Instream & Riparian Enhancement of Mainstem McGarvey Creek (Phase I)

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Background

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 the Lower Klamath Restoration Partnership (LKRP), 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.

McGarvey Creek is ranked third out of all 24 Lower Klamath tributaries for watershed restoration activities (Gale and Randolph 2000). As a result, the Yurok Tribal Watershed Restoration Department (YTWRD) conducted an upslope road assessment and restoration need inventory throughout the McGarvey Creek watershed during winter 1996-1997. This inventory resulted in a prioritized list of road segments in need of treatment and/or decommissioning, and YTWRD crews undertook these upslope restoration activities from 1997-2007. YTWRD has completed decommissioning of all medium and high priority roads in the McGarvey Creek watershed and GDRC has been actively upgrading all road segments that were not scheduled for decommission. As a result, the LKRP is nearing the completion of all upslope restoration throughout this top-ranked tributary. In addition, YTFP has undertaken fish barrier modification within the

drainage, reestablishing access to large portions of the watershed's historic anadromous salmonid range.

Now that upslope erosion sources have been addressed in the watershed, it is imperative to accelerate instream and riparian restoration measures to achieve the restoration goals set forth in the Lower Klamath Watershed Restoration Plan (Gale and Randolph 2000).

Historic logging extracted virtually all conifers from riparian corridors and large wood recruitment zones in this watershed and these areas were not re-planted following logging activities (Gale and Randolph 2000). As a result, red alder currently dominate riparian forests that were historically dominated by mature coastal redwood, Douglas fir and Port Orford cedar (Table 1). These deciduous trees rarely attain diameters large enough to affect pool habitat formation or sediment storage and do not provide long-term habitat complexity and channel stability. Large wood inventories conducted in the McGarvey Creek watershed (Table 1) reveal that instream wood is limited in the anadromous reach and that much of this wood is in a moderate to advanced state of decay.

To address these conditions, YTFP initiated a multi-year project in 2007 to reload the stream channel with large woody debris and plant adjacent riparian habitats with native conifers. YTFP placed unanchored large wood throughout lower West Fork McGarvey Creek in summer 2007 and planted the adjoining floodplains and riparian zone with native conifers during winter 2007-2008 (DFG Project # P0510330, FWS Project #813316J172). This report details the second year of this effort, in which we placed large wood throughout the mainstem upstream of the West Fork confluence during summer 2008, as well as conifer planting in the adjoining riparian zone during winter 2008-2009.

Native conifers attain large diameters (>30 in.) and provide complex riparian canopies, maintain long-term bank stability, reduce sediment delivery rates, and allow for formation of critical instream habitats (e.g. pools). Adding large wood to the channel is facilitating short-term goals such as improving spawning and rearing potential by increasing habitat complexity and altering sediment storage dynamics. Long-term benefits of these restoration treatments include reduction of sediment delivery, increased channel and bank stability, increased instream and riparian habitat complexity, and improved large wood recruitment potential in the McGarvey Creek drainage.

The McGarvey Creek watershed is located in the Klamath Glen HSA, which was given the highest priority rating throughout California in the California Department of Fish and Game's *Recovery Strategy for California Coho Salmon*. Placement of instream LWD and conifer revegetation were identified as top priority restoration measures required in this HSA to meet the goals identified in this coho salmon recovery plan (CDFG 2004).

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 McGarvey Creek.

McGarvey Creek is a third order stream draining 8.6 miles in the lower portion of the sub-basin (Figure 1). McGarvey Creek's mainstem begins at an elevation of 5 feet at its confluence with the Klamath and extends 4.9 miles to its headwaters, located at an elevation of 600 feet. McGarvey 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 low-gradient floodplain which is routinely inundated when the Klamath River is under high flow conditions.

The McGarvey Creek watershed supports anadromous populations of late fall-run chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), steelhead (*O. mykiss*), and coastal cutthroat trout (*O. clarki clarki).* West Fork McGarvey Creek, the principle tributary in the drainage, totals 2.2 miles in length and supports populations of coho salmon, steelhead coastal cutthroat trout, and both lamprey species. Coho salmon within the Klamath Basin have been listed as threatened under the Federal and California State Endangered Species Acts, while chinook salmon, steelhead and sea-run cutthroat trout have all previously been petitioned for Federal listing and their status within the Klamath Basin continues to be of great concern.

Other fish species likely to benefit from improved habitat conditions in these watersheds include: Pacific lamprey (*Lampetra tridentata*), Western brook lamprey (*L. richardsoni*), Klamath smallscale sucker (*Catostomus rimiculus*), speckled dace (*Rhinichthys osculus*), threespine stickleback (*Gasterosteus aculeatus*), coastrange sculpin (*Cotus aleuticus*), and prickly sculpin (*C. asper*) (Table 2).

Other sensitive species located within these drainages, that might benefit from these activities include: Pacific giant salamander (*Dicamptodon ensatus*), southern torrent salamander (*Rhyacotriton variegatus*), red-legged frog (*Rana aurora*), foothill yellow-legged frog (*Rana boylei*), and tailed frog (*Ascaphus truei*) (Table 2).

This project area is located in mainstem McGarvey Creek upstream of the West Fork confluence, on private property owned by Green Diamond Resource Company (GDRC – formerly Simpson Resource Company) (Figure 3).

Heading south from the town of Klamath on U.S. Highway 101, take the first exit immediately after crossing the Klamath River. Turn right at the stop sign and travel under the highway and upriver approximately one mile. Turn right onto the GDRC road # M10. A GDRC key is required to pass through the gate located at the road turnoff. Follow the M10 road approximately 1.5 miles to the bridge crossing McGarvey Creek. Travel another 0.3 miles to a wide area in the road next to McGarvey Creek. The project site begins at the decommissioned road on the left bank and extends upstream approximately 0.5 miles.

Project Objectives

The objectives of this project were as follows:

- Improve anadromous salmonid spawning and rearing potential by increasing habitat diversity, creating/improving pool habitat and providing fish cover in 2,500 feet of mainstem McGarvey Creek upstream of the West Fork confluence.
- Reduce sediment delivery rates by stabilizing streambanks throughout 2,500 feet of mainstem McGarvey Creek.
- Reestablish redwood and Douglas fir within 3,900 feet of the riparian corridor of mainstem McGarvey Creek where past riparian logging and have left a riparian canopy composed almost exclusively of red alder. This will significantly increase future LWD supplies, streambank stability and stream shading.
- Monitor and evaluate project effectiveness by establishing a permanent geo-referenced, detailed 3D topographic channel survey and photographic monitoring sites throughout the project reach.
- Improve skills and knowledge of YTFP employees/Yurok Tribal members through hands-on experience implementing instream habitat improvement and riparian restoration projects, topographic survey monitoring, and operating heavy equipment.

Project Methods

A Level IV habitat inventory (Flosi et al. 1998) of mainstem McGarvey Creek was conducted in 1996 as part of the Lower Klamath River sub-basin restoration planning effort. Although primary pool habitats comprised 70% of the total length surveyed only 18.5% were greater than three feet deep (Table 1). The average shelter rating for pool habitats in 1996 was extremely low (27.8 out of 300 possible). Subsequent annual habitat surveys conducted through the project reach indicate pool habitats have further simplified, resulting in less available habitat for rearing salmonids (YTFP, Unpublished Data). Based on these findings, YTFP constructed habitat cover structures based on methods outlined in Rosgen (1996) and Flosi et al. (1998).

The majority of the logs and rootwads used in this project were salvaged from clearcuts, and corresponding skid roads and slash piles in upper McGarvey Creek. This wood was loaded in 40-foot End-Dump Trucks and transported to the project area prior to implementation. In addition, wood was salvaged from "Humboldt stream crossings" during nearby road decommissioning projects. This included several fir trees 18"-24" diameter which had to be removed from roadbeds prior to decommissioning. YTWRD was able to push these trees over with an excavator to keep the rootwads intact. YTFP worked in conjunction with YTWRD to transport and stockpile this LWD during the 2005-2007 road decommissioning work seasons in McGarvey Creek. All the wood was stockpiled adjacent to the mouth of the West Fork, at the lower end of the project reach. This resulted in a substantial savings to this project for costs that would have been associated with locating and transporting LWD to the project site.

Following the methods we used the previous season in the West Fork, all structures were built without the use of boulders, cable or other means of artificial anchoring. Instead we chose to make use of the stream's soft streambanks and adjacent alder canopy to naturally position and anchor the placed LWD. Not only does this approach result in more natural and aesthetically appealing fish habitat but it alleviates concerns about the long-term fate of cable, rebar and other unnatural materials typically used for anchoring. In addition, it alleviates concerns about the introduction of large diameter boulders in a stream reach where the largest streambed particle size (D_{100}) is 4"-5" and the potential long-term impacts such large boulders could have on the geomorphic function of an alluvial stream reach.

All wood was transported down the "Old M-10 Road" to the vicinity of each structure site with the use of a Dresser 540 frontend loader and a 25-foot flatbed trailer. All wood was then transported to each structure site and subsequently placed in the channel with a Komatsu PC220 Excavator fitted with a bucket & thumb and a set of log-lifting tongs.

Where possible, fir logs that had rootwads intact were positioned by shoving the end opposite the rootwad into the soft streambanks until just the rootwad and a short section of the tree stem remained exposed. In most cases this resulted in 20-30 feet of the log being inserted into the streambank, providing excellent holding power far superior to that which would normally occur with traditional boulder placement and anchoring techniques. Redwood logs and other larger diameter material were primarily placed in the channel as "digger logs", with one end intertwined between streambank alders and/or other pieces of placed LWD to minimize shifting or movement potential.

Conifer saplings were planted using standard tree planting techniques. Care was taken to select planting sites with appropriate soil and light conditions for each species to maximize survivability. Crewmembers took care when burying root systems to prevent "J-rooting" and ensured each tree was stabilized.

Project Tasks

All work commenced August, 2008 and was completed in February, 2009. Below is a summary of completed tasks:

- We secured 25 Douglas fir logs with rootwads that were removed during the course of road decommissioning being conducted by the Yurok Tribe Watershed Restoration Department in upper McGarvey Creek. We also secured several hundred pieces of large and small woody debris from clearcuts and associated road networks and slash piles on the M-1300 road network in upper McGarvey Creek. These logs were transported to a staging area near the mouth of West Fork McGarvey Creek with a 20-yard end-dump truck.
- An excavator was used to re-establish access on the decommissioned "Old M-10" road that parallels mainstem McGarvey Creek throughout the project reach.

- Stockpiled logs were sorted and transported up this re-established road access to the appropriate structure construction sites throughout the project reach.
- We constructed 20 instream structures throughout the project reach, comprised of a total of 122 logs and/or rootwads (Figures 3-4, Table 3). No anchoring was used in constructing these structures as detailed above in the project methods. In addition to the 122 pieces of LWD, several of the structures had extensive amounts of small woody debris under/in/behind the LWD to enhance the complexity of the cover created by the wood placement.
- Once structure placement was complete, the Old M-10 roadbed and stream crossings were decommissioned, as well as being thoroughly ripped and loosened to facilitate tree planting. Residual logs and wood were buried and placed on the disturbed portions of the floodplain, as well as wood and vegetative debris being spread on the ripped roadbed surface.
- All remaining LWD that was not placed in structures was stockpiled along the M-10 road for use during summer 2009 structure construction in mainstem McGarvey Creek.
- Crews planted a total of 2,200 bareroot coastal redwood and 1,700 bareoot Sitka spruce throughout the McGarvey Creek floodplain and riparian zone within the project reach (Figure 5). All bareroot trees were stock purchased from Hastings Tree Nursery in Smith River California.
- 356 five-gallon potted coastal redwood trees, 141 five-gallon potted western red cedar trees, 322 two-gallon Sitka spruce, and 247 five-gallon Port Orford cedar were planted along the decommissioned Old M-10 Road and areas adjacent to the stream channel that were disturbed by the excavator (Figure 5). These potted trees were donated by YTFP from our native tree nursery in Klamath. The conifer trees averaged 24”-48” tall. They were utilized to accelerate revegetation in the disturbed areas due to their larger size and more developed root systems.
- YTFP removed a large Himalayan blackberry patch on the Old M-10 Road in the upper end of the LWD placement reach (Figure 5). The berries were removed with the excavator in the process of decommissioning and ripping the roadbed. This area was then planted with potted conifers as noted above.
- YTFP conducted pre-project stream channel topographic surveying using a total station during July 2008. This surveying, conducted with a Nikon total station, included a full longitudinal profile of mainstem McGarvey Creek from the site of the decommissioned stream crossing on the Old M-10 Road (upstream of this project area) down to the confluence with West Fork McGarvey Creek (5,609 feet of channel surveyed). In addition, 20 monumented stream channel cross-sections were installed and surveyed in this same reach (Figure 3). These geomorphic surveys provided baseline for long-term geomorphic monitoring of the site. The topographic surveys will be repeated during summer 2009 to document channel changes following the first winter after structure installation, and will also be repeated in future years on a regular interval.

- Each piece of placed LWD was marked with a sequentially numbered aluminum tag and two survey pins were inserted at each exposed end of every piece of wood (Figure 116, Table 3). These pins were then all surveyed using a Nikon total station during late fall 2008 (Figures 3-4). These pins will be resurveyed during summer 2009 and on regular intervals thereafter to document any shifting or movement of each of the LWD pieces. This will provide valuable long-term data on the effectiveness of our anchor-free LWD placement approach.
- Long-term photographic monitoring stations were established and photographs were taken of pre- and post-restoration conditions throughout the project area.

Monitoring Results

A detailed three dimension topographic survey of the project area was surveyed during July 2008. All surveying was conducted using a Nikon Total Station and the resultant topographic data was brought into ArcView and rectified to the Klamath Glen USGS 1993 DOQ. This survey included a longitudinal profile of mainstem McGarvey Creek from the site of the decommissioned stream crossing on the Old M-10 Road (upstream of this project area) down to the confluence with West Fork McGarvey Creek (5,609 feet of channel surveyed). In addition, 20 monumented stream channel cross-sections were installed and surveyed in this same reach. Permanent benchmarks and cross section pins were established to allow repeat surveying over time. The topographic surveys will be repeated during summer 2009 to document channel changes following the first winter after structure installation, and will also be repeated in future years on a regular interval.

Restoration goals included the placement of large woody debris throughout the project reach to increase habitat diversity, pool depth, and cover complexity. The topographic surveys will be repeated during summer 2009 to document channel changes following the first winter after structure installation, and will also be repeated in future years on a regular interval. Analysis of successive longitudinal profiles throughout the reach will provide YTFP with the ability to assess geomorphic channel changes over time.

In addition, it was a project goal to effectively place large woody debris without the use of boulders, cable or other means of artificial anchoring. A potential concern with this approach would be how much this wood will move over time during high flow events and what the fate and effectiveness of the wood is if and when such movement occurs. Each piece of placed LWD was marked with a sequentially numbered aluminum tag and two survey pins were inserted at each exposed end of every piece of wood (Figure 116, Table 3). These pins were then all surveyed using a Nikon total station during late fall 2008 (Figure 3-4). These pins will be resurveyed during summer 2009 and on regular intervals thereafter to document any shifting or movement of each of the LWD pieces. This will provide valuable long-term data on the effectiveness of our anchor-free LWD placement approach and allow us to adapt our placement techniques to best achieve our restoration goals.

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:

- Increase/improve instream fish cover
- Protection/stabilization of streambanks
- Revegetation/rehabilitation of riparian canopies

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

- Task # KR-KG-13 Supplement ongoing efforts to provide short-term and log-term benefits to coho salmon by restoring LWD and shade through a) LWD placement and c) improvement of existing riparian zones through plantings, release of conifers, and control of alders, blackberries, and other competitors.
- Task # KR-KG-08a 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.
- Task # KR-KG-09 Develop a plan to provide suitable accumulations of woody cover in slow-velocity habitats for coho salmon winter rearing on a short-term basis by placing wood in needed areas until natural supplies become available.

Type of monitoring included in project:

- Geomorphic surveying (channel cross sections and a longitudinal profile).
- LWD movement monitoring (total station survey of each LWD piece).
- Photographic documentation of pre- and post-restoration conditions.

Number of stream miles treated/affected by project:

- Stream miles treated: 0.74 miles (3,900 feet)
- Stream miles affected: 0.74 miles (3,900 feet)

Instream Habitat Projects (HI):

Description of instream treatments used, including site locations referenced to an established landmark, number of treatment sites, and any modifications to site/treatment design:

- See Project Methods and Project Tasks sections above.

Riparian Habitat Projects (HR):

Number of miles treated: 0.=74 miles (3,900 feet)

Number of acres treated: 19.9 acres

Number of acres and type of invasive species controlled: 0.02 acres – Himalayan blackberry.

Species and size of trees planted: Coastal redwood (18”-36”), western red cedar (24”-48”), Sitka spruce (18”-36”), Port Orford cedar (24”-36”).

Number of trees/density of plantings: 2,200 bareroot coastal redwood, 356 5-gallon coastal redwood, 141 5-gallon western red cedar, 1,700 bareroot Sitka spruce, 322 two-gallon Sitka spruce, and 247 five-gallon Port Orford cedar. Trees were spaced every eight feet throughout the planting areas.

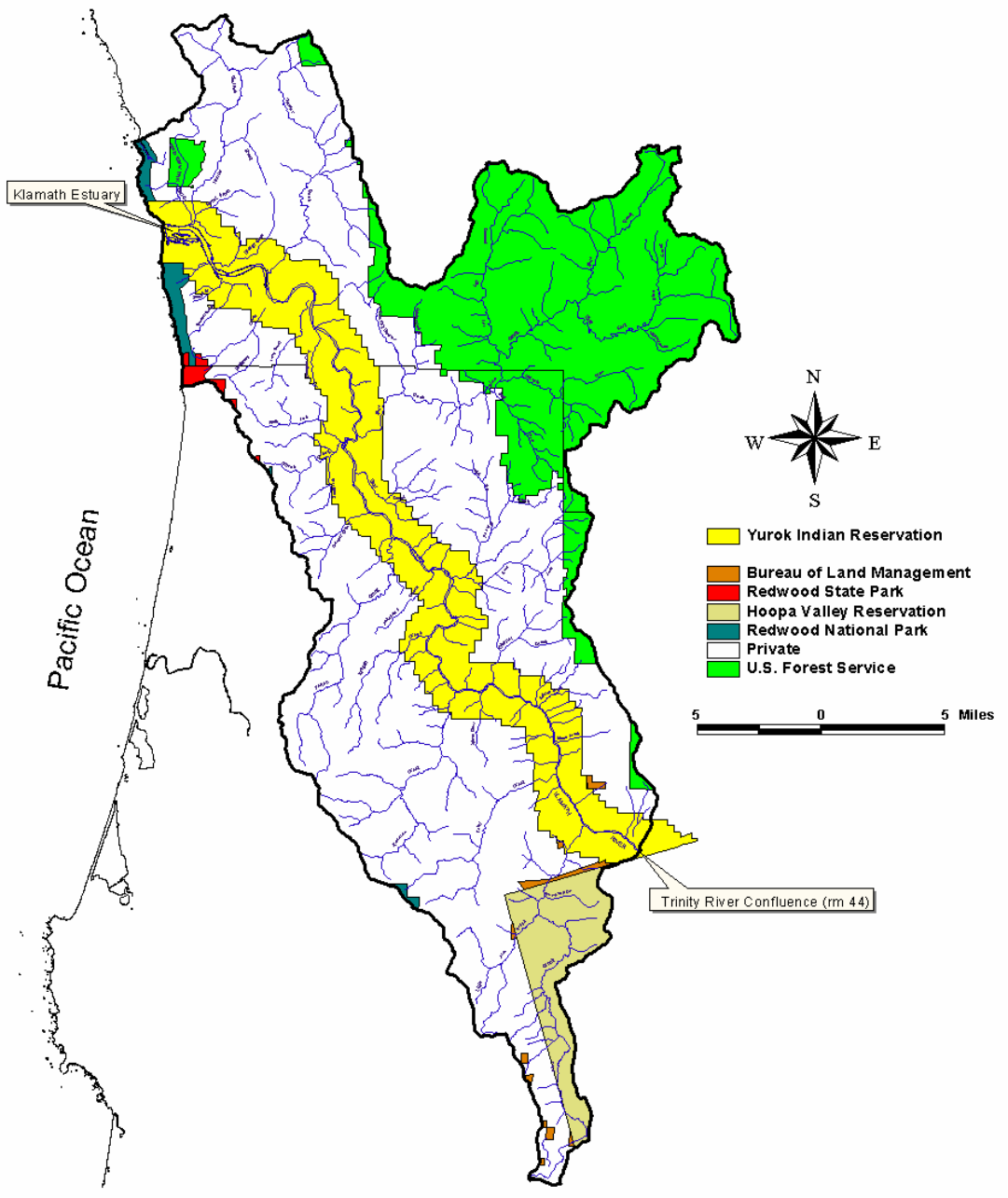

Figure 1. Lower Klamath River Sub-basin, California.

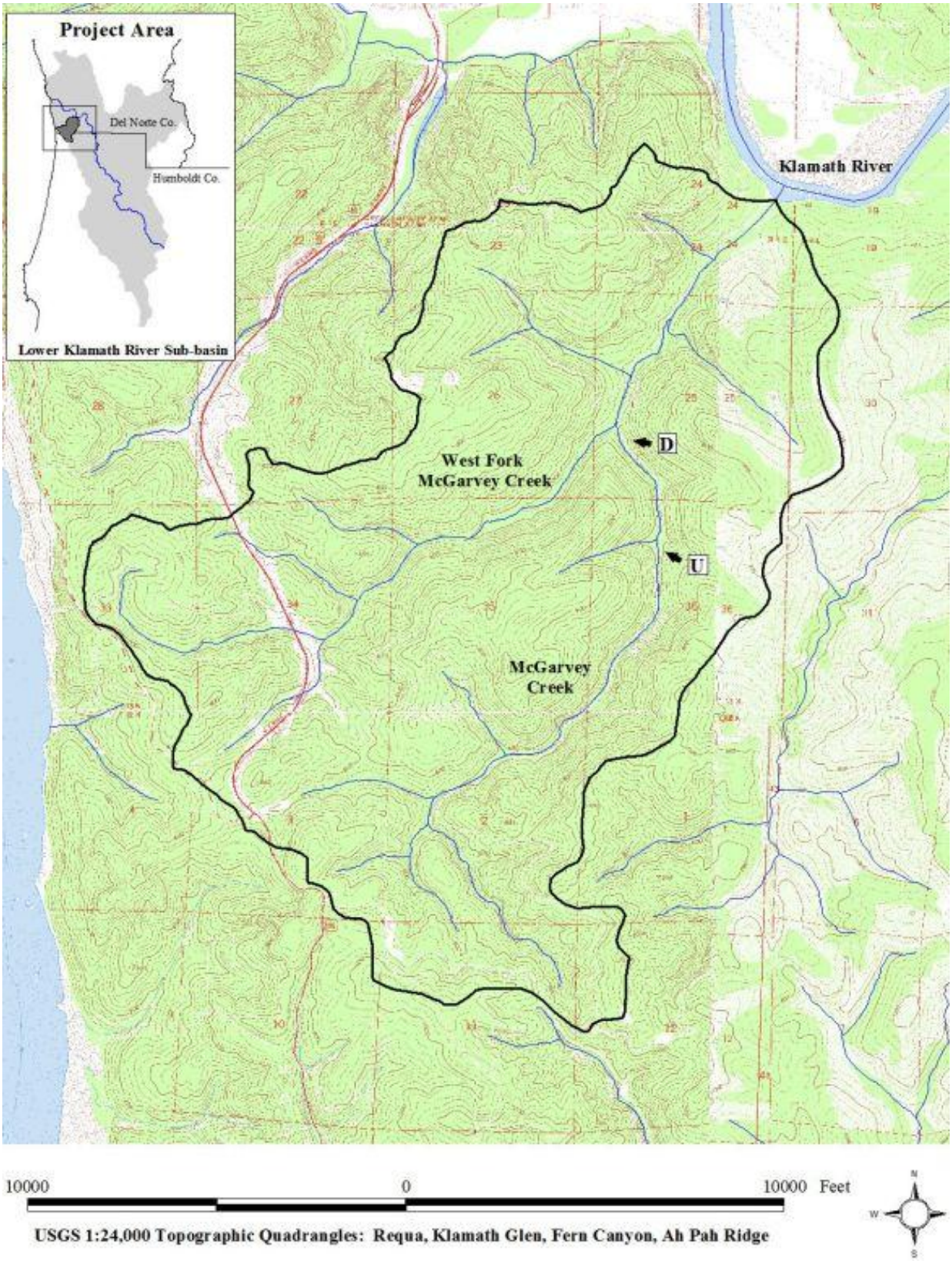

Figure 2. Instream restoration project location map, Mainstem McGarvey Creek, Lower Klamath River, California, 2008.

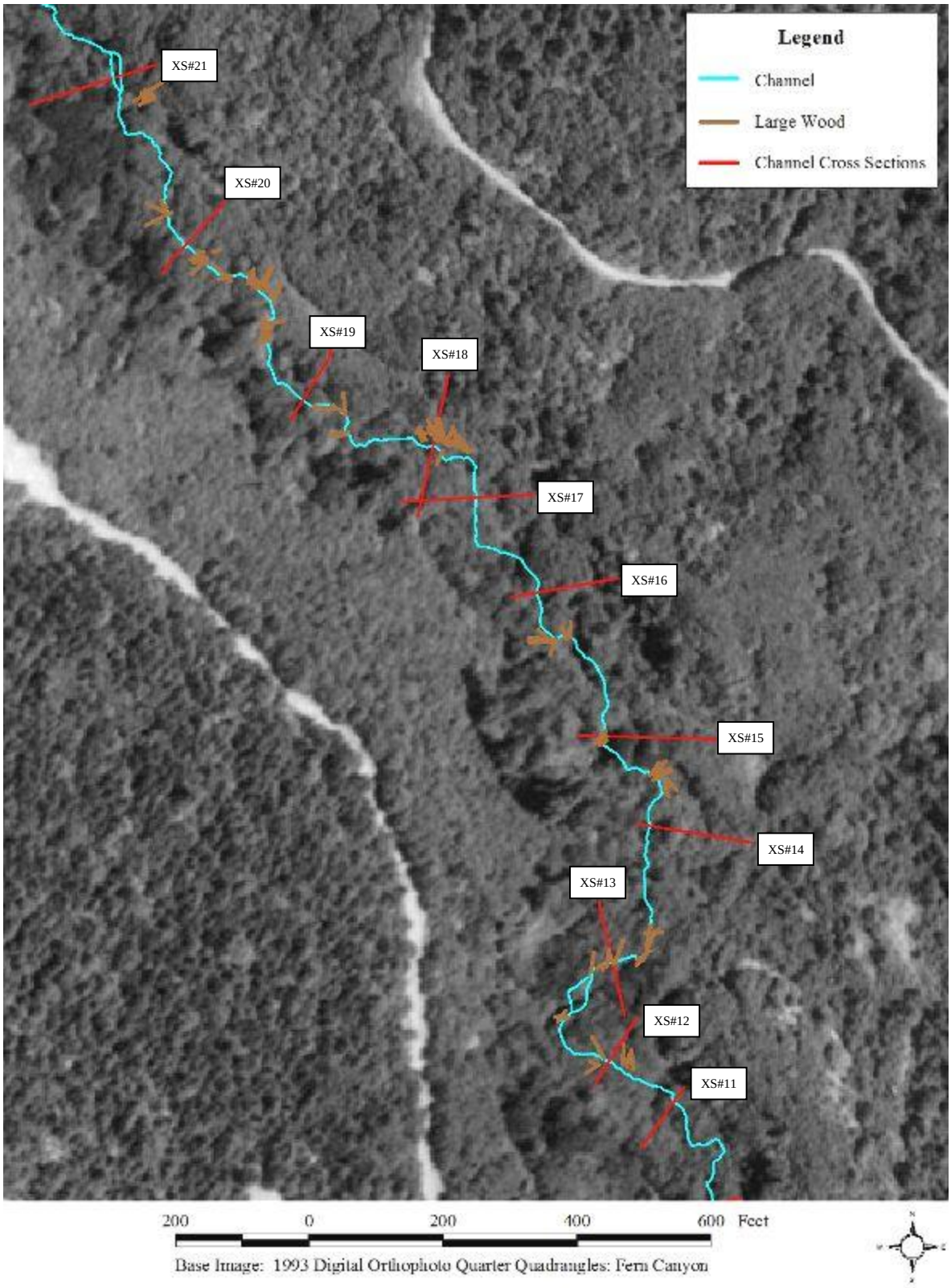

Figure 3. Digital orthophoto detailing surveyed stream thalweg, channel cross sections, and locations of placed large woody debris, Mainstem McGarvey Creek, Lower Klamath River, California, 2008.

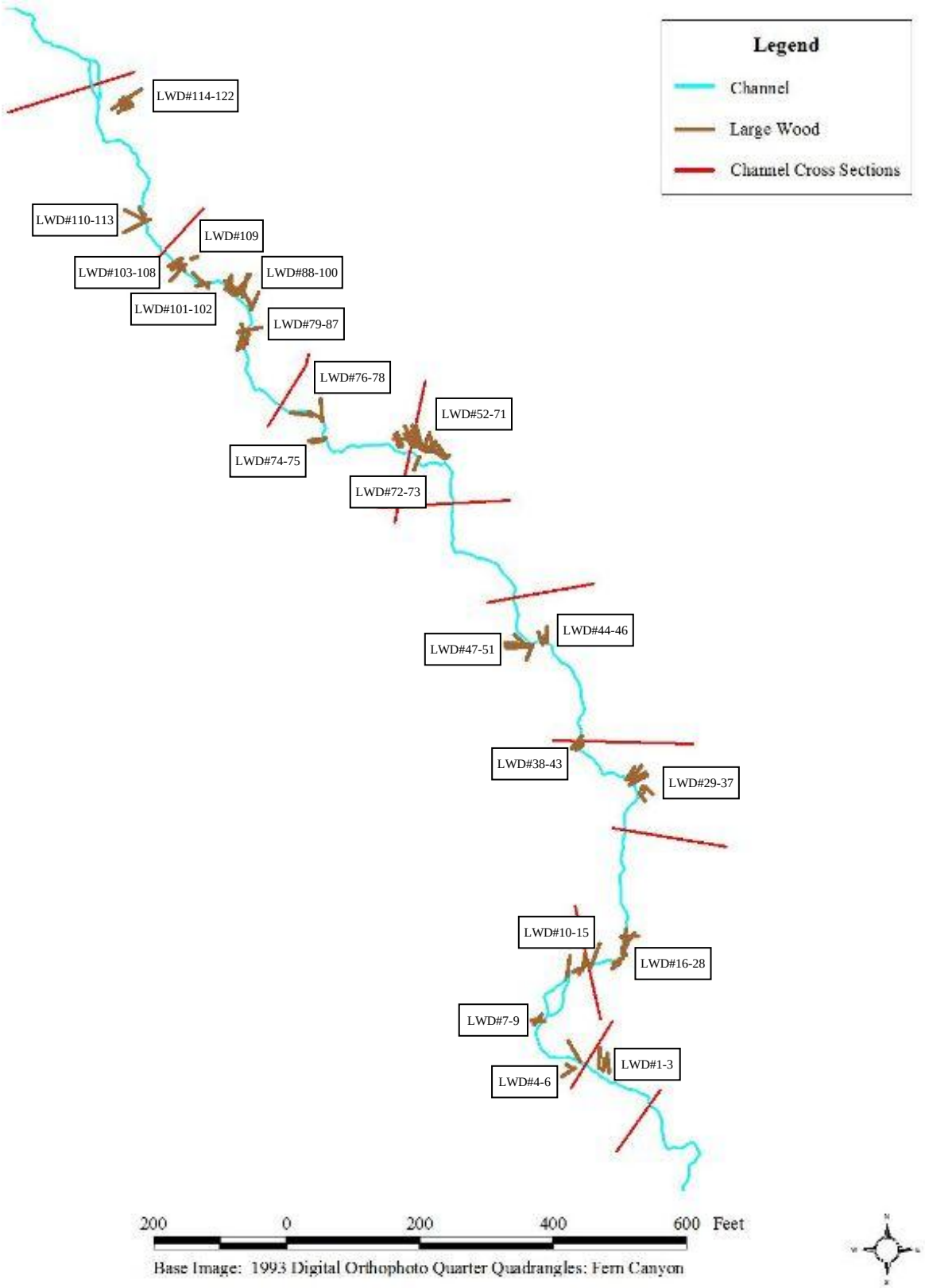

Figure 4. Stream channel thalweg within project reach and locations of placed large woody debris, Mainstem McGarvey Creek, Lower Klamath River, California, 2008.

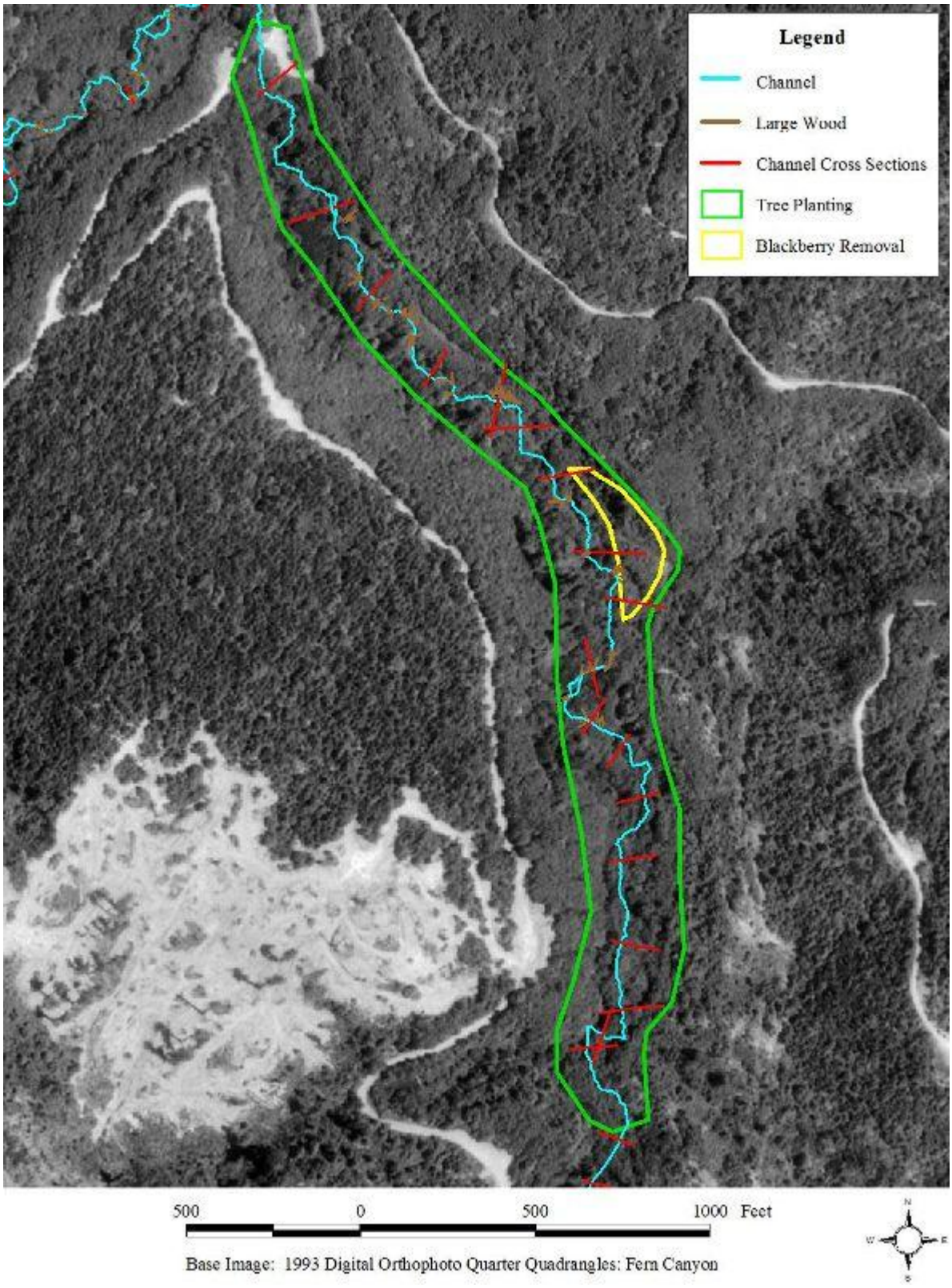

Figure 5. Riparian tree planting and exotic vegetation removal sites, Mainstem McGarvey Creek, Lower Klamath River, California, 2008.

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

Table 3. Summary of large woody debris placed in Mainstem McGarvey Creek, Lower Klamath River, California, 2008.

LWD Piece #	Structure #	Tag #	Species	Length (ft)	Mean Width (in)	Volume (ft^3)	Weight (lbs)	Density (lbs/ft^3)	Rootwad Complexity (1-5)	Notes
1	1	401	Fir	35.0	14.8	38.3	1,627	42	1	Digger log on right bank at top of reach
2	1	402	Fir	24.0	14.7	25.0	1,146	46	2	Digger log on right bank at top of reach
3	1	403	Fir	37.0	13.0	38.5	1,388	36	2	Digger log on right bank at top of reach
4	2	404	Fir	41.1	12.2	39.1	2,605	67	3	Angled digger log on right bank
5	2	405	Fir	29.9	18.1	38.9	1,886	48	2	Angled digger log on left bank
6	2	406	Redwood	10.5	59.6	52.2	-	-	4	On left bar below #405
7	3	407	Redwood	20.0	26.6	44.3	3,285	74	None	Digger log in pool at top of reach
8	3	408	Redwood	22.2	19.9	36.8	3,625	99	None	Digger log in pool at top of reach
9	3	409	Redwood	26.5	25.4	56.1	3,320	59	None	Underneath #407-408
10	4	410	Fir	38.5	13.3	39.4	1,427	36	3	Angled digger log on left bank over long shallow pool
11	4	411	Redwood	11.4	26.3	25.0	-	-	None	Against left bank, over #412
12	4	412	Fir	35.0	15.6	41.0	1,332	32	4	Digger log plunged into left bank - 6.1ft exposed
13	4	413	Fir	27.5	14.8	31.9	1,650	52	2	Digger log angled upstream on left bank
14	4	414	Redwood	9.3	36.0	27.8	-	-	2	Digger log on left bank
15	4	415	Fir	41.0	11.3	35.5	1,303	37	2	Digger log on left bank
16	5	416	Redwood	12.8	35.4	37.6	-	-	None	Against right bank, over #417-419
17	5	417	Redwood	15.0	14.0	17.5	-	-	None	Plunged in right bank under #416 - 3.5ft exposed
18	5	418	Alder	15.0	9.0	11.3	-	-	None	Plunged in right bank under #416 - 3.2ft exposed
19	5	419	Alder	15.0	12.0	15.0	-	-	None	Plunged in right bank under #416 and over #418 - 6.3ft exposed
20	5	420	Fir	20.0	12.0	20.0	-	-	4	Plunged into right bank, interlocked with #421 - 4.8ft exposed, including rootwad
21	5	421	Fir	20.0	12.0	20.0	-	-	4	Plunged into right bank, interlocked with #420 - 2.8ft exposed, including rootwad
22	5	422	Redwood	11.0	59.0	54.1	-	-	4	Perched over right bank between #421 and #423-426
23	5	423	Fir	11.2	10.0	9.3	-	-	None	Plunged slightly and angled parallel to right bank
24	5	424	Fir	20.0	14.0	23.3	-	-	5	Plunged into right bank under #423 and #426 - 2.6ft exposed, including rootwad
25	5	425	Fir	41.0	11.2	34.8	2,272	65	3	Digger log angled upstream on right bank over #424 and #426
26	5	426	Redwood	16.8	28.3	39.7	-	-	None	Angled against right bank, behind/under #422-#425
27	5	427	Redwood	20.9	30.7	53.5	4,575	86	None	Parallel to right bank
28	5	428	Alder	25.6	9.9	21.1	-	-	None	Digger log over #427
29	6	429	Redwood	12.0	35.7	35.7	-	-	2	Digger log at top of "Reach Break Pool"
30	6	430	Maple	14.2	20.6	24.3	-	-	None	Along right bank of unnamed tributary at confluence in "Reach Break Pool"
31	6	431	Fir	7.7	44.8	28.6	-	-	3	Large rootwad at confluence of unnamed tributary in "Reach Break Pool"
32	6	432	Maple	5.0	40.0	16.7	-	-	2	Rootwad at Confluence of unnamed tributary in "Reach Break Pool" - downstream of #431
33	6	433	Fir	30.0	33.3	83.2	7,940	95	None	Digger log off right bank of "Reach Break Pool"
34	6	434	Redwood	18.0	28.1	42.2	3,247	77	None	Digger log off right bank of "Reach Break Pool"
35	6	435	Fir	27.0	18.1	36.0	2,538	71	3	Digger log off right bank of "Reach Break Pool"
36	6	436	Alder	11.0	12.8	11.7	-	-	4	Digger log off right bank of "Reach Break Pool"
37	6	437	Redwood	22.8	29.1	55.8	4,577	82	None	Digger log off right bank of "Reach Break Pool"
38	7	438	Fir	12.7	11.0	11.6	-	-	None	Plunged into left bank in lateral scour pool
39	7	439	Fir	25.5	10.8	20.1	713	35	2	Plunged into left bank in lateral scour pool
40	7	440	Fir	24.0	14.7	25.0	1,146	46	2	Plunged into left bank in lateral scour pool
41	7	441	Fir	16.0	15.1	15.6	1,111	71	3	Plunged into left bank in lateral scour pool

Table 3 (Cont). Summary of large woody debris placed in Mainstem McGarvey Creek, Lower Klamath River, California, 2008.

LWD Piece #	Structure #	Tag #	Species	Length (ft)	Mean Width (in)	Volume (ft^3)	Weight (lbs)	Density (lbs/ft^3)	Rootwad Complexity (1-5)	Notes
42	7	442	Fir	27.0	8.9	18.3	870	48	4	Plunged into left bank in lateral scour pool
43	7	443	Redwood	24.3	47.3	95.6	-	-	None	Large redwood slab over top of #438-442 to create undercut bank
44	8	444	Redwood	28.0	30.3	70.7	-	-	None	Digger log over existing LWD and SWD at top of large lateral scour pool
45	8	445	Redwood	9.5	48.0	38.0	-	-	1	Digger log over existing LWD and SWD at top of large lateral scour pool
46	8	446	Redwood	21.2	13.5	643.1	3,151	5	None	Digger log over existing LWD and SWD at top of large lateral scour pool
47	9	447	Fir	23.8	23.1	45.9	-	-	None	Digger log on left bank
48	9	448	Redwood	31.0	37.0	95.6	6,774	71	None	Huge redwood slab over #448-450
49	9	449	Fir	31.1	29.3	75.9	-	-	None	Digger log on left bank into lateral scour pool - log has twin tops with one broken
50	9	450	Fir	38.0	10.2	30.0	1,747	58	1	Digger log on left bank into lateral scour pool - underneath #451
51	9	451	Fir	41.0	11.6	35.6	1,734	49	3	Digger log on left bank into lateral scour pool - underneath #451
52	10	452	Fir	10.2	21.3	18.1	-	-	3	Rootwad buried in prone position at top of "The Great Wall"
53	10	453	Redwood	21.5	43.9	78.7	8,910	113	None	On right bank, keyed between #452 and #455
54	10	454	Redwood	29.8	36.0	89.5	-	-	None	On right bank, over #456-458 and in front of #452, 453, and 455
55	10	455	Redwood	10.0	49.2	41.0	-	-	3	Rootwad buried in prone position at top of "The Great Wall"
56	10	456	Fir	11.5	9.0	8.6	-	-	None	Broken off top from #457 - underneath #454
57	10	457	Fir	20.9	13.0	22.7	-	-	2	From same log as #456 - underneath #454
58	10	458	Redwood	7.5	33.0	20.6	-	-	3	Old-growth redwood rootwad against right bank, underneath #454
59	10	459	Redwood	10.0	47.0	39.2	-	-	3	Old-growth redwood rootwad against right bank
60	10	460	Fir	23.0	9.7	17.8	1,247	70	3	Digger log on right bank, underneath #461
61	10	461	Redwood	21.0	36.0	63.0	4,475	71	None	Parallel to right bank, over #460, 462-466
62	10	462	Fir	34.5	11.3	27.5	1,461	53	3	Digger log on right bank, underneath #461
63	10	463	Fir	34.0	12.5	32.1	1,289	40	4	Digger log on right bank, underneath #461
64	10	464	Redwood	20.8	20.5	35.6	-	-	None	Digger log on right bank, underneath and behind #461
65	10	465	Redwood	14.0	48.0	56.0	5,051	90	None	Digger log on right bank, underneath and behind #461
66	10	466	Fir	33.7	14.3	40.1	-	-	4	Digger log on right bank, underneath #461
67	10	467	Alder	10.8	11.8	10.6	-	-	4	Digger log on right bank, over #467 and behind #461
68	10	468	Redwood	9.0	48.3	36.2	-	-	4	Redwood rootwad on right bank, below #466 and above #469
69	10	469	Redwood	16.3	57.3	77.6	-	-	None	Massive redwood slab parallel to right bank
70	10	470	Redwood	22.0	32.5	59.6	2,865	48	None	Perpendicular to channel off right bank, under #469
71	10	471	Redwood	11.8	22.7	22.2	-	-	None	Perpendicular to channel off right bank, under #469
72	11	472	Alder	5.7	11.3	5.3	-	-	4	Digger log on left bank with #473, across from "The Great Wall"
73	11	473	Alder	9.7	17.1	13.8	-	-	4	Digger log on left bank with #472, across from "The Great Wall"
74	12	474	Redwood	27.8	27.0	62.4	-	-	None	Digger log off left bank in pool with natural old growth redwood digger log
75	12	475	Alder	16.5	11.5	15.8	-	-	4	Digger log off left bank between #474 and natural old growth redwood digger log
76	13	476	Fir	32.0	13.2	35.2	-	-	3	Digger log on right bank with pistol-butted rootwad
77	13	477	Redwood	21.0	35.0	61.3	9,128	149	None	Against right bank, below #476
78	13	478	Fir	32.3	8.9	24.0	-	-	3	Long skinny DF log at lower end of #470
79	14	479	Redwood	14.5	18.3	22.1	2,677	121	None	Against left bank underneath #481, at top of old "Bowling Alley Reach"
80	14	480	Fir	10.0	24.0	20.0	-	-	2	Rootwad with short stem - gainst left bank underneath #479 and #481
81	14	481	Fir	19.0	32.0	50.7	3,590		None	Over #479-480, 482
82	14	482	Redwood	6.6	27.0	14.8	-	-	None	Rootwad below #480 and underneath #481 and #483

Table 3 (Cont). Summary of large woody debris placed in Mainstem McGarvey Creek, Lower Klamath River, California, 2008.

LWD Piece #	Structure #	Tag #	Species	Length (ft)	Mean Width (in)	Volume (ft^3)	Weight (lbs)	Density (lbs/ft^3)	Rootwad Complexity (1-5)	Notes
83	14	483	Redwood	18.7	16.8	26.1	-	-	None	Redwood digger log in pool, with bark intact
84	14	484	Alder	31.6	13.7	36.1	-	-	None	On left bank, behind #479-483
85	14	485	Redwood	15.8	26.0	34.3	-	-	None	Digger log off left bank into pool
86	14	486	Redwood	32.8	23.3	63.8	-	-	None	Redwood spanner log over pool
87	14	487	Redwood	9.3	24.7	19.0	-	-	None	On left bank, partially underneath #486
88	15	488	Redwood	29.3	16.0	39.0	-	-	None	Digger log on right bank - immediately downstream of lower equipment acess road
89	15	489	Fir	6.0	35.7	17.9	-	-	1	Against right bank
90	15	490	Redwood	15.0	68.5	85.6	11,303	132	None	Against right bank
91	15	491	Fir	42.3	10.7	35.9	3,083	86	3	Digger log off right bank
92	15	492	Fir	10.0	16.0	13.3	-	-	2	Possible plunge log - difficult to see
93	15	493	Redwood	8.0	13.7	9.1	-	-	None	Digger log off right bank
94	15	494	Fir	42.5	11.4	34.2	2,164	63	None	Digger log off right bank
95	15	495	Fir	29.7	9.4	23.2	-	-	None	
96	15	496	Redwood	14.0	41.7	48.7	-	-	None	Massive redwood slab on alder plunge logs to create undercut
97	15	497	Fir	37.0	10.8	30.9	665	22	3	Digger log off right bank
98	15	498	Redwood	8.8	19.0	14.0	-	-	None	Digger log off right bank
99	15	499	Alder	14.0	8.0	9.3	-	-	None	Plunge log under #496 - 7.9ft exposed
100	15	500	Redwood	20.0	26.0	43.3	2,563	59	None	Digger log off right bank
101	16	501	Redwood	18.5	23.2	35.8	2,020	56	None	Digger log off left bank
102	16	502	Redwood	31.5	14.0	36.8	-	-	None	Against left bank
103	17	503	Redwood	7.8	14.0	9.1	-	-	None	Against left bank
104	17	504	Fir	47.0	11.4	44.3	2,051	46	3	Digger log over #503 and #505
105	17	505	Redwood	19.0	24.0	38.0	-	-	None	Digger log over #506
106	17	506	Redwood	19.0	20.7	32.8	-	-	None	Digger log off left bank
107	17	507	Redwood	10.0	17.3	14.4	-	-	None	Perpendicular to left bank between #506 and #508
108	17	508	Fir	21.7	24.3	43.9	-	-	None	Digger log off left bank
109	18	509	Redwood	10.5	18.0	15.8	-	-	None	On right bank, across from #503-508
110	19	510	Fir	37.1	14.0	43.3	-	-	2	Digger log underneath #511
111	19	511	Fir	43.0	16.8	60.2	-	-	2	Digger log over #510
112	19	512	Redwood	18.0	38.7	58.1	-	-	None	Against left bank
113	19	513	Fir	9.8	24.0	19.6	-	-	3	Wedged in pool under #512
114	20	514	Redwood	14.3	27.0	32.1	-	-	None	Placed from road along right bank overflow channel and floodplain
115	20	515	Redwood	14.8	25.3	31.3	-	-	None	Placed from road along right bank overflow channel and floodplain
116	20	516	Redwood	17.5	18.0	26.3	-	-	None	Placed from road along right bank overflow channel and floodplain
117	20	517	Redwood	14.5	21.0	25.4	-	-	None	Placed from road along right bank overflow channel and floodplain
118	20	518	Redwood	8.1	32.7	22.0	-	-	None	Placed from road along right bank overflow channel and floodplain
119	20	519	Redwood	10.7	38.0	33.9	-	-	1	Placed from road along right bank overflow channel and floodplain
120	20	520	Fir	57.0	18.0	63.6	6,901	109	None	Placed from road along right bank overflow channel and floodplain
121	20	521	Redwood	7.5	42.0	26.3	-	-	1	Placed from road along right bank overflow channel and floodplain
122	20	522	Redwood	12.0	30.0	30.0	-	-	None	Placed from road along right bank overflow channel and floodplain

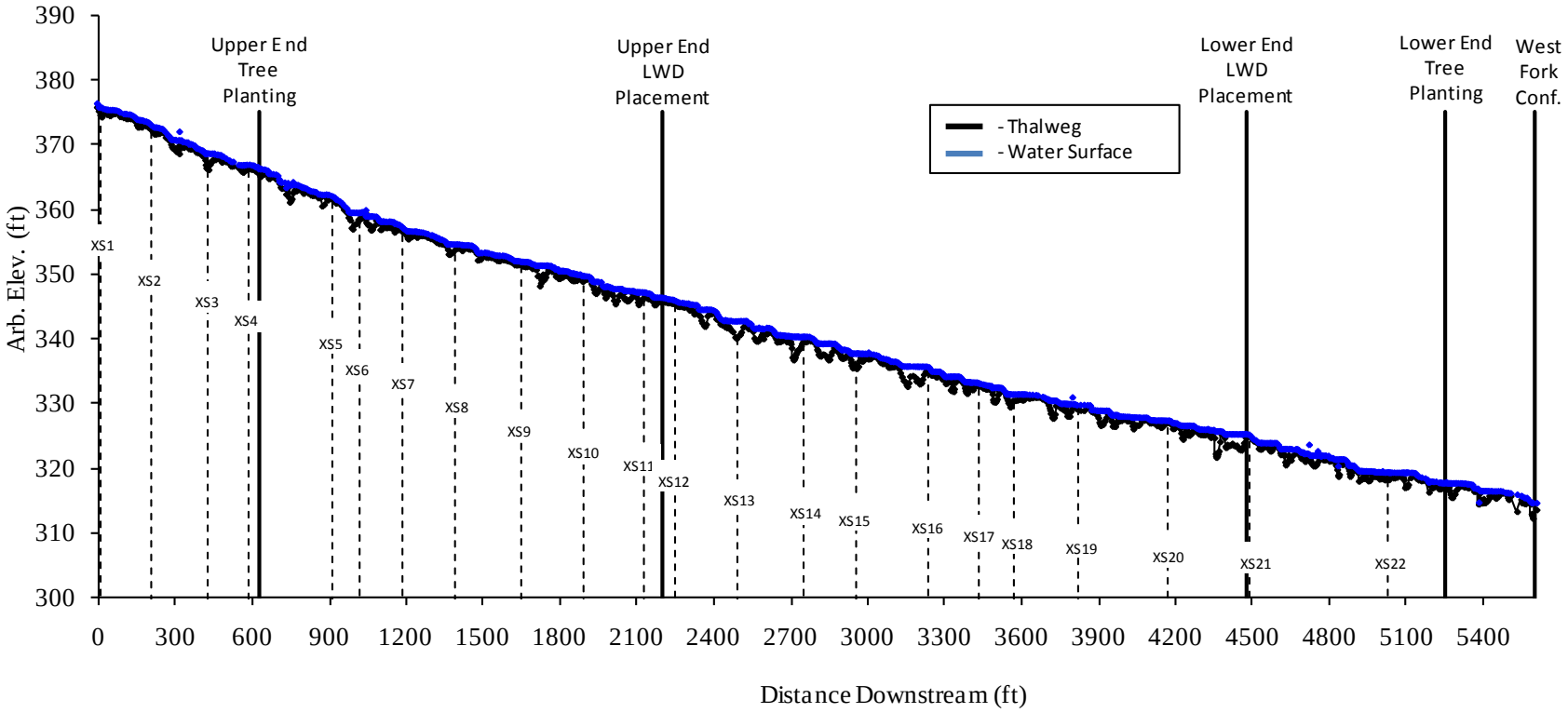

Figure 6. Longitudinal profile of 5,610 feet of Mainstem McGarvey Creek stream channel upstream of the West Fork confluence, Lower Klamath River, California, 2008

Figure 7. McGarvey Creek watershed, Lower Klamath River, California, 2005.

Figure 8. Large woody debris retrieved from "Humboldt" stream crossing during road decommissioning, McGarvey Creek, Lower Klamath River, California 2006.

Figure 9. LWD being transported from road decommissioning site to the stockpile area, McGarvey Creek, Lower Klamath River, 2006.

Figure 10. YTFP loading salvaged LWD into end-dump truck for transportation to the stockpile area, McGarvey Creek, Lower Klamath River, 2008.

Figure 11. Salvaged LWD being loaded for transport from the stockpile area to the structure sites, McGarvey Creek, Lower Klamath River, California, 2008.

Figure 12. Excavator fitted with log tongs being used to transport LWD to structure site, McGarvey Creek, Lower Klamath River, California, 2008.

Figure 13. Shallow run at top of project reach before installation of structures #1-2, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 14. Shallow run at top of project reach before installation of structures #1-2, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 15. Shallow run at top of project reach before installation of structures #1-2, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 16. Shallow run at top of project reach following installation of structures #1, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 17. Shallow run at top of project reach following installation of structures #2, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 18. Structure #1 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, March 2009.

Figure 19. Structure #1 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, March 2009.

Figure 20. Structure #2 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, March 2009.

Figure 21. Shallow pool near top of project reach prior to installation of structure #3, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 22. Shallow pool near top of project reach prior to installation of structure #3, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 23. Shallow pool near top of project reach following installation of structure #3, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 24. Shallow pool near top of project reach following installation of structure #3, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 25. Structure #3 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, March 2009.

Figure 26. Structure #3 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, March 2009.

Figure 27. Structure #3 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, March 2009.

Figure 28. Shallow pool near top of project reach prior to installation of structure #4, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 29. Shallow pool near top of project reach prior to installation of structure #4, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 30. Shallow pool near top of project reach prior to installation of structure #4, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 31. Shallow pool near top of project reach prior to installation of structure #4, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 32. Shallow pool near top of project reach prior to installation of structure #4, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 33. Shallow pool near top of project reach following installation of structure #4, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 34. Shallow pool near top of project reach following installation of structure #4, Mainstem McGarvey Creek, Lower Klamath River, California, November 2008.

Figure 35. Shallow pool near top of project reach following installation of structure #4, Mainstem McGarvey Creek, Lower Klamath River, California, November 2008.

Figure 36. Structure #4 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, January 2009.

Figure 37. Structure #4 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, March 2009.

Figure 38. Structure #4 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, January 2009.

Figure 39. Structure #4 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, March 2009.

Figure 40. Shallow pool in upper portion of reach prior to installation of structure #5, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 40. Shallow pool in upper portion of reach prior to installation of structure #5, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 41. Shallow pool in upper portion of reach prior to installation of structure #5, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 42. Shallow pool in upper portion of reach prior to installation of structure #5, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 43. Shallow pool in upper portion of reach following installation of structure #5, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 44. Shallow pool in upper portion of reach following installation of structure #5, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 45. Shallow pool in upper portion of reach following installation of structure #5, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 46. Shallow pool in upper portion of reach following installation of structure #5, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 47. Shallow pool in upper portion of reach following installation of structure #5, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 48. Structure #5 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, January 2009.

Figure 49. Structure #5 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, March 2009.

Figure 50. Structure #5 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, March 2009.

Figure 51. Channel confluence pool in upper portion of reach prior to installation of structure #6, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 52. Channel confluence pool in upper portion of reach prior to installation of structure #6, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 53. Confluence pool in upper portion of reach prior to installation of structure #6, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 54. Confluence pool in upper portion of reach prior to installation of structure #6, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 55. Confluence pool in upper portion of reach following installation of structure #6, Mainstem McGarvey Creek, Lower Klamath River, California, October 2008.

Figure 56. Confluence pool in upper portion of reach following installation of structure #6, Mainstem McGarvey Creek, Lower Klamath River, California, October 2008.

Figure 57. Confluence pool in upper portion of reach following installation of structure #6, Mainstem McGarvey Creek, Lower Klamath River, California, October 2008.

Figure 58. Confluence pool in upper portion of reach following installation of structure #6, Mainstem McGarvey Creek, Lower Klamath River, California, October 2008.

Figure 59. Structure #6 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, January 2009.

Figure 60. Backwater pool in upper portion of reach prior to installation of structure #7, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 61. Backwater pool in upper portion of reach prior to installation of structure #7, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 62. Backwater pool in upper portion of reach following installation of structure #7, Mainstem McGarvey Creek, Lower Klamath River, California, November 2008.

Figure 63. Backwater pool in upper portion of reach following installation of structure #7, Mainstem McGarvey Creek, Lower Klamath River, California, November 2008.

Figure 64. Backwater pool in upper portion of reach following installation of structure #7, Mainstem McGarvey Creek, Lower Klamath River, California, November 2008.

Figure 65. Lateral scour pool in middle portion of reach prior to installation of structures #8-9, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 66. Lateral scour pool in middle portion of reach prior to installation of structures #8-9, Mainstem McGarvey Creek, Lower Klamath River, California, February 2007.

Figure 67. Scour pool in middle portion of reach following installation of structures #8-9, Mainstem McGarvey Creek, Lower Klamath River, California, November 2008.

Figure 68. Structures #8-9 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, March 2009.

Figure 69. Step-run in middle portion of reach following installation of structures #10, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 70. Step-run in middle portion of reach following installation of structures #10, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 71. Step-run in middle portion of reach following installation of structures #10, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 72. Step-run in middle portion of reach following installation of structures #10, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 73. Step-run in middle portion of reach following installation of structures #10, Mainstem McGarvey Creek, Lower Klamath River, California, September 2008.

Figure 74. Structures #10-11 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, January 2009.

Figure 75. Structure #11 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, January 2009.

Figure 76. Structures #10-11 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, January 2009.

Figure 77. Structures #10-11 following high winter flows, Mainstem McGarvey Creek, Lower Klamath River, California, March 2009.