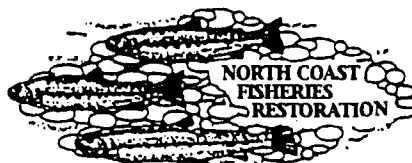
1998

FINAL REPORT

Contract # FG 7058 IF

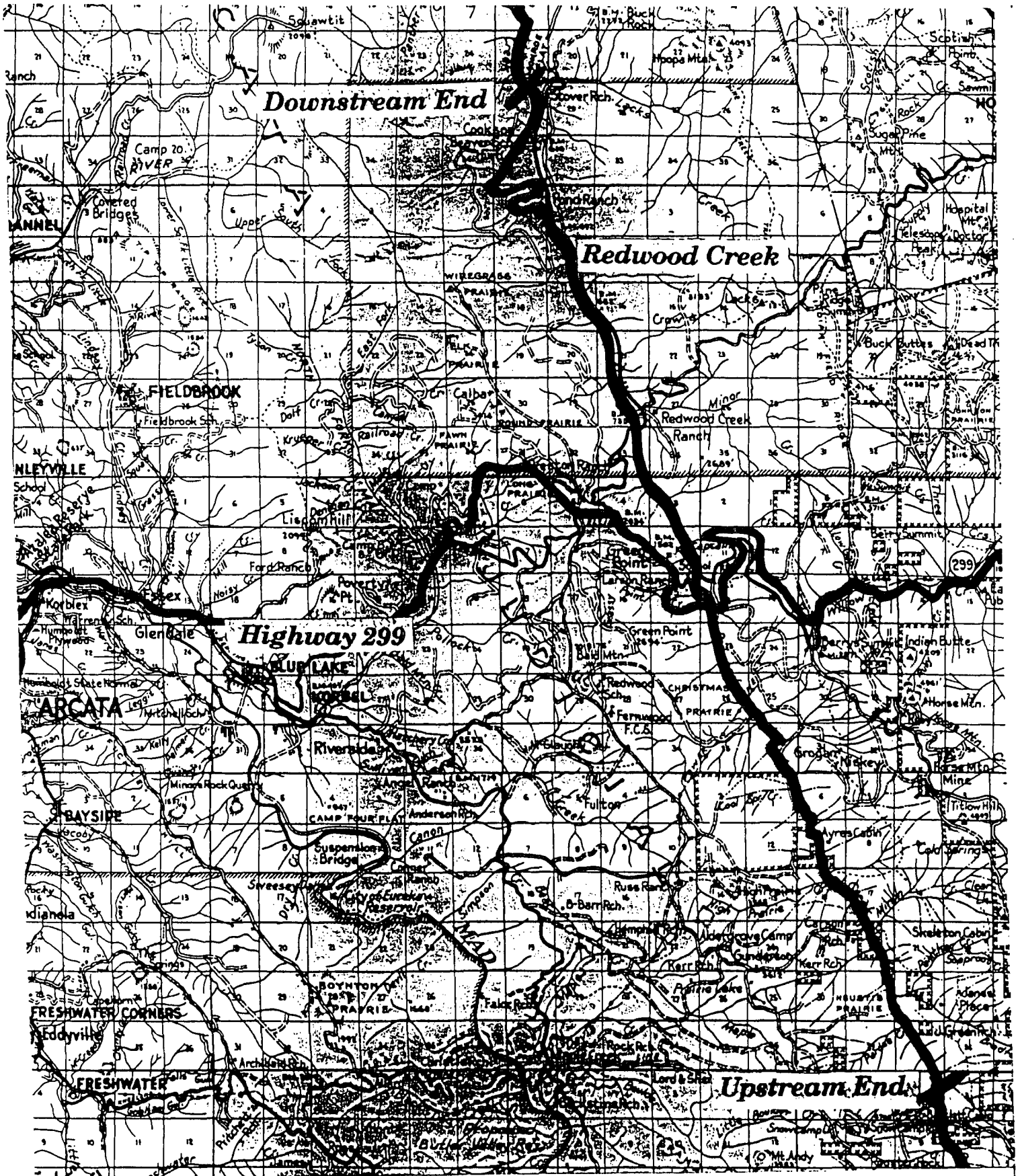
**California Department of Fish and Game
Inland Fisheries Division
1997/1998 Fishery Restoration Grants Program**

performed by

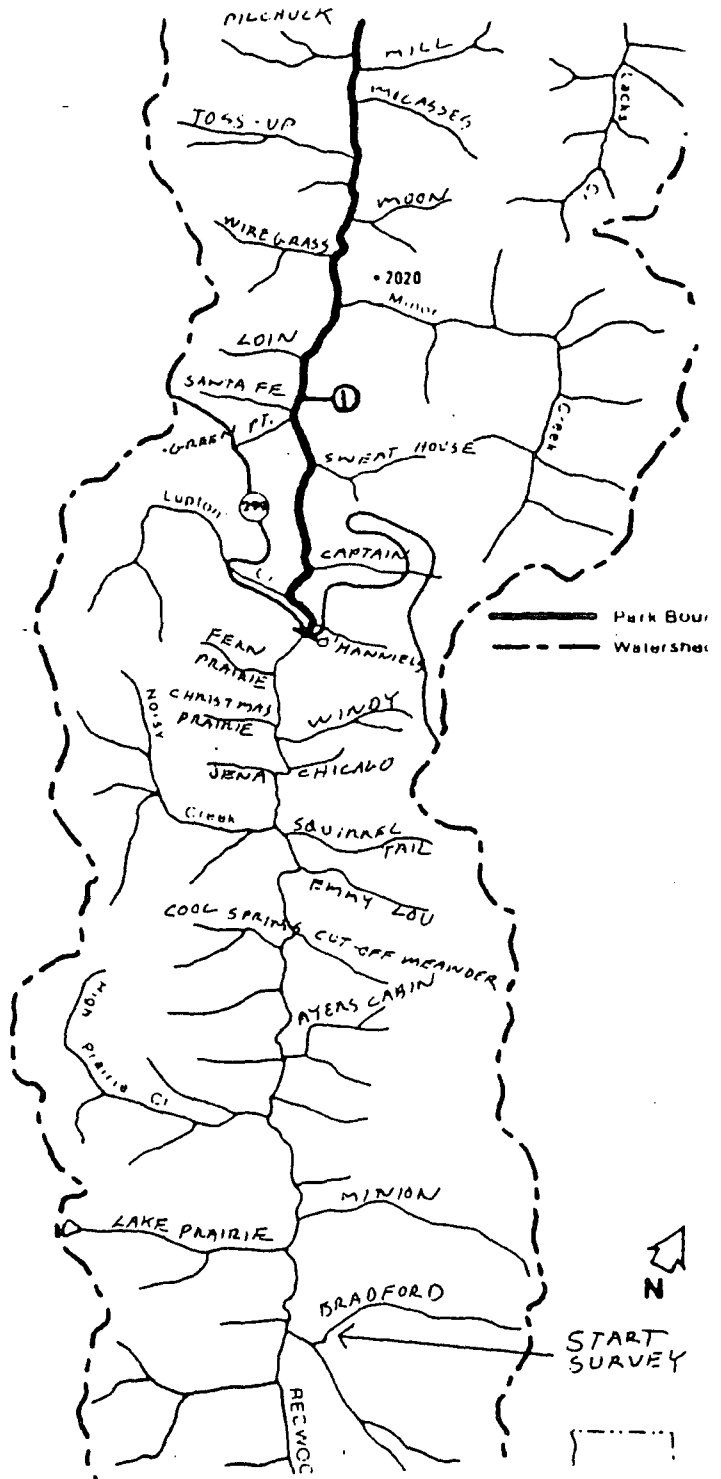
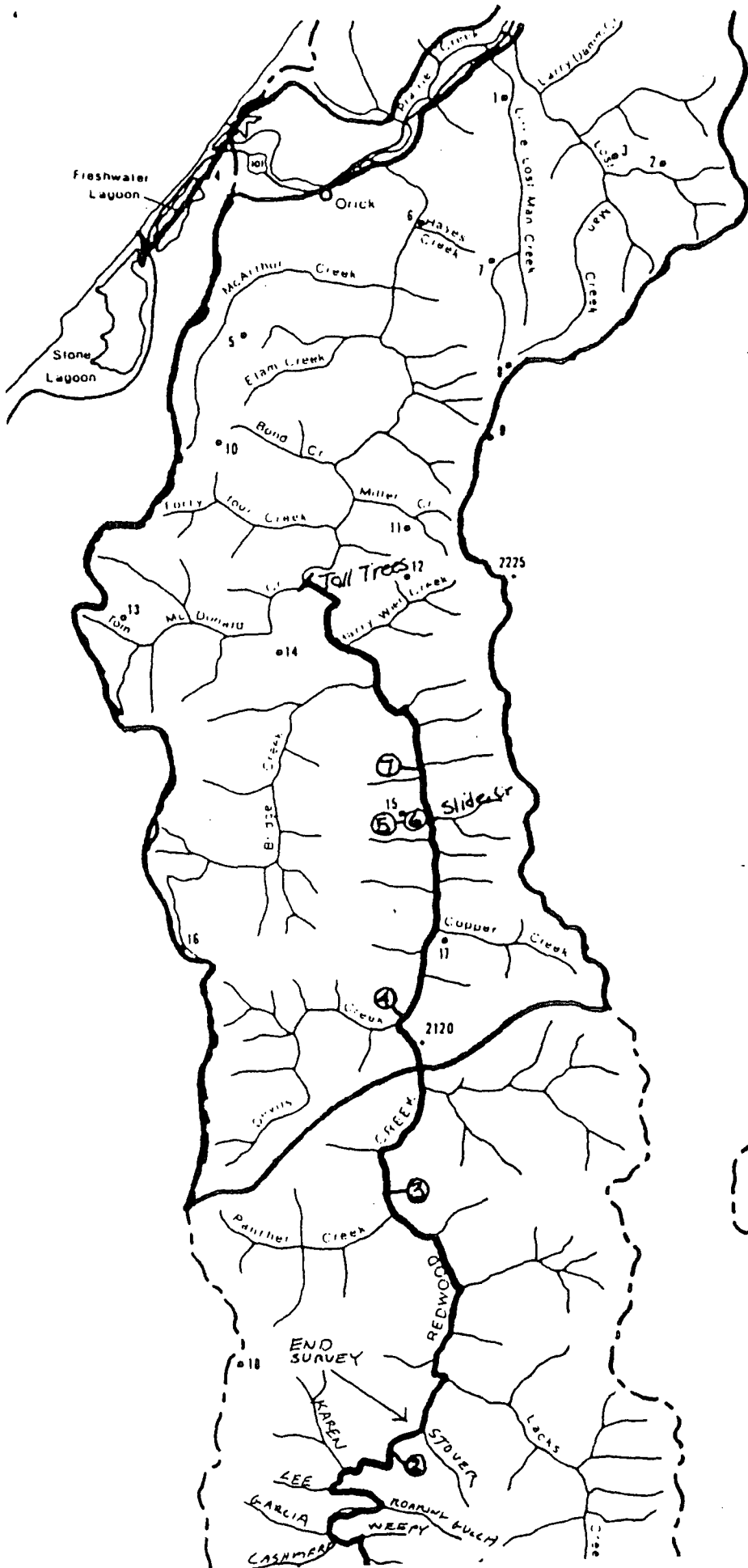


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Project Site Map



Redwood Creek Map



1998 REDWOOD CREEK SUMMER STEELHEAD RECOVERY PROJECT

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Project Location: Twenty six continuous miles of Redwood Creek, located from Bradford Creek, 13 miles upstream of Highway 299, downstream to Stover Creek in Redwood Valley. This area is located in Eastern Humboldt County on the Maple Creek, Grouse Mt., and Lord Ellis Summit USGS 7.5 Minute Quadrangles.

Background: Redwood Creek is a fourth order stream with peak discharges of 45,000 cfs recorded at the mouth during flood events. Peak discharges forty miles upstream are 6,000 cfs. The effects of the 1964 flood were devastating on Redwood Creek. The period since 1964 has seen a slow recovery in Redwood Creek's channel. Pool depth has increased but the channel is still prone to deposition during even moderate flows. The channel bed is highly mobile and new inputs of sediment cause aggradation regularly. Pools and runs lacking roughness scour less, allowing sediment to deposit. Where structure providing roughness such as large woody debris (LWD) is present in the channel, scour associated with it improves sediment transport and pool depth.

Some North Coast summer steelhead streams are relatively productive with adequate cold temperatures and good quality habitat. However, Redwood Creek is the opposite, with high temperature problems and degraded habitat which is threatening its dwindling summer steelhead population.

Surveys of upper Redwood Creek, by Department of Fish and Game (CDF&G), and North Coast Fisheries Restoration (NCFR) had determined that virtually all the larger pools (4 feet or deeper) are lacking in cover, consisting mostly of bedrock with few undercut shelves. NCFR, has completed three previous projects on upper Redwood Creek, constructing LWD cover structures under contract to CDF&G. These past projects have been very successful both biologically and physically. Volunteered pre and post-project monitoring has shown increased usage of the LWD improved pools by adult summer steelhead and juvenile steelhead trout. Salmonid preference is greatest for the structures placed in pools that have cold water inputs from tributaries or springs. Most of the improved pools have shown dramatic increases in depth and in their ability to transport bedload. The sandy pool tailouts which were prevalent before restoration, now have more spawning gravel.

Since 1981, adult summer steelhead surveys have been conducted on Redwood Creek to document their population condition. In recent years, NCFR has donated time surveying the upper extent of Redwood Creek increasing the range that Redwood National Park could cover in the lower reaches. The total distance covered is 48.5 miles from Bradford Creek upstream to Hayes Creek downstream. During the mid eighties as many as 40 adult summer steelhead were observed, and in recent years only ten to twenty have been observed. Historically this number would have been in the double and triple digit numbers. Temperature observations have been made during these surveys, but an inventory of all the cold water sources and their proximity to habitat types which can support adult summer steelhead had not been documented.

Habitat typing has been conducted at least once in the survey reach by Redwood National Park and by the Northwest Emergency Assistance Program . This habitat data combined with additional temperature and habitat monitoring is necessary to develop a comprehensive long term plan for restoring the summer steelhead population of Redwood Creek. This contract has helped to achieve this goal.

The 26 mile project reach is privately owned. This reach from Bradford Creek, downstream to Stover Creek includes many land owners ranging from large timber companies to people with summer cabins. The largest land holdings belong to Simpson Timber Co., Sierra Pacific Industries, and Barnum Timber Co.

Objectives: The objectives of this project are to identify cold water input locations where large woody debris structures could be constructed. Develop a report identifying the highest priority pools to be targeted for future restoration.

By re-introducing LWD structures, summer steelhead and other salmonids could better utilize the project reach instead of being limited to other less desirable habitat types.

Large woody debris, a natural component of streams, provide many benefits; such as:

1. Summer rearing habitat providing juveniles with cover from predators.
2. Summer cover habitat for adult summer steelhead.
3. Winter velocity cover habitat providing salmonids with a resting refuge.
4. Causing scour of the channel bed, deepening pools, and reducing water temperature.
5. Providing direct shade, reducing solar gain and resultant temperatures.
6. Flushing out fine sediment and sorting gravels, creating spawning areas.
7. Providing much preferred spawning area cover habitat.
8. Introduction of salmonid food sources; aquatic and terrestrial invertebrates.
9. Future small and large woody debris recruitment.
10. Increased bank stability from armoring.
11. Increased channel stability by locking the thalweg in to a consistent meander pattern.
12. Increased wildlife habitat by providing stream side cover.

Project Description: This contract includes a temperature survey to determine site locations for construction of large woody debris cover structures. Prior to the survey, NCFR contacted and secured access approvals from all landowners through the project reach. A twenty six mile temperature and habitat survey was conducted to identify cold water sources and the habitat type located at each. This report documenting the survey includes a prioritized list of potential habitat improvement sites for potential future restoration projects. For example, sites where pools are located at cold water inputs would have the highest priority for future improvement. Pools lacking cover would have priority over pools with cover, etc. Access and anchoring limitations to the sites would be determined and be integrated in to the prioritization process.

A crew consisting of one supervisor and two surveyors did logistical planning for shuttling vehicles back and forth for each days creek walk. The crew was equipped with wet suits, masks and snorkels, wading boots, stadia rod, tape measure, thermometers, maps, and field books. The crew would walk from upstream in a downstream direction until a pool

three feet or deeper was encountered. These pools were habitat typed using standard CDF&G habitat typing guidelines, and then measured for length, width, and depth. If the pool was near a cold water input its temperature would be recorded.

Temperatures were collected using hand held thermometers. Temperatures were taken at the cold water inputs (tributary or spring) and in the mainstem upstream and downstream at each location. In some cases springs entered the creek at the bottom of pools, therefor snorkel diving was required to accurately collect temperatures.

Results: The following listing will include a numbered entry for each pool 3 feet deep or greater or any habitat type located at a cold water source. The entry will first be identified by location relative to landmarks and to which side of channel (LB or RB), then by habitat type (LSBO etc.), pool size (LxWxD with depth being the deepest point in pool), by temperature (degrees fahrenheit). Temperatures in Redwood Creek ranged from 59° to 73°. Finally any pertinent notes about the pools are included.

There was a total of one hundred and sixteen (116) sites inventoried over the 26 mile survey reach. Out of these sites, eighty three (83) were potential candidates for restoration because they either had adequate temperatures or a depth of 3 feet or greater. These sites are denoted by asterisks. Forty-two (42) sites were then identified over the entire reach which actually were possible to restore because access and land owner cooperation allowed it. The high temperatures downstream of Loin Creek canceled out twenty-four (24) of these sites leaving eighteen (18) possible sites for restoration. A final list of twelve (12) sites was prioritized which include the best potential for improving salmonid populations.

The top priority pools which have cold temperatures, good depth, good access, good anchor points, and good potential for success of improving Redwood Creeks summer steelhead population are as follows (in some cases cold water inputs over rule depth, access, and anchor points):

Top Priority Sites

- | | |
|-----|-----------|
| 1. | Site # 3 |
| 2. | Site # 7 |
| 3. | Site # 16 |
| 4. | Site # 20 |
| 5. | Site # 25 |
| 6. | Site # 32 |
| 7. | Site # 35 |
| 8. | Site # 36 |
| 9. | Site # 40 |
| 10. | Site # 48 |
| 11. | Site # 53 |
| 12. | Site # 55 |

Listing of all sites inventoried

(Sites with asterisks have potential for improvement)

1. 1997 Site #1 downstream of Bradford Creek. RB. LSBO. 30x10x5.5. 59° Redwood Crk. Bradford Crk. dry. Existing structure providing good cover and causing scour.
2. Mouth of Lake Prairie Crk. LB. LSB. 30x10x3.5. 59° Lk. Prair. Crk., 61° Redwood Crk. Poor access, poor anchor points, heavily impacted by upslope failure.
- 3.* Left bank pool just upstream from Minion Crk. LB. LSB. 25x20x7. 64° Redwood Crk. Good access, fair anchor points, old structure site that failed.
4. Mouth of Minion Crk. RB. LSBO. 30x8x3. 60° Minion Crk., 64° Redwood Crk. 1997 site #4, good cover, not much depth.
5. Digger log pool just upstream of 1996 site #5. LB. LSBO. 10x10x3. 64° Redwood Crk. small pool with adequate existing cover.
6. 1996 site #5. LB. LSBO. 35x20x4.5. 64° Redwood Crk. Good existing LWD causing good scour.
- 7.* Mid Channel Boulder pool downstream of right bank slide. Center. LSBO. 20x10x3. 67° Redwood Crk. Poor access, good anchor points, needs cover.
8. Spring downstream of boulder rough at large mid channel boulder. LB. LSBO. 62° spring, 67° Redwood Crk. Shallow 2 foot pool, poor access, no real scour potential because of boulders, good cover.
- 9.* Left Bank pool upstream of High Prairie Crk. LB. LSB&BO. 20x10x5.5. 67° Redwood Crk. Poor access, poor anchors points.
- 10.* Next pool downstream from #9. LB. LSBO. 15x10x4. 69° Redwood Crk. Poor access.
11. 1997 Site #7. upstream of Massei access. RB. LSBO. 40x12x4. 68° Redwood Crk. Structure in place and functioning well.
- 12.* Right bank pool just upstream of old Massei upper site (S bend). RB. LSB. 30x12x6. 68° Redwood Crk. Fair access, poor anchor points, good potential for scour.
13. Old upper Massei Site on S bend. LB. LSBO. 45x20x6. 68° Redwood Crk. 1992 structure in place and functioning well.
14. No name tributary at Massei bridge. LB. Riffle(LGR). 58° Trib., 68° Redwood Crk. No pool to improve.
- 15.* Right bank corner pool downstream of Massei lower crossing. RB. LSBO. 90x20x4. 63° Redwood Crk. Good access, good anchor points, fair cover already.

- 16.* 1990 site in trench pool. Center. Trench pool(TRP). 45x20x6.5. 63° Redwood Crk. Left bank structure still functioning but in poor condition, good access, poor anchor points.
- 17.* Left Bank boulder pool downstream of Massei lowest site. LB. LSBO. 20x10x4. 64° Redwood Creek. Poor access, fair anchor points.
18. Mouth of Six Rivers Creek. LB. Run. 57° 6 Rivers Crk., 64° Redwood Crk. Poor access, no pool.
- 19.* Oxbow pool. LB. LSBO. 60x20x9. 68° Redwood Crk. Good access, poor anchor points, high velocity gorge area, old structure failed here.
- 20.* Old structure site pool at oxbow outlet. RB. LSBO. 35x20x7. 66° spring in upper end of pool, 68° Redwood Crk. Good access, poor anchor points. Old structure failed here.
21. Mouth of Cool Springs Creek. LB. Riffle(LGR). 57° Cool Springs, Redwood Crk. 68° upstream and 65° downstream. No pool.
- 22.* Corner pool downstream of Cut-off Meander Creek (dry). RB. LSB. 30x12x7. 68° Redwood Crk. Poor access, fair anchor points, old structure failed here. Vulnerable site due to orientation of flow into right angle bend.
23. Deerings upper structure site. LB. LSBO. 20x15x5. 68° Redwood Crk. Existing 1992 structure functioning but in poor condition, heavy fishing pressure.
24. Deerings lower structure site. LB. LSB. 20x8x4. 68° Redwood Crk. Existing 1992 structure in place and functioning well, strong anchors, good LWD recruitment.
- 25.* Left bank spring downstream of Deerings. LB. LSBO. 15x10x3. 67° spring, 68° Redwood Crk. Poor access, poor anchor points.
- 26.* Mouth of Emmy-Lou Creek. RB. LSBO. 15x8x3. 64° Emmy-Lou Crk., 70° Redwood Creek. Poor access, poor anchors.
- 27.* Left Bank pool downstream of Deerings boulder rough. LB. LSBO. 20x10x5. 70° Redwood Crk. Poor access, poor anchor points.
28. O'Hannons upper swimming hole. RB. LSBO. 35x20x5. 66° spring seep on bottom, 68° Redwood Crk. Old revetment site, good access, good anchors, uncooperative land owner.
29. Mouth of Noisy Creek. LB. LSB. 45x30x7. 57° Noisy Crk., 65° upstream Redwood Crk. and 68° downstream. Part of old structure existing but not functioning, land owner cut off structure, uncooperative land owner. Good access, and anchor points.
30. Pool at O'Hannons house. LB. LSBO. 80x20x5. 68° Redwood Crk. 1992 structure site, failed last winter, good access and anchor points, uncooperative land owner.

- 31.* Left bank pool in S-bends downstream of O'Hannons. LB. LSB. 30x10x8. 68° Redwood Crk. Lower S-bend, fair anchor points, poor access, must come through O'Hannon.
- 32.* Upper Tilly structure site. RB. LSBO. 35x30x4. 68° Redwood Crk. Good access, fair anchor points, cover needed, very long riffles up and downstream.
- 33.* Pool downstream of Masons cabin. Center. LSBO. 30x30x3.5. 61° Redwood Crk. Good access, good anchor points, fair cover.
- 34.* Pool at Masons sisters cabin. LB. LSBO. 40x10x3.5. 61° Redwood Crk. Good access, fair cover, good anchor points.
- 35.* Newly formed pool downstream of Masons sister's. LB. LSB. 60x20x6. 63° Redwood Crk. Good access, fair anchors, no cover.
- 36.* Spring pool by Walts trailer. LB. LSB. 50x25x4.5. 56° spring at downstream left bank end of pool, 63° Redwood Crk. Poor access, poor anchor points, no cover, good cold pool.
37. Pool just downstream of spring pool. LB. LSBO. 50x30x3. 64° Redwood Crk. Poor access, fair anchor points, just upstream of Choppo's property.
38. Choppo's pool. LB. LSB & BO. 60x35x6. 64° Redwood Creek. 1990 structure still in place and functioning, good access, fair anchors.
39. Boulder trench pool upstream of 299 bridge. Center. Trench pool(TRP). 60x15x4. 65° Redwood Crk. Poor access, good anchors, high velocity chute not good for anchoring.
- 40.* Big bedrock point downstream of Hwy 299 bridge. RB. LSB. 30x15x8. 62° Redwood Crk. Fair access, good anchor points, needs cover.
- 41.* Mouth of Lupton Creek. LB. Confluence pool(CCP). 20x10x1.5. 57° Lupton Crk., 62° Redwood Crk. Fair access, good anchor points on boulders, shallow pool.
- 42.* Big split rock pool downstream of Lupton Creek. RB. LSBO. 30x30x8. 60° spring seep on bottom of pool, 62° Redwood Crk. Good access, fair anchor points, good cover, cold water from Lupton Crk, recreational pool with low water dam.
- 43.* Second pool downstream of Lupton Crk. LB. LSB. 20x10x3.5. 62° Redwood Crk. Fair access, poor anchor points.
- 44.* Third pool downstream of Lupton Creek. LB. LSB. 25x8x4. 62° Redwood Crk. Fair access, poor anchor points.
- 45.* Pool under power line. LB. LSB. 15x10x5. 62° Redwood Crk. Fair access, poor anchor points, fractured bedrock.
46. Mouth of Captains Creek. RB. Chezum lake. 1/2 mile long dammed lake. 64° Captains Crk. 70° Redwood Crk. Dammed lake floods back in to Captains Crk. No anchor points, good cover from depth.

- 47.* Pool downstream of left bank access road downstream of dam. LB. LSB. 25x15x5. 70° Redwood Crk. Has good cover, good access, warm temperature, highly mobile substrate due to dam removal.
- 48.* Second pool downstream of left bank access. RB. LSB. 20x10x6. 70° Redwood Crk. Not much cover, good access.
- 49.* Third pool downstream of left bank access. LB. LSBO. 25x10x7. 70° Redwood Crk. Good access, good anchor points, fair cover already.
- 50.* Bedrock pool at Frankies left bank access road. RB. LSB. 60x15x9. 70° Redwood Crk. Good access, fair anchor points.
- 51.* Giant boulder pool downstream of access road. LB. LSBO. 30x10x5. 70° Redwood Crk. Good access, fair anchor points, good potential site.
- 52.* Spring downstream of left bank dry tributary. LB. LSBO. 15x8x2.5. 61° spring, 68° Redwood Crk. Fair site for structure even though shallow pool.
- 53.* Pool at giant bedrock point. LB. LSB. 20x10x3. 70° Redwood Crk. Good anchor points, needs cover, long riffle reach downstream.
- 54.* Frankies swimming hole. LB. LSBO&R. 20x10x3. 72° Redwood Crk. Good access, upstream of cabin, temporary low flow dam for recreation, Alder and Maple rootwads in channel.
- 55.* Pool just downstream of Frankies cabin. RB. LSBO. 40x6x3. 72° Redwood Crk. Good access, good anchor points.
- 56.* Pool downstream of Sweat house Creek. RB. LSB. 10x10x3. 70° Redwood Crk. Poor access, good anchor points.
- 57.* Big boulder pool downstream end of Frankies. LB. LSB. 40x10x10. 70° Redwood Crk. Poor access, good anchor points, fair cover already.
58. Mouth of Santa Fe Creek. LB. Riffle(LGR). 1 foot deep riffle. 61° Santa Fe Crk, 73° Redwood Crk. Split channel and Santa Fe Crk. doesn't go directly into Redwood Crk.
- 59.* Pool just upstream of Loin Creek. LB. LSBO. 30x15x3. 72° spring on bottom of pool, 77° Redwood Crk. 10-15 foot diameter boulder in pool, good anchor points, poor access.
- 60.* Bedrock Trench Pool upstream of Loin Creek. Center, Trench pool(TRP). 30x20x7. 75° Redwood Crk. Poor access, fair anchors, needs cover, bedrock constriction.
- 61.* Pool just upstream of Loin Creek. LB. LSB. 30x15x3. 75° Redwood Crk. Poor access, good anchor points on two large boulders, Loin Crk. dry.

- 62.* Pool with big black rock downstream of Loin Creek. RB. LSB. 35x25x12. 75° Redwood Crk. Poor access, good anchor points, needs cover, high priority.
- 63.* Pool upstream of Minor Creek. RB. LSB. 25x15x4. 75° Redwood Crk. Fair access, good anchor points, needs cover, slide on right bank.
- 64.* Mouth of small spring upstream of Barnum's ranch house. LB. LSBO. 20x15x3.5. 59° spring, 73° Redwood Crk. Good access, good anchor points, spring located at draw across from left bank slide.
- 65.* Pool just downstream of spring and upstream of ranch house. RB. LSBO. 40x15x5. 77° Redwood Crk. Several 10-15 foot boulders, good access, good anchor points, needs cover.
- 66.* Big boulder pool just upstream of suspension bridge RB. LSBO. 30x25x10. 77° Redwood Crk. Cold water seep on bottom right bank side of pool (68°).
- 67.* Mouth of Minor Creek. RB. LSBO. 30x30x4. 66° Minor Crk., 73° Redwood Crk. Good access, fair anchor points, low water dam in place.
- 68.* Pool under Redwood Valley road bridge. RB. LSB. 40x25x8. 74° Redwood Crk. Good access, good anchor points, good cover already, cold seeps at bottom of pool.
- 69.* First pool downstream of bridge. LB. LSB. 20x10x4. 73° Redwood Crk. Good access, good cover already, 15 foot boulder in pool.
70. Mouth of Wiregrass Creek. LB. Pocket water(POW). 16x15x1. 61° Wiregrass Crk., 73° Redwood Crk. No pool, good access, fair anchor points.
- 71.* Pool just downstream of Wiregrass Creek. RB. LSB. 40x25x4. 73° Redwood Crk. Good access, poor anchor points, needs cover.
- 72.* First pool downstream of Moon Creek. RB. LSBO. 30x20x7. 70° Redwood Crk. Good access, good anchor points.
- 73.* Pool by satellite dish on first private property downstream of Barnum's. LB. LSBO. 60x15x5. 70° Redwood Crk. Good access, good anchor points, needs cover.
- 74.* Pool at upstream end of slide and downstream of private access road. RB. LSBO. 20x10x5. 70° Redwood Crk. Good access, needs cover, 15 foot diameter boulder in pool.
75. Mouth of Toss-up Creek. LB. Riffle(LGR). 62° Toss-up Crk., 75° Redwood Crk. No pool to improve.
76. Mouth of Molasses Creek. RB. Riffle(LGR). 12 feet wide, 6 inches deep. 62° Molasses Crk., 77° Redwood Crk. Cold water not effecting Redwood Crk. No pool to improve.
77. Mouth of Pilchuck Creek. LB. Riffle(LGR). 61° Pilchuck Crk., 73° Redwood Crk. No pool to improve.

- 78.* Pool with spring seep upstream of old bridge. LB. LSBO. 60x10x5. 68° spring seep, 77° Redwood Crk. Spring at bottom of pool, good access, fair anchor points.
- 79.* Pool at old bridge. LB. LSB. 60x15x6.5. 79° Redwood Crk. Good access, good anchors, good cover already.
80. Mouth of Beaver Creek. RB. Riffle(LGR). 15 feet wide, 4 inches deep. 68° Beaver Crk., 79° Redwood Crk. Beaver Crk. almost dry, not connected to Redwood Crk., no pool to improve.
- 81.* Mouth of Weepy Creek. RB. LSB. 50x15x3.5. 66° Weepy Crk., 77° Redwood Crk. Poor access, poor anchor points (fractured bedrock).
- 82.* Bedrock pool downstream of Weepy Creek. LB. LSR. 30x20x3. 79° Redwood Crk. Poor access, needs cover, 1 rootwad in pool.
- 83.* Next pool downstream of #82. RB. LSB. 60x25x4. 79° Redwood Crk. Poor access, good anchor points.
- 84.* Big boulder pool downstream of #83. RB. LSB. 20x10x4. 79° Redwood Crk. Poor access, good anchor points.
85. Mouth of Cashmere Creek. LB. Riffle(LGR). 18 feet wide, 2 inches deep. 61° Cashmere Crk., 79° Redwood Crk. Cold water not effecting Redwood Crk. No pool to improve.
86. Mouth of Garcia Crk. LB. Riffle(LGR). 4 inches deep. 61° Garcia Crk., 70° upstream in Redwood Crk. and 70° downstream. No pool to improve.
- 87.* Run downstream of Garcia Creek where flow enters Redwood Creek. RB. Run. 40x15x2.5. 70° Redwood Crk. Poor access, poor anchor points.
- 88.* First pool downstream of Garcia Creek. LB. LSB. 35x10x3. 73° Redwood Crk. Poor access, fair anchor points.
- 89.* Second pool downstream of Garcia Creek. LB. LSB. 60x20x4. 73° Redwood Crk. Some woody debris present, poor access.
- 90.* Third pool downstream of Garcia Creek. LB. LSB. 50x10x6. 73° Redwood Crk. Poor access, poor anchor points, close to unnamed tributary.
- 91.* Pool just upstream of Roaring Gulch. LB. LSB. 40x20x4. 73° Redwood Crk. Pool tailout at mouth of Roaring Gulch, confluence is dry, poor access, poor anchor points.
92. Mouth of Roaring Gulch. RB. Riffle(LGR). 61° Roaring Gulch, 66° Redwood Crk. (morning). No pool to improve.
- 93.* First pool downstream of Roaring Gulch. RB. LSBO. 80x15x3. 66° Redwood Crk. Poor access, several 5 foot diameter boulders to anchor too, needs cover.

- 94.* Pool at big bedrock point downstream of #93. RB. LSB. 80x15x3. 66° Redwood Crk. Poor access, good anchor points, needs cover.
- 95.* Third pool downstream from Roaring Gulch. LB. LSBO. 75x20x5. 67° Redwood Crk. Long left bank bend, has some woody debris.
- 96.* Fourth pool downstream of Roaring Gulch. RB. LSR. 40x25x6 67° Redwood Crk. Good cover from rootwad (one of the few pieces of wood in this reach).
- 97.* Fifth pool downstream of Roaring Gulch. LB. LSBO. 20x15x4. 67° Redwood Crk. Fair anchor points, needs cover.
- 98.* Sixth pool downstream of Roaring Gulch. RB. LSBO. 60x20x5.5. 67° Redwood Crk. Poor access, poor anchor points.
- 99.* Third pool upstream from Lee Creek. LB. LSB. 25x15x4. 67° Redwood Crk. Fair anchor points on upslope Redwood trees.
- 100.* Second pool upstream from Lee Creek. RB. LSB. 20x14x4. 67° Redwood Crk. Fair access, good anchor points on Alders, small rootwad in pool.
- 101.* Pool just upstream of Lee Creek. LB. LSB. 100x10x5.5. 67° Redwood Crk. Good access, fair anchor points.
102. Mouth of Lee Creek. LB. Riffle(HGR). 80 feet wide and shallow. 61° Lee Crk., 67° Redwood Crk. Cold water not effecting Redwood Crk., no pool to improve.
- 103.* Pool upstream of Karen Creek. RB. LSB. 40x15x5. 70° Redwood Crk. On bend with broken bedrock, good access, good anchors on Redwood trees.
- 104.* Mouth of Karen Creek. LB. Confluence Pool(CCP). 20x10x3. 61° Karen Crk., 68° Redwood Crk. Narrow pool with riffle on right bank side, 1 degree temperature change downstream in Redwood Crk.
- 105.* First pool downstream of Karen Creek. LB. LSB. 25x10x5.5. 68° Redwood Crk. Fair access.
- 106.* Ten foot diameter boulder pool downstream of Karen Creek. LB. LSBO. 20x15x5. 70° Redwood Crk. Boulder in middle of pool, good anchor points.
- 107.* Third pool downstream of Karen Creek. LB. LSB. 25x10x5. 72° Redwood Crk. Good anchor points, Redwoods and boulders on left bank.
- 108.* Fourth pool downstream of Karen Creek. LB. LSB. 30x15x7. 72° Redwood Crk. Poor anchor points.
- 109.* Fifth pool downstream of Karen Creek. RB. LSBO. 20x20x10. 72° Redwood Crk. Fair access, good anchor points, good LWD already.

- 110.* Sixth pool downstream of Karen Creek. RB. LSB. 25x10x6. 64° Redwood Crk. Fair access, good anchor points, LWD present in pool.
- 111.* Seventh pool downstream of Karen Creek. LB. LSB. 10x8x5. 68° Redwood Crk. End of long straight reach upstream from Adventist Camp, Good access, fair cover already.
- 112.* Second pool upstream of Adventist Camp. LB. LSB. 10x8x5. 68° Redwood Crk. End of long straight reach upstream from Adventist Camp, Good access, good anchor points.
- 113.* First pool upstream of Adventist Camp. RB. LSBO. 60x15x8. 70° Redwood Crk. Big bedrock point, private access road, fair anchor points.
114. Adventist Camp dammed pool. Center. Dammed pool. 150x40x10. 70° Redwood Crk. Good anchor points, good cover from depth.
- 115.* Bedrock point pool downstream of Adventist Camp dammed pool. RB. LSB. 15x10x5. 70° Redwood Crk. Good access, fair anchor points.
116. Mouth of Stover Creek. RB. Run. 1 foot deep. 62° Stover Crk., 73° Redwood Crk. No pool to improve.

Recommendations: The twelve identified top priority sites should be checked for changes following winter flows to determine if improvement is still appropriate. The land owners at each site should be contacted and a written agreement secured from them. Access logistics should be determined. On site large woody debris or materials to be imported should be identified (in some cases large diameter boulders may need to be imported to anchor the structures. Large Woody Debris Cover Structures shown in the typical design diagram in this report could then be constructed. Time tested anchoring techniques developed by NCFR on Redwood Creek should be used to insure structure longevity. During the pre project design phase of the in-stream structures, personnel should document all physical baseline data collected. The following year, and on future occasions, post-project monitoring and evaluation to determine the effectiveness of the project should be performed. There has been continuing concern about the cost-benefit of in-stream structures. Monitoring the completed in-stream structures will be extremely beneficial in determining appropriate future restoration prescriptions for Redwood Creek.

Time Frame and Costs: The total hours and cost for the project were as follows:

Personnel Costs

Project Supervisor (100 hrs. @ \$20.00)	\$2,000.00
2 Laborers (45 hrs total @ \$14.50)	\$652.00
Staff Benefits (24%)	<u>\$636.60</u>
Total Personnel Costs	\$3,289.10

Materials and Supplies

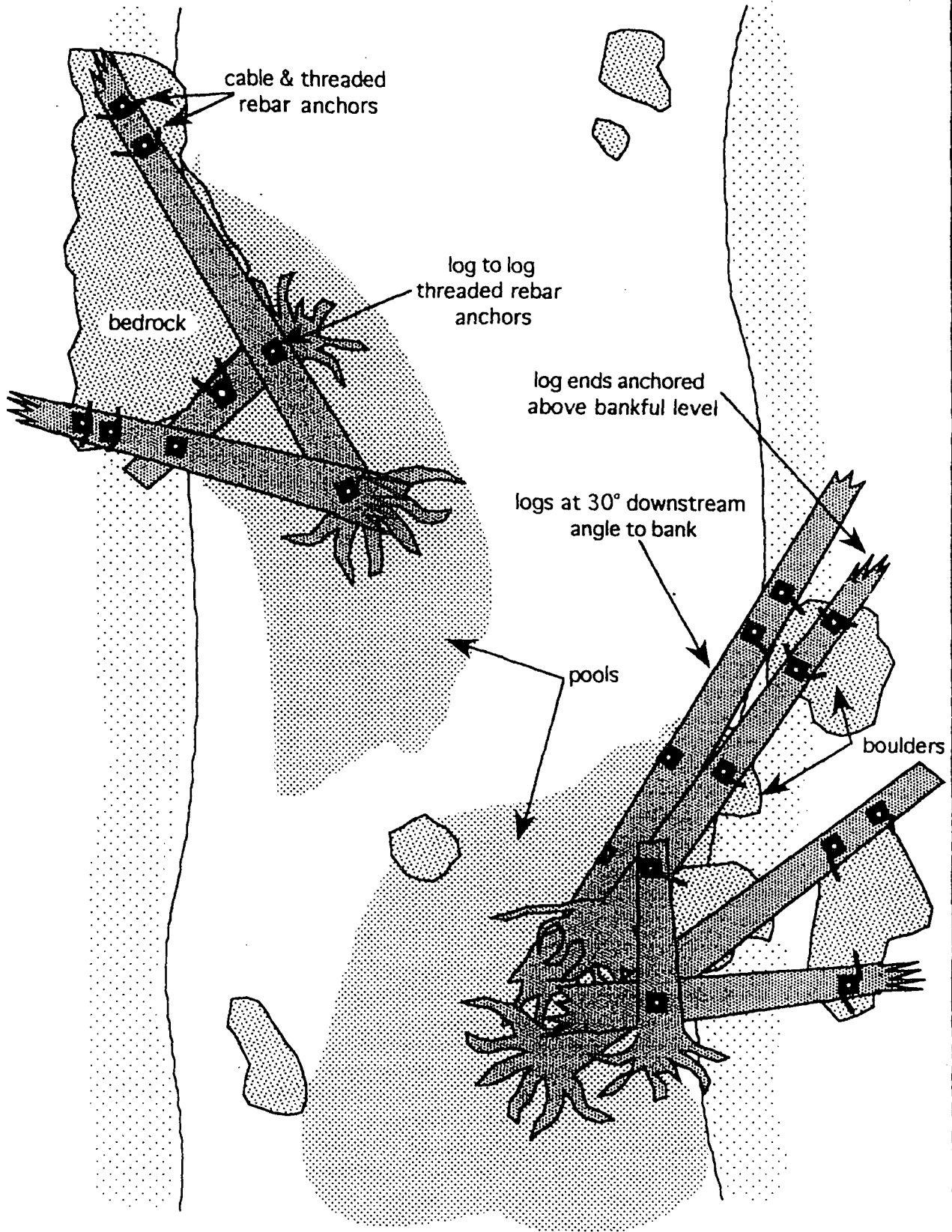
Supplies Hand held thermometers 3 @ \$27.00	
Wading boots, booties, dry bags @ 440.00	
Safety gear @ \$45.00	
Total Materials and Supplies	\$485.00

Operating Expenses

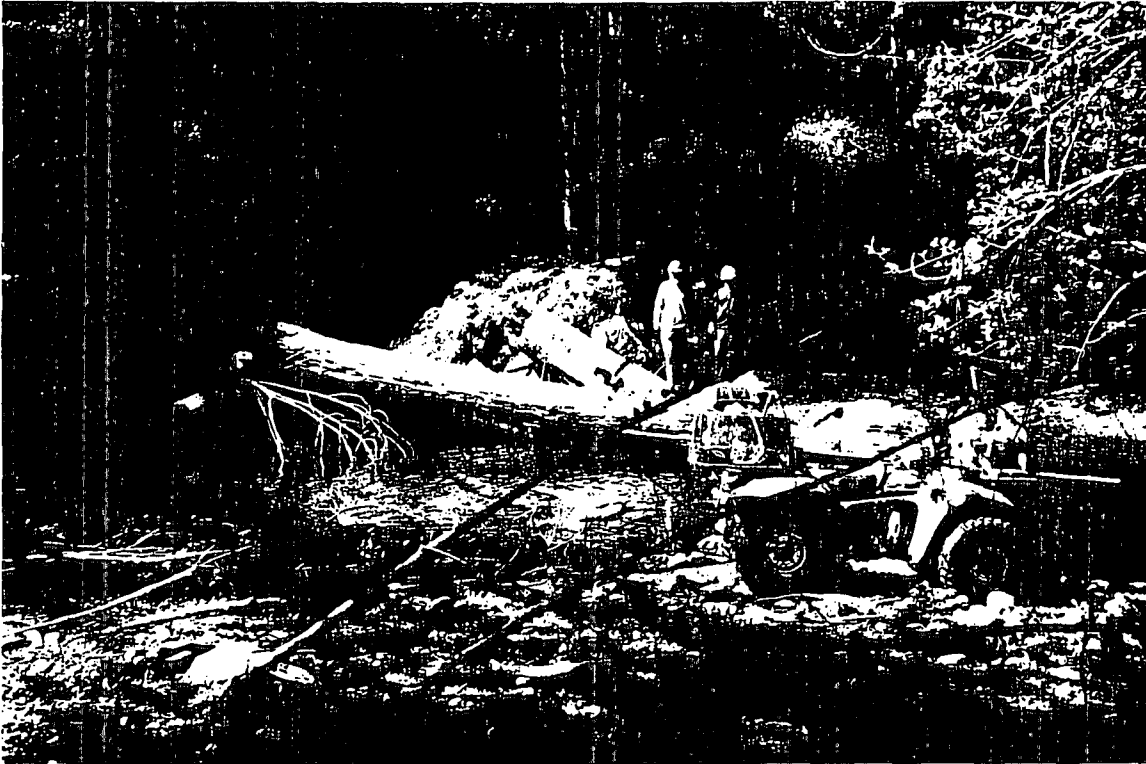
Transportation Costs (1,440 mi. @ .24¢)	\$346.00
Photographic supplies	\$45.00
Printing and duplicating	\$45.00
Administration	<u>\$400.90</u>
Total Operating Costs	\$836.90

Total Budget **\$4,611.0**

*Redwood Creek Summer Steelhead & Coho Salmon
Recovery Project
Typical Designs*



1996-1997 Redwood Creek Cover Structure Project Photographs



1996 completed
LWD Cover Structure



1997 completed LWD
cover structure

1996-1997 Redwood Creek Cover Structure Project Photographs



Completed LWD
Cover Structure



Cable eye to threaded
rebar anchors securing
LWD to boulder