Lower Terwer Creek Emergency Streambank Stabilization Project

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Introduction

The Yurok People have inhabited the lands of and sustained themselves upon the resources of the Klamath River for centuries. The Yurok Tribe's entire culture is largely based upon the Klamath River and its associated fish populations. Today, only a fraction of historic anadromous fish runs return to spawn in the Klamath River and its tributaries. Although many factors have contributed to these declines in native fish runs, degradation of freshwater habitat has been pervasive in the Klamath River Basin. Kier and Associates (1991) note that "the fish habitats of the basin have been greatly diminished in extent and value in the past century by the construction of impassable dams and by stream diversions and sand and silt from mining, logging, grazing, road development, and floods." The declining health and productivity of the Klamath River's anadromous fisheries is of great cultural and economic concern to the Yurok Tribe.

To proactively address these declines, the Tribe initiated a large-scale, coordinated watershed restoration effort throughout the Lower Klamath sub-basin in conjunction with Green Diamond Resource Company (GDRC – formerly Simpson Resource Company) and the California Coastal Conservancy. This cooperative framework is intended to meet the mandates and objectives of tribal, state, and federal planning efforts, the Northwest Economic Adjustment Initiative and the state and federal ESA through innovative solutions to resource management issues between private landowners, Tribal interests, and public agencies.

In order to provide for meaningful restoration plans that truly address the limiting factors facing each salmonid species in a given drainage, the Yurok Tribe initiated the Lower Klamath River Watershed Assessment. This interdisciplinary effort, consisting of historical and current condition assessments throughout each of the Lower Klamath tributaries, resulted in the prioritization of restoration activities throughout the basin. The Lower Klamath Sub-Basin Watershed Restoration Plan (Gale and Randolph 2000) identifies chronic streambed sedimentation, heavily degraded instream and riparian habitat, and loss of habitat connectivity as the primary factors for salmonid decline. In order to address these problems, the Sub-Basin Plan prioritizes treatment of upslope sediment sources, in conjunction with instream and riparian restoration and fish barrier treatment.

The Yurok Tribal Fisheries Program (YTFP) undertook a multi-phase riparian enhancement project in lower Terwer Creek beginning in 2003. Restoration treatments are designed to provide long-term benefits including reduction of sediment delivery, increased channel and streambank stability, increased habitat complexity, improved LWD recruitment potential, and self-sustaining riparian forests. This project was designed and implemented on an emergency basis to protect and stabilize a 100 foot stretch of streambank that was rapidly eroding due to repeated high flow conditions during winter 2005-2006. This site will then be further treated during summer 2006 dry stream channel conditions when the entire reach will be restored using bioengineering and log-boulder revetment methods.

Project Area

The Lower Klamath sub-basin encompasses the lower 40 miles of the Klamath River and its tributaries, between the confluence with the Trinity River and the Pacific Ocean. There are 25 anadromous fish bearing tributaries within the sub-basin (Figure 1). The Yurok Indian Reservation extends one mile on either side of the mainstem throughout the lower 44 miles of the Klamath River. An aquatic and riparian habitat summary for the sub-basin is presented in Table 1. A summary of aquatic species presence by tributary is presented in Table 2. All project work occurred within lower Terwer Creek.

Terwer Creek is a fourth order stream that drains approximately 31.8 sq. miles of coniferous-forested mountains. The headwaters originate at an elevation of 1,600 ft. and flows southerly 13.9 miles, through mostly steep, highly confined stream channels. Terwer Creek is moderately to highly confined throughout most of its course, with "B" and "C" channel types dominant throughout (see Rosgen 1994 for channel type descriptions). The lower portion of the creek flows through a broad floodplain past the community of Klamath Glen (Figures 2-3). The Terwer Creek watershed supports anadromous populations of chinook salmon, coho salmon, steelhead trout, coastal cutthroat trout and Pacific lamprey. The East Fork is the largest tributary in the drainage, supporting populations of coho salmon, steelhead and coastal cutthroat trout.

This project site is located on private property owned by Ken Farley and is within the project area YTFP is restoring with bioengineering and log-boulder revetment techniques during 2005-2006. The project site is located approximately 4,000 feet upstream from the Highway 169 Terwer Creek Bridge and extends approximately 100 feet upstream along the west side bank of Terwer Creek (Figure 3).

Traveling directions to the site are as follows: Traveling south on U.S. Highway 101 in Klamath, exit on Terwer Valley 169/Klamath Glen Exit. Drive approximately two miles, turning left on Terwer Valley Road. Drive approximately one mile traveling onto Ken Farley's private property. Drive approximately 1/8 mile and turn right onto a dirt road which leads to Terwer Creek where the project site is located.

Project Objectives

This project funded the purchase of boulders for emergency stabilization and protection of 100 feet of actively eroding streambank in Lower Terwer Creek on Ken Farley's property. Repeated high flow events during this past winter (2005-2006) resulted in a 100' stretch of streambank on Mr. Farley's property to rapidly erode, resulting in over ten feet of lateral bank erosion and threatening to erode Mr. Farley's access road to the north end of his property. The sudden loss of streambank in the 100-foot reach resulted in an emergency field visit between Mr. Farley and CDFG and YTFP staff to identify what measures could be taken to stabilize the bank until this summer when additional structure and bioengineering work can be implemented. It was agreed that the best approach is to place boulders along the eroding bank now to curb the bank erosion, with the plan of

repositioning this rock during summer 2006 dry stream channel conditions when the entire reach will be restored using bioengineering and log-boulder revetment methods.

These funds allowed YTFP to purchase 200 tons of boulders to place along this eroding bank, with an additional 275 tons being purchased and stockpiled on the site to allow for rapid treatment of any additional erosion problems that may occur during the remainder of the winter and spring. Any surplus stockpiled rock will be utilized this summer when the bioengineering and structure placement work occurs in this project area.

This project resulted in the protection and stabilization of 100 linear feet of Terwer Creek streambank, as well as the prevention of an estimated 600 cubic yards of sediment that would have been delivered to the stream channel had the erosion been allowed to continue without treatment.

Project Tasks

YTFP worked in conjunction with the Yurok Tribe Watershed Restoration Department (YTWRD) to place 200 tons of boulders on the eroding streambank. All boulder placement occurred with an excavator, which operated from Ken Farley's road immediately adjacent to (and affected by) the eroding streambank (Figure 11). We placed boulders along the affected streambank up to the level of the adjoining road to minimize any additional erosion or lateral stream channel migration.

An additional 275 tons of boulders were stockpiled on the site to allow for rapid treatment of any additional erosion problems that may occur during the remainder of the winter and spring. Any surplus stockpiled rock will be utilized this summer when the bioengineering and structure placement work occurs in this project area.

YTFP conducted photographic documentation of pre- and post-restoration conditions within the project area.

All work commenced on February 1, 2005 and was completed on February 17, 2005. A total of 24 hours of YTWRD staff time (excavator operator) and 24 hours YTFP staff time (Fisheries Biologist oversight) were expended to complete this project.

Project Reporting Metrics

Habitat Projects (all):

Watershed plan identifying project as a priority:

- Lower Klamath Sub-Basin Watershed Restoration Plan (Gale and Randolph 2000)
- Recovery Strategy for California Coho Salmon (CDFG 2004)

Priority habitat limiting factors identified in plans that are addressed by project:

- Reduction in sediment delivery to stream channel
- Protection/stabilization of streambanks

This project addressed the following tasks in the California state coho Recovery plan:

- Task # KR-KG-14 Provide technical and financial support to implement riparian restoration throughout alluvial reaches in lower Blue, Terwer, hunter and Salt creeks.
- Task # KR-KG-08b Implement the plan to restore in-channel and riparian habitat in tributaries.
- Task # KR-KG-07 Treat sediment sources and improve riparian and instream habitat conditions to provide adequate and stable spawning and rearing areas for coho salmon.

Type of monitoring included in project:

- Photographic documentation of pre- and post-restoration conditions within the project area.

Number of stream miles treated/affected by project:

- Stream miles treated: 0.02 miles (100 feet)
- Stream miles affected: 1.4 miles (7,400 feet)

Riparian Habitat Projects (HR):

Number of miles treated: 0.02 miles (100 feet)

Number of acres treated: 0.1 acres

Number of acres and type of invasive species controlled: N/A

Species and size of trees planted: N/A

Number of trees/density of plantings: N/A

Feet of streambank stabilized and treatments used: 100 feet.

- Bank stabilized by placing 200 tons of large boulders along bank, with an additional 275 tons being purchased and stockpiled on the site to allow for rapid treatment of any additional erosion problems that may occur during the remainder of the winter and spring. Any surplus stockpiled rock will be utilized this summer when the bioengineering and structure placement work occurs in this project area.

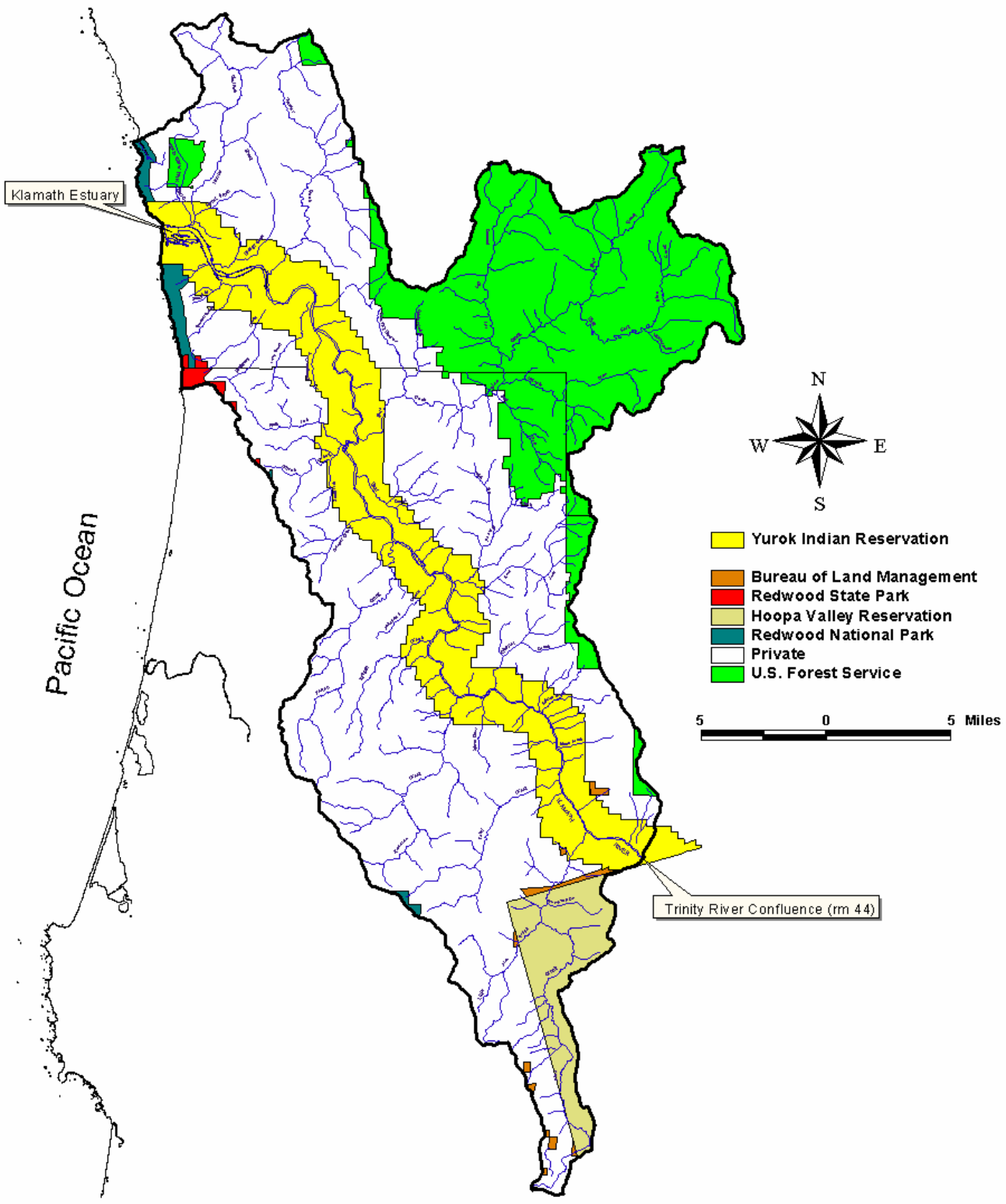

Figure 1. Lower Klamath River Sub-basin, California.

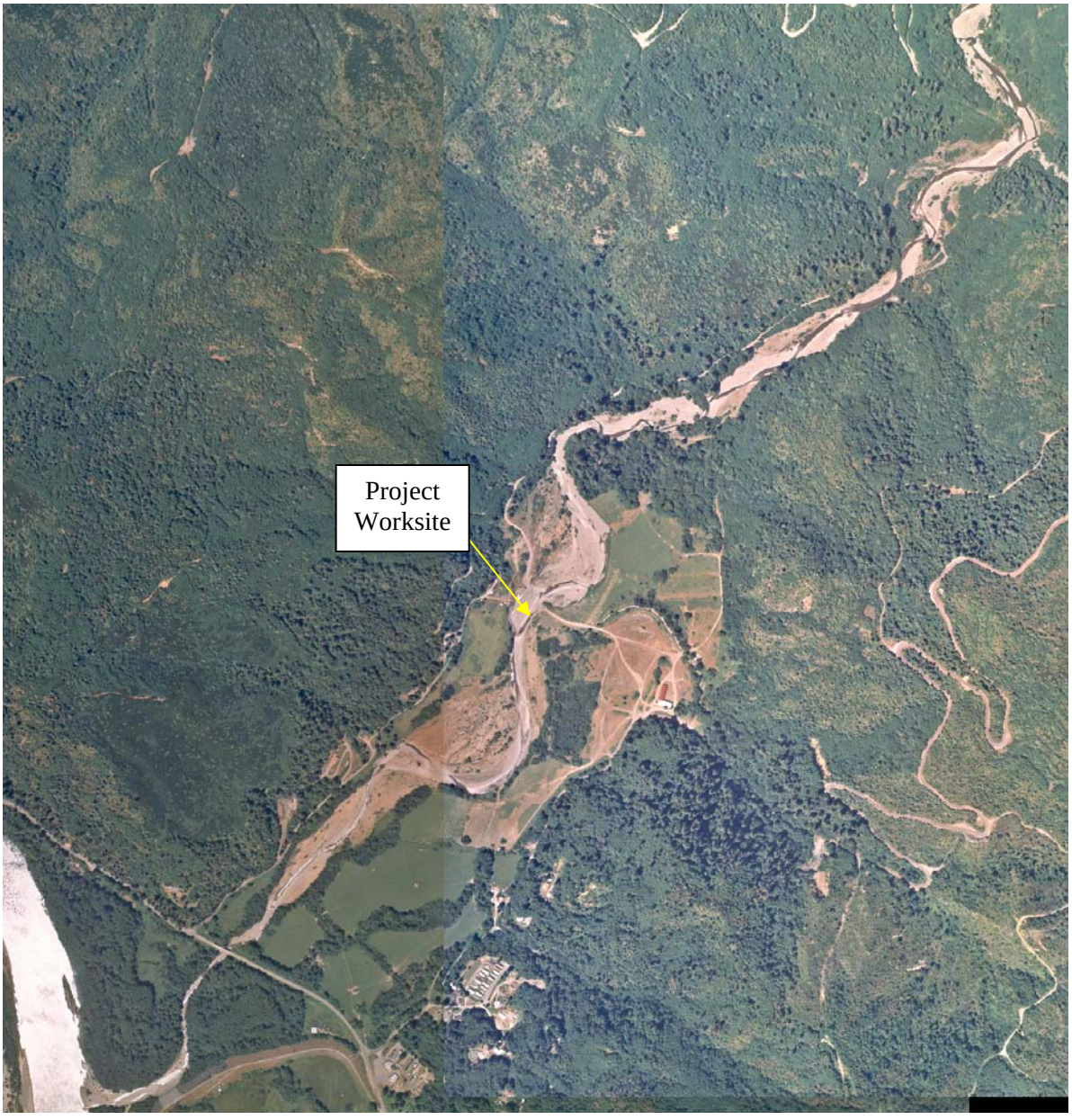

Figure 2. Aerial view of the lower 3.0 miles of Terwer Creek,
Lower Klamath River, California, 1997.

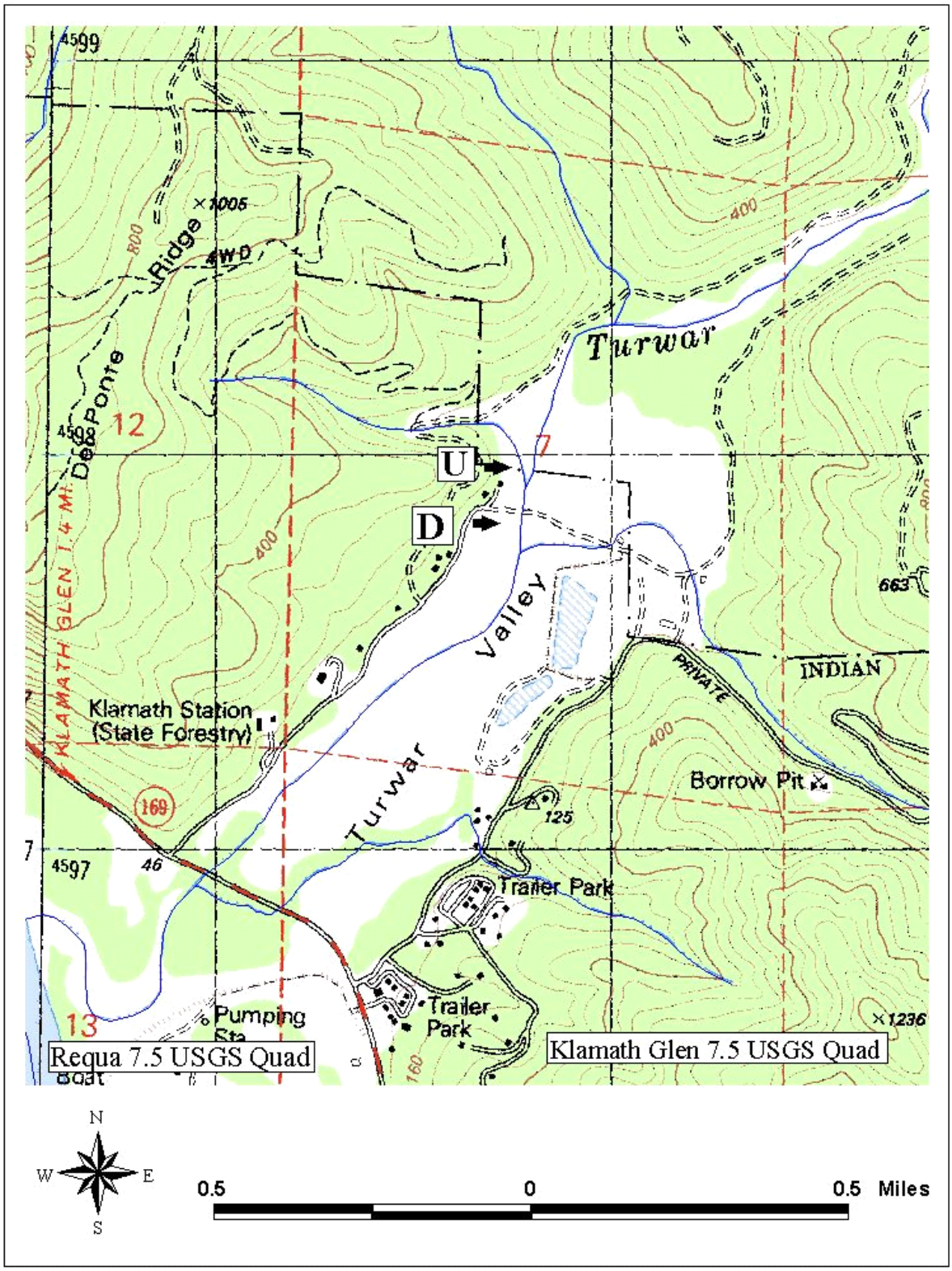

Figure 3. Project location map, Lower Terwer Creek Emergency Stream Bank Stabilization Project, lower Klamath River, California, 2006.

Table 1. Summary of physical habitat and riparian parameters by tributary, lower Klamath River, California, 1996-1998.

Tributary	Drainage Size (sq. mi.)	Stream Order	Dominant Channel Type	Pool:Flatwater:Riffle Ratio	% Pools >=3ft Max. Depth	Ave. Shelter Rating	Prim./Sec. Cover Type	Prim./Sec. Substrate Type	Ave. Embeddedness (%)	Ave. Canopy Closure (%)	% Conifers in Canopy	Existing LWD Density (# pieces/mile)	Total Future LWD Density (# pieces/mile)	% Future LWD Composed of Live Conifers	% Future LWD Composed of Deciduous Trees <2' Dia.	Sub-surface Flow Severity
High Prairie Creek	4.2	2	A-4	46:44:10	7.1	31.5	LWD/BL	GR/SC	25-50	80%	23%	N/S	N/S	N/S	N/S	M
Hunter Creek																
- Mainstem	23.8	4	C-4	43:50:07	48.4	20.0	BL/LWD	GR/SC	50-75	79%	10%	186	328	14.9%	55.5%	H
- East Fork		3	B-4	26:73:01	10.5	18.8	LWD/BL	GR/SL	50-75	88%	7%	351	456	13.0%	55.4%	M
- Mynot Creek	4.9	2	F-4	49:48:03	5.3	23.7	TV/BL	GR/SA	50-75	76%	15%	209	381	33.8%	32.7%	H
Hoppaw Creek																
- Mainstem	4.9	3	F-4	37:39:24	1.7	15.7	LWD/SWD	GR/SC	50-75	91%	11%	275	413	24.4%	28.4%	H
- North Fork		2	A-4	62:11:27	2.0	17.1	LWD/BL	GR/SC	50-75	95%	27%	537	556	41.8%	23.5%	L
Saugep Creek	1.7	2	F-4	38:56:06	2.5	11.4	TV/SWD	GR/SL	50-75	84%	0%	N/S	N/S	N/S	N/S	L
Terwer Creek																
- Mainstem	32.8	4	B-3	36:52:12	32.9	67.1	BL/WW	BL/GR	0-25	61%	18%	169	512	21.9%	12.3%	M
- East Fork		3	A-2	35:59:07	13.7	84.7	BL/WW	BL/GR	25-50	71%	5%	264	519	20.7%	11.8%	N/A
McGarvey Creek																
- Mainstem	8.6	3	C-4	70:26:04	18.5	27.8	LWD/SWD	GR/SC	50-75	89%	8%	359	907	7.4%	61.4%	M
- West Fork		2	C-4	74:20:06	11.4	30.2	LWD/SWD	SL/GR	50-75	94%	11%	445	1,129	6.4%	68.9%	N/A
Tarup Creek	4.9	3	C-4	71:19:10	25.8	20.5	LWD/SWD	GR/SC	50-75	97%	7%	228	515	12.1%	59.2%	H
Omagaar Creek	2.5	2	B-4	35:52:13	5.0	19.4	LWD/BL	GR/SC	25-50	95%	10%	233	641	14.7%	56.4%	H
Blue Creek																
- Mainstem (below barrier)	128.3	5	C-2	23:61:16	88.4	14.2	BL/WW	BL/LC	25-50	41%	34%	N/S	N/S	N/S	N/S	N/A
- Crescent City Fork	13.4	4	B-2	27:61:12	51.3	17.2	BL/WW	LC/BL	25-50	87%	42%	169	569	56.1%	16.6%	N/A
- Nickowitz Creek	12.4	3	B-2	25:66:09	22.0	14.8	BL/WW	GR/SC	25-50	90%	27%	135	567	39.8%	31.4%	N/A
- Slide Creek	5.7	2	A-2	19:65:16	42.4	18.5	BL/WW	LC/BL	25-50	38%	77%	94	538	69.3%	2.3%	N/A
- West Fork	9.7	3	B-2	30:62:08	44.3	17.5	BL/WW	LC/GR	50-75	86%	12%	216	590	12.7%	41.3%	N/A
Ah Pah Creek																
- Mainstem	16.3	4	B-3	33:61:06	3.8	16.2	LWD/SWD	GR/SA	25-50	84%	8%	394	778	19.9%	54.0%	M
- North Fork		3	B-4	40:54:06	11.1	15.9	LWD/SWD	GR/SC	25-50	82%	9%	262	777	27.7%	53.4%	M
- South Fork		2	A-2	34:63:03	5.4	12.7	SWD/LWD	GR/SA	25-50	89%	9%	400	890	21.0%	48.4%	M
Bear Creek																
- Mainstem	19.3	3	A-2	38:47:15	9.8	74.1	BL/WW	BL/LC	25-50	73%	8%	188	323	26.2%	16.6%	H
- North Fork		3	B-3	32:52:16	6.3	78.4	BL/WW	BL/GR	25-50	77%	7%	312	533	23.4%	10.8%	N/A
Surpur Creek	5.7	3	B-3	73:23:04	19.9	16.5	BL/SWD	GR/SC	50-75	89%	6%	321	677	21.5%	46.2%	L
Little Surpur Creek	2.7	2	A-2	64:35:01	19.7	13.2	SWD/BL	SC/GR	50-75	93%	10%	255	486	21.1%	59.9%	L
Tectah Creek	19.9	3	B-3	48:45:07	27.8	18.6	BL/LWD	LC/SC	25-50	86%	11%	131	559	23.0%	49.5%	M
Johnsons Creek	3.4	2	B-3	69:27:04	15.6	15.6	BL/UC	SC/GR	50-75	94%	3%	116	474	3.5%	73.9%	H
Pecwan Creek (Lower Mainstem)	27.7	4	B-2	24:62:14	45.0	22.2	WW/BL	GR/BL	50-75	74%	31%	N/S	N/S	N/S	N/S	L
Mettah Creek																
- Mainstem	10.7	3	B-2	40:51:09	11.2	30.0	BL/WW	GR/SC	50-75	86%	17%	112	150	14.5%	12.5%	L
- South Fork		2	B-2	24:64:12	7.1	29.1	WW/BL	GR/SC	50-75	89%	22%	181	143	4.6%	20.4%	N/A
Roaches Creek	29.5	4	B-2	46:49:05	37.7	31.0	BL/WW	GR/BL	50-75	78%	30%	34	112	35.5%	8.2%	L
Morek Creek	4.0	2	A-2	24:51:25	4.6	18.9	BL/WW	GR/BL	50-75	85%	34%	78	309	4.5%	80.6%	L
Cappell Creek	8.6	2	A-2	43:30:27	18.6	21.8	WW/BL	BL/GR	50-75	79%	41%	N/S	N/S	N/S	N/S	L
Tully Creek																
- Mainstem	17.3	3	B-3	24:71:05	34.7	14.8	BL/WW	BL/GR	25-50	79%	8%	106	254	12.9%	9.9%	L
- Robbers Gulch		2	B-3	39:52:09	12.5	13.5	BL/SWD	SC/BL	50-75	84%	8%	166	363	10.3%	3.1%	N/A

Cover Type Codes: LWD= Large Woody Debris SWD=Small Woody Debris BL=Boulder WW=Whitewater TV=Terrestrial Vegetation UC=Undercut Bank

Substrate Codes: SL=Silt/Clay SA=Sand GR=Gravel SC=Small Cobble LC=Large Cobble BL=Boulder

Table 2. Summary of aquatic species presence by tributary, lower Klamath River, California, 1996-2002.

Tributary	Chinook Salmon	Coho Salmon	Steelhead	Coastal Cutthroat Trout	Resident Rainbow Trout	Pacific/Brook Lamprey	Prickly/Coastrange Sculpin	Speckled Dace	Threespine Stickleback	Klamath Small Scale Sucker	Pacific Giant Salamander	Yellow Legged Frog	Tailed Frog
High Prairie Creek	n	y	y	y	n	y	y	y	y	y	y	y	y
Hunter Creek													
- Mainstem	y	y	y	y	n	y	y	y	y	y	y	y	y
- East Fork	y	y	y	y	n	n	y	n	n	n	y	n	y
- Mynot Creek	y	y	y	y	n	y	y	y	y	y	y	n	n
- Kurwitz Creek	n	n	y	y	n	n	y	n	n	y	y	n	y
Hoppaw Creek													
- Mainstem	y	y	y	y	n	y	y	y	y	y	y	n	y
- North Fork	n	y	y	y	n	n	y	y	y	y	y	n	y
Saugep Creek	y	y	y	y	n	y	y	y	y	y	y	n	n
Waukell Creek	n	y	n	y	n	y	y	y	n	n	n	n	n
Terwer Creek													
- Mainstem	y	y	y	y	n	y	y	y	y	n	y	y	y
- East Fork	n	y	y	y	n	n	y	n	n	n	y	n	y
McGarvey Creek													
- Mainstem	y	y	y	y	n	y	y	y	y	y	y	y	y
- West Fork	n	y	y	y	n	y	y	y	y	y	y	y	n
Tarup Creek	y	y	y	y	n	y	y	y	y	y	y	y	n
Omagaar Creek	n	y	y	y	n	n	y	y	n	n	y	y	y
Blue Creek													
- Mainstem (below barrier)	y	y	y	y	y	y	y	y	y	y	y	y	n
- Mainstem (above barrier)	n	n	n	n	y	n	n	n	n	n	y	n	n
- East Fork	n	n	n	n	y	n	n	n	n	n	y	n	n
- Crescent City Fork	y	y	y	y	y	n	y	n	n	n	y	n	n
- Nickowitz Creek	y	n	y	n	y	n	y	n	n	n	y	n	n
- Slide Creek	n	n	y	n	y	n	y	n	n	n	y	n	n
- West Fork	y	y	y	n	n	n	y	y	n	n	y	n	n
Ah Pah Creek													
- Mainstem	n	y	y	y	n	n	y	y	n	n	y	y	y
- North Fork	n	n	y	y	n	n	y	y	n	n	y	n	y
- South Fork	n	y	y	y	n	n	y	y	n	n	y	n	y
Bear Creek													
- Mainstem	y	y	y	y	n	n	y	y	y	y	y	y	y
- North Fork	n	n	y	y	n	n	y	n	n	n	y	y	y
Surpur Creek	n	n	y	y	n	n	y	y	n	n	y	y	n
Little Surpur Creek	n	y	y	y	n	n	y	y	n	n	y	y	n
Tectah Creek	y	y	y	y	n	y	y	y	y	n	y	y	y
Johnsons Creek	y	y	y	y	n	n	y	y	n	y	y	y	y
Pecwan Creek													
- Mainstem	y	y	y	y	n	n	y	y	n	y	y	y	n
- East Fork	n	n	n	n	y	n	n	n	n	n	y	n	n
- West Fork	n	n	n	n	y	n	n	n	n	n	y	n	y
Mettah Creek													
- Mainstem	y	n	y	y	n	n	y	y	n	n	y	y	n
- South Fork	n	n	y	y	n	n	n	n	n	n	y	y	y
Roaches Creek	y	y	y	n	y	y	y	y	y	n	y	y	n
Morek Creek	n	n	y	n	n	n	y	n	n	n	y	y	y
Cappell Creek	n	n	y	n	y	n	y	n	n	n	y	n	n
Tully Creek													
- Mainstem	n	n	y	n	n	n	y	n	n	n	y	y	n
- Robbers Gulch	n	n	y	n	n	n	n	n	n	n	y	n	n

Figure 4. Streambank erosion at upper half of project site, Lower Terwer Creek , Lower Klamath River, California, January 20, 2006.

Figure 5. Streambank erosion at lower half of project site, Lower Terwer Creek , Lower Klamath River, California, January 20, 2006.

Figure 6. Streambank erosion at project site, Lower Terwer Creek ,
Lower Klamath River, California, January 24, 2006.

Figure 7. Streambank erosion at upper half of project site, Lower Terwer Creek ,
Lower Klamath River, California, January 24, 2006.

Figure 8. Upper half of project site during boulder placement, Lower Terwer Creek , Lower Klamath River, California, January 31, 2006.

Figure 9. Lower half of project site during boulder placement, Lower Terwer Creek , Lower Klamath River, California, January 31, 2006.

Figure 10. Boulders being delivered to project site, Lower Terwer Creek , Lower Klamath River, California, January 31, 2006.

Figure 11. Excavator placing boulders at project site, Lower Terwer Creek , Lower Klamath River, California, February 01, 2006.

Figure 12. Stabilized streambank viewed from lower end of project site, Lower Terwer Creek ,Lower Klamath River, California, February 01, 2006.

Figure 13. Stabilized streambank viewed from upper end of project site, Lower Terwer Creek ,Lower Klamath River, California, February 01, 2006.

Figure 14. Stabilized streambank viewed from lower end of project site, Lower Terwer Creek, Lower Klamath River, California, February 28, 2006.

Figure 15. Stockpiled boulders at project site, Lower Terwer Creek, Lower Klamath River, California, February 28, 2006.