Stream & Floodplain Enhancement of Hunter Creek
Lower Klamath River

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Acknowledgements

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Introduction

The Yurok People have relied upon Klamath River and coastal resources for their subsistence, cultural, and economic livelihood since time immemorial. Central to Yurok culture is the harvest of anadromous fish. Runs of anadromous fish currently returning to spawn in Lower Klamath tributaries are depressed when compared with historical numbers. Extensive timber removal and road building activities has resulted in chronic sedimentation of streams and floodplains; a significant loss of channel-stored wood and riparian conifers; and a concomitant loss of habitat diversity and production potential in the sub-basin (Payne & Associates 1989; Gale and Randolph 2000; Beesley and Fiori 2007 & 2008; Voight and Gale 1998).

In the Klamath River, all runs of chinook salmon (*Oncorhynchus tshawytscha*), green sturgeon (*Acipenser medirostris*), and Pacific lamprey (*Lampetra tridentata*) are on the decline and coho salmon (*O. kisutch*) are listed as "threatened" under the Endangered Species Act. The Yurok Tribe is dedicated to rehabilitating degraded instream and riparian habitats to levels that support robust, self-sustaining populations of native anadromous fish. To help address this need, the Yurok Tribe's Fisheries (YTFP) and Watershed (YTWRD) programs have been conducting fisheries and watershed assessments, and implementing instream and upslope restoration activities in the Lower Klamath River Sub-basin since the late 1990s.

Initial restoration planning efforts included developing the Lower Klamath Sub-Basin Watershed Restoration Plan that prioritized upslope restoration and identified tributary specific restoration objectives for each Lower Klamath tributary (Gale and Randolph 2000). Sub-basin restoration objectives included: 1) reducing sediment inputs from upslope sources by treating high priority watershed road segments and stream crossings; 2) restoring native, conifer-dominated riparian forests; and 3) enhancing freshwater aquatic habitats. Since 2007, YTFP has been working with Rocco Fiori of Fiori GeoSciences (FGS) to design and implement innovative stream and floodplain enhancement projects in priority Lower Klamath tributaries. Treatments have included installation of constructed wood and engineered log jams (CWJs & ELJs) to facilitate formation and maintenance of productive fish habitats (e.g. spawning beds, deep pools with cover, slow velocity habitats), and enhancing off-channel habitats to increase salmonid rearing capacity (YTFP 2010; Hiner et al. 2011; YTFP 2013; Beesley and Fiori 2012a, 2012b, 2013).

Project Area

Hunter Creek is a fourth order watershed draining approximately 28.7 square miles of steep, forested terrain (Figure 1). Hunter Creek flows into the north side of the Lower Klamath River ~1.2 river miles upstream of the Pacific Ocean (Figure 1). The watershed supports anadromous populations of chinook and coho salmon, steelhead (*O. mykiss*), coastal cutthroat trout (*O. clarkii clarkii*), and multiple species of lamprey. East Fork Hunter Creek is the largest tributary in the watershed (Figure 1) and supports populations of coho, steelhead, coastal cutthroat trout, and lamprey. The lower reaches and tributaries of Hunter Creek also provides critically valuable rearing habitat for non-natal juvenile coho salmon and thermal refuge to fish migrating through the river during the low flow period (Silloway 2010; Silloway and Beesley 2011). Hunter Creek is located in the Klamath Glen Hydrologically Significant Area, which was given the highest priority rating in the Recovery Strategy for California Coho Salmon (CDFG 2004).

YTFP has been conducting physical and biological monitoring and restoration planning in Hunter Creek since the late 1990s (Hayden and Gale 1999; Gale and Randolph 2000; Beesley 2004, 2007, & 2008; Hiner and Brown 2004; Hiner 2006). These activities have also included assessments of historic information to further characterize changes in fisheries and riparian habitat through time, and identify limiting factors. The watershed has been impacted by historic and current water and land management activities that have resulted in draining and conversion of off-estuary wetlands, removal of old growth conifers from riparian habitats, habitat simplification, increased channel sedimentation, and loss of large wood in fluvial habitats (Beesley and Fiori 2004, 2007, & 2008; Gale and Randolph 2000; Graham Matthews & Associates 2006). Large floods occurring over the last 150 years have exacerbated degraded conditions by increasing rates of riparian loss, channel widening, and valley aggradation.

To address stream and riparian dysfunction, the California Conservation Corps (CCC) and the California Department of Fish and Wildlife (CDFW) began implementing riparian planting and large wood placement projects in Hunter Creek and East Fork Hunter Creek in the late 1990s. Some of the CCC/CDFW habitat structures still influence pool habitat formation and provide limited instream cover for juvenile salmonids. However, most of the structures are disassembling and leaving remnant pieces of rebar and cable in the creek; or are not effective at collecting and storing mobile wood or metering and sorting channel stored sediment.

Excessive channel sedimentation of lower Hunter Creek has also resulted in damage to private property in a residential housing community located in the watershed that prompted an emergency gravel extraction effort in an attempt to provide relief for residents (Beesley and Fiori 2008). Complex wood accumulations consisting of interlinked pieces of large and small wood are required to form and maintain productive stream and floodplain habitats capable of supporting healthy salmonid populations and riparian forests; and to meter channel stored sediment and slow the delivery of coarse sediment to downstream habitats and communities. Increasing the amount of instream wood accumulations throughout the watershed was identified as a priority habitat restoration measure in several local and regional watershed plans and species recovery documents (Gale and Randolph 2000; Beesley and Fiori 2007 & 2008; CDFG 2004).

In 2011-2012, YTFP and FGS conducted a stream enhancement project in East Fork Hunter Creek using funding from the U.S. Bureau of Reclamation (USBOR - Klamath River Restoration Program & Native American Affairs Program - NAAP) and the U.S. Fish and Wildlife Service (USFWS – Partners for Fish and Wildlife Program). Enhancement efforts included installation of 18 constructed wood jams (CWJs) and planting 3,793 native trees in riparian habitats (Figures 2-3). YTFP and FGS are also currently installing CWJs in mainstem Hunter Creek using USFWS (Partners for Fish and Wildlife Program) and USBOR (NAAP) funds (Figures 2 & 4-5). These projects are components of a larger-scale effort by YTFP, YTWRD, and GDRC to rehabilitate upslope, instream, and riparian habitats within the Hunter Creek watershed.

YTWRD is currently working with GDRC to decommission high priority road segments and stream crossings throughout the watershed. This work continues to generate quality wood materials for our on-going instream restoration projects in the watershed. We work very closely with YTWRD and GDRC to coordinate upslope and instream efforts to ensure that: 1) restoration objectives are compatible with GDRC; 2) wood generated from upslope treatment

activities are used to improve salmonid habitats in the Lower Klamath; and 3) stream reaches are properly addressed prior to road decommissioning efforts inhibit access via heavy equipment.

Project Overview

In 2010, YTFP received funding from CDFW's Fisheries Restoration Grant Program (FRGP), and the U.S. Bureau of Reclamation (BOR) (Native American Affairs Program) to enhance stream and floodplain habitats within 2.0 miles of Hunter Creek by installing several CWJs (Figure 1). Unfortunately, the FRGP funding expired in spring of 2013 prior to the proposed project end date of fall 2013. Therefore, we were only able to treat 1.0 mile of stream and floodplain habitats within the originally proposed project reach (Figure 1). Priority California coho salmon recovery tasks addressed by this project were KR-KG-24, KR-KG-23, KR-KG-17, and KR-KG-15 (CDFG 2004). The project start date was 1/31/12 and the end date was 3/31/13. Instream habitat restoration activities were initiated in late July 2012 and concluded in early September 2012. No fish relocation was necessary to perform project tasks and all other project permit requirements were met.

Hunter Creek Project objectives included:

- Increasing salmonid spawning and rearing habitat complexity in Hunter Creek and reducing water quality impacts in the watershed by installing several constructed wood jams;
- Evaluating project effectiveness to facilitate adaptive management of the project area; and
- Creating high quality, resource-based employment opportunities for Yurok tribal members.

Driving Directions & Project Location

The project site is located on property owned by Green Diamond Resource Company (GDRC - Contact: Ryan Bourque - Aquatic Monitoring Supervisor - PO Box 68; Korbel CA, 95550). Heading north from the town of Klamath on U.S. Highway 101, travel approximately 2.7 miles and turn right on Hunter Creek Road. Travel approximately 1.8 miles to a private gate. A GDRC North Klamath key is needed to unlock this gate. Proceed through the gate and travel on this road for 2.5 miles to the downstream boundary of the project reach. The reach included ~1.0 mile of instream habitats located upstream from this location. The project reach is located in T14N, R1E, Sections 11 & 2 (USGS Requa & Childs Hill Quads - Downstream BND: Lat. 41.621; Long. -124.024; Upstream BND: Lat. 41.636; Long. -124.024 (Figure 1).

Physical Monitoring

Prior to structure installation (July 2012), YTFP conducted 3-D topographic surveys of the channel and established multiple, permanent cross sections in the project reach (Figures 6-7; Appendix A). Surveys were conducted using an optical total station and a hand-held data collector and data was collected in meters using the following coordinate systems: projected coordinate system NAD_1983_UTM Zone_10N; geographic coordinate system GCS North American 1983. End points for the longitudinal profile survey and cross sections were marked using rebar with end caps and georeferenced using the optical total station. YTFP tied all project

surveys to GDRC's long-term channel monitoring survey located within the project reach to expand and enhance physical monitoring activities in this priority Lower Klamath watershed.

Following CWJ construction, YTFP marked all the key logs with individual identification tags and surveyed the position of these logs and CWJs using the total station and data (Figure 8). At this time, survey crews established additional cross sections within the project reach to improve our ability to monitor channel conditions at the CWJ sites (Appendix A). Unfortunately, the funding expiration date did not allow for the year 1 post-project survey that was proposed for July 2013. Instead, crews conducted a repeat survey of the project reach during March 2013 to document conditions following winter flows (Figure 7; Appendix A). We tried to target a period of low spring base flow for this survey but were interrupted by two storm events and therefore the data should be considered with an understanding that flow conditions were highly variable. All survey data was analyzed using Trimble Geomatics Office, ESRI GIS, and Excel software to produce maps and monitor changes in channel morphology over time.

In summer 2012, YTFP established a network of photographic monitoring sites within the project reach to help characterize habitat conditions and document changes over time (Table 1). Photo-monitoring location information was collected using a hand-held Garmin GPS Map 78s unit (Latitude, Longitude -decimal degrees, geographic coordinate system, WGS 84). Photographs were obtained throughout the project's duration in an effort to document pre-project and post-project conditions including CWJ site conditions under various flows (Appendix B).

Constructed Wood Jams

In summer 2012, YTFP restoration crews and FGS used heavy equipment and whole tree materials to install 14 CWJs within the Hunter Creek project reach (Figures 7-8; Table 2). CWJs installed for this project were a variation of Engineered Log Jams (ELJs) described by Abbe et al. (2003a, 2003b, 2005). These structures were constructed to mimic naturally occurring features such as bar apex jams (BAJs), abutment jams (staggered and non-staggered), and toppled riparian trees (Appendix B). CWJs were constructed using the same geomorphic and engineering principles as ELJs; where mechanically driven logs, riparian trees, old growth stumps, and other landforms were used to create the resisting elements necessary for maintaining CWJ stability and function under a variety of flows (Appendix B). None of the CWJs installed relied on cable and/or threaded rebar anchoring systems and no imported quarry rock was used.

The CWJs installed in Hunter Creek were designed to facilitate formation and maintenance of productive fish habitats (e.g. spawning beds, deep pools with cover, slow velocity habitats), increase floodplain connectivity to increase salmonid rearing capacity, and to meter channel stored sediment and slow the delivery of coarse sediment to downstream habitats. YTFP and FGS are currently still assessing CWJ function and performance in the project reach; however, initial surveys indicate positive habitat responses resulting from CWJ installation.

Performance Measures – Instream Habitat Restoration (HI)

1. Total miles of instream habitat treated: 1.0 mile
2. Type of materials used for channel structure placement: Individual Logs (Unanchored)
   More specifically, Constructed Wood Jams (CWJs) consisting of whole tree materials and in some cases use of ballast materials (native bed materials) – no anchoring.
3. Miles of stream treated with channel structure placement: 1.0 mile
4. Number of instream pools created by structure placement: 3
   (Most CWJs Placed to Enhance Existing Pools or Promote Floodplain Connectivity)
5. Number of structures placed in channel: 14 CWJs
6. Type of monitoring: Physical monitoring
7. Location of monitoring: Onsite

Summary & Next Steps

As mentioned, the FRGP funds expired before we were able to treat the entire proposed project reach and only 14 of the 20 purposed CWJs were installed (Figures 1 & 8). We are currently seeking the funding to install the remaining CWJs to complete the originally purposed scope of work. We will also seek the funding necessary to continue our physical monitoring activities. We hope to install the remaining CWJs in summer 2013 in coordination with our wood loading activities in the USFWS project reach located downstream of the CDFW reach (Figure 2).

YTFP is also currently seeking funds to conduct the next phase of wood loading and riparian rehabilitation in Hunter Creek. This next phase will consist of treating 1.0 mile of stream and floodplain habitats located downstream of the East Fork Hunter Creek confluence. The project will consist of installing 48 CWJs and 1,000 ft of willow baffles as well as planting riparian habitats with native trees. Once we have built all of the key CWJs within the various mainstem project reaches we can begin putting whole tree materials in the reaches upstream. Heavy equipment access to these upper reaches is extremely limited and therefore our ability to build CWJs in these areas is also limited. Instead we will have to transition to methods that will supply whole tree materials to these reaches either via a helicopter or from limited access points. Most of this wood will be fairly mobile in the system but the key CWJs located downstream will likely act as “catcher mits” and retain or temporarily store these materials (Abbe and Montgomery 1996; Abbe et al. 2003a, 2003b & 2005). Supplying instream habitats with whole tree materials is a necessary restorative measure until riparian habitats are capable of continuously providing high quality woody materials through natural recruitment mechanisms. YTFP will also continue to rehabilitate riparian habitats throughout the watershed by planting native conifers and other species capable of providing large diameter wood to instream habitats.

References Cited

Abbe, T.B. and D.R. Montgomery. 1996. Large Woody Debris Jams, Channel Hydraulics, and Habitat Formation in Large Rivers. Regulated Rivers: Research and Management 12: 201-221.

Abbe, T.B., A. Brooks, and D.R. Montgomery. 2003a. Wood in River Restoration and Management. pp. 367-389 in: S. Gregory et al. (ed.), Wood in World Rivers. American Fisheries Society, Bethesda, Maryland.

Abbe, T. B., G. Pess, D. R. Montgomery, and K. L. Fetherston. 2003b. Integrating engineered logjam technology in river rehabilitation. Pages 443–490 *in* D. R. Mongtomery, S. Bolton, D. B. Booth, and L. Wall, editors. Restoration of Puget Sound Rivers. University of Washington Press, Seattle.

Abbe, T.B., Montgomery, D.R., Adams, C.A., Riley, R.C., Robinsen, K.M., and Owens, E.L., 2005. Bank Protection and Habitat Enhancement using Engineered Log Jams: An Experimental Approach Developed in the Pacific Northwest. Natural Resources Concervation Service, U.S. Department of Agriculture. 169 p.

Beesley, S. and R.A. Fiori. 2004. Habitat Assessment and Restoration Planning in the Salt Creek Watershed, Lower Klamath River Sub-Basin, California. Yurok Tribal Fisheries Program, Klamath, California.

Beesley, S. and R.A. Fiori. 2007. Lower Klamath River Tributary Delta and Subsurface Flow Study, Lower Klamath River Sub-basin, California. Yurok Tribal Fisheries Program, Klamath, California.

Beesley, S. and R.A. Fiori. 2008. Cooperative Restoration of Tribal Trust Fish and Wildlife Habitat in Lower Klamath River Tributaries. Yurok Tribal Fisheries Program, Klamath, California.

Beesley, S. and R.A. Fiori. 2012a. Lower Terwer Creek Riparian Revegetation Project. Yurok Tribal Fisheries Program, Klamath, California.

Beesley, S. and R.A. Fiori. 2012b. Lower Terwer Creek Off-Channel Wetland Enhancement. Yurok Tribal Fisheries Program, Klamath, California.

Beesley, S. and R.A. Fiori. 2013. Stream & Floodplain Enhancement of Lower Terwer Creek: 2012. Yurok Tribal Fisheries Program, Klamath, California.

CDFG. 2004. Recovery Strategy for California Coho Salmon. Report to the California Fish and Game Commission. 594 pp. California Department of Fish and Game, Native Anadromous Fish and Watershed Branch, 1416 9th Street, Sacramento, CA 95814.

Gale, D.B. and D.B. Randolph. 2000. Lower Klamath River Sub-basin Watershed Restoration Plan. Yurok Tribal Fisheries Program, Klamath, California.

Graham Matthews and Associates. 2006. Hydrology, Geomorphology, and Stream Channel Changes in Hunter Creek, Del Norte County, California. Prepared for: Green Diamond Resources Company. Prepared by: Graham Mathews & Associates. P.O. Box 1516, Weaverville, California, 96093.

Hayden, T.R. and D.B. Gale. 1999. Juvenile Salmonid Emigration Monitoring from the Hunter Creek Basin, Lower Klamath River, California. 1996-1997. Yurok Tribal Fisheries Program, Klamath, California.

Hiner, M. 2006. Seasonal Water Quality in the Klamath River Estuary and Surrounding Sloughs, 2001-2003. Yurok Tribal Fisheries Program, Klamath, California.

Hiner, M. and A. Brown. 2004. Monitoring and Evaluation of Current and Historical Physical Habitat Conditions, Water Quality, and Juvenile Salmonid use of the Klamath River Estuary. Yurok Tribal Fisheries Program, Klamath, California.

Hiner, M., S. Silloway, A. Antonetti, and S. Beesley. 2011. Lower Klamath Tributaries Riparian Restoration Projects and Yurok Tribal Native Plant Nursery. Yurok Tribal Fisheries Program, Klamath, California.

Payne and Associates. 1989. Lower Klamath River Tributary Delta Study. Thomas R. Payne and Associates. Arcata, California. Report to the Bureau of Indian Affairs, Redding, California.

Silloway, S. 2010. Fish Surveys Related to the Proposed Del Norte Highway 101 Klamath Grade Raise Project. Yurok Tribal Fisheries Program, Klamath, California.

Silloway, S. and S. Beesley. 2011. Fish Surveys Related to the Proposed Del Norte Highway 101 Klamath Grade Raise Project: Addendum Report 2010-2011. Yurok Tribal Fisheries Program, Klamath, California.

Voight, H.N. and D.B. Gale. 1998. Distribution of Fish Species in Tributaries of the Lower Klamath River: an Interim Report, FY 1996. Yurok Tribal Fisheries Program, Klamath, California.

Yurok Tribal Fisheries Program. 2010. Lower Terwer Creek Streambank and Riparian Restoration - U.S. Fish and Wildlife Service – Tribal Landowner Incentive Program Project. Yurok Tribal Fisheries Program, Klamath, California.

Yurok Tribal Fisheries Program. 2013. Juvenile coho salmon use of constructed off-channel habitats in two Lower Klamath River tributaries: McGarvey Creek & Terwer Creek – Spring 2013. Yurok Tribal Fisheries Program, Klamath, California.

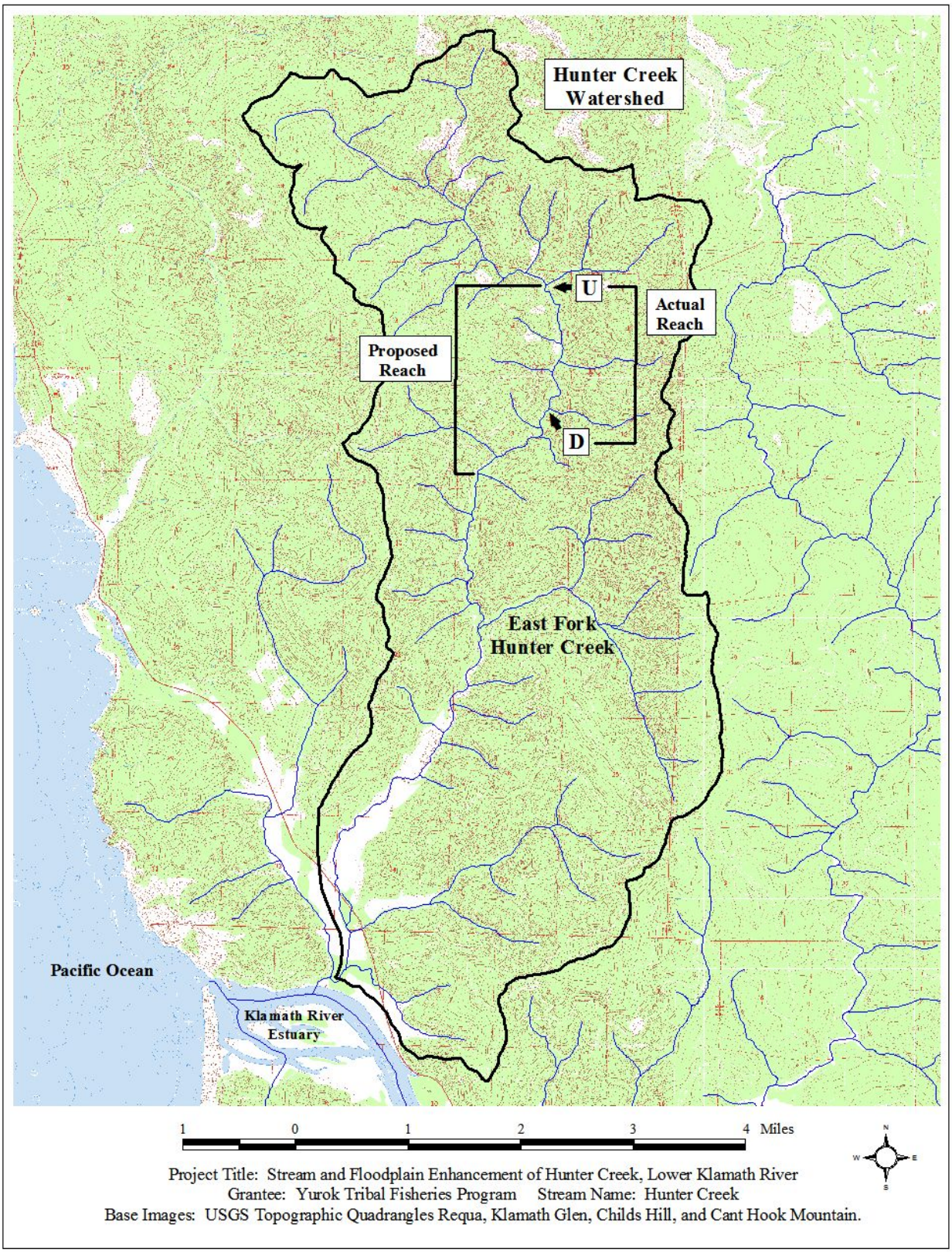


Figure 1. Hunter Creek project location map, Lower Klamath River.

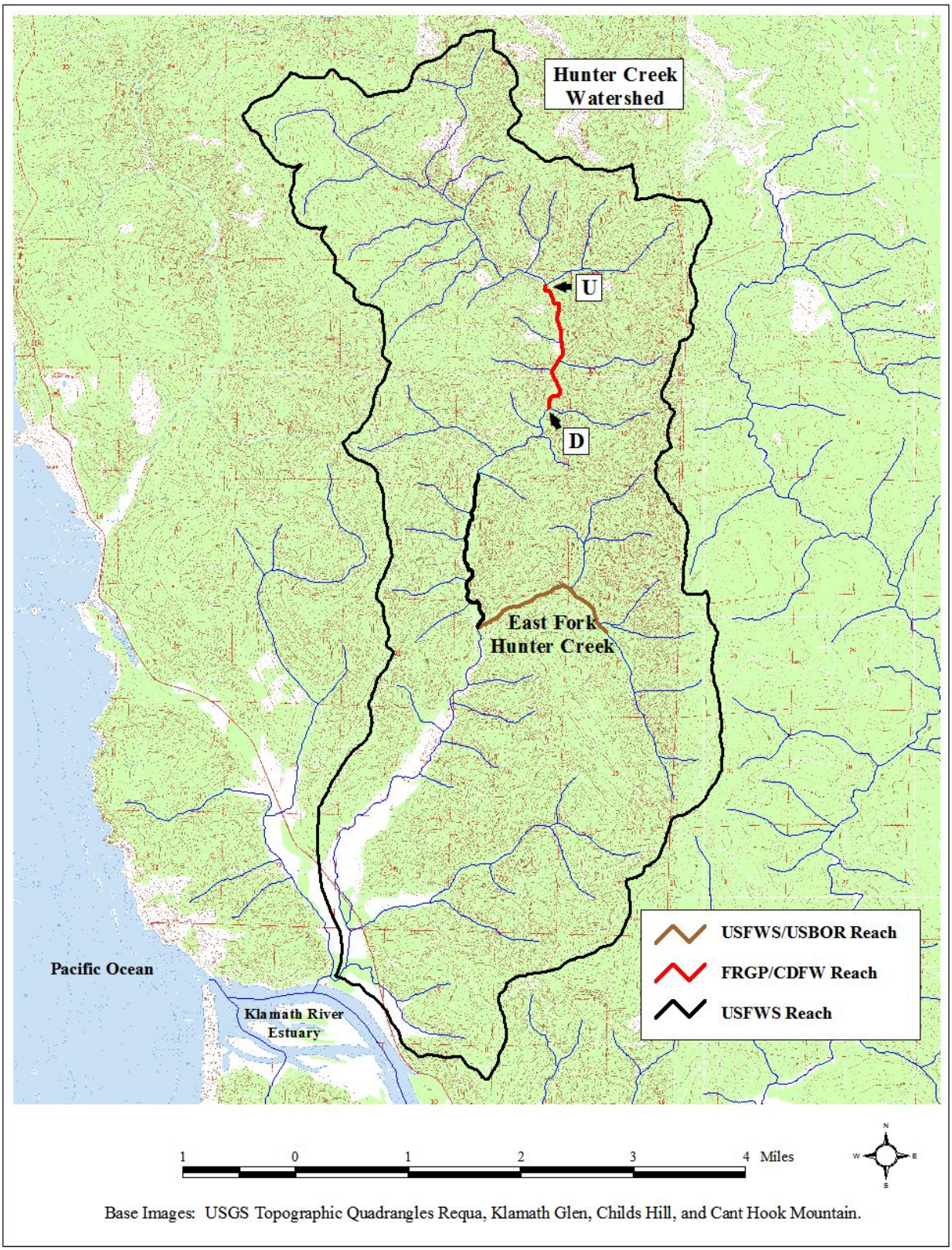


Figure 2. Map depicting wood loading reaches in the Hunter Creek watershed, California.

Figure 3. Constructed wood jam in East Fork Hunter Creek in the first spring post-construction.

Figure 4. Constructed wood jam in Hunter Creek in the first spring post-construction.

Figure 5. A bar apex jam (USFWS Site 2) during construction (Top, Middle – Aug. 2012) and during the first winter-spring post-construction (Bottom Left 11/20/12 – Bottom Right 3/7/13).

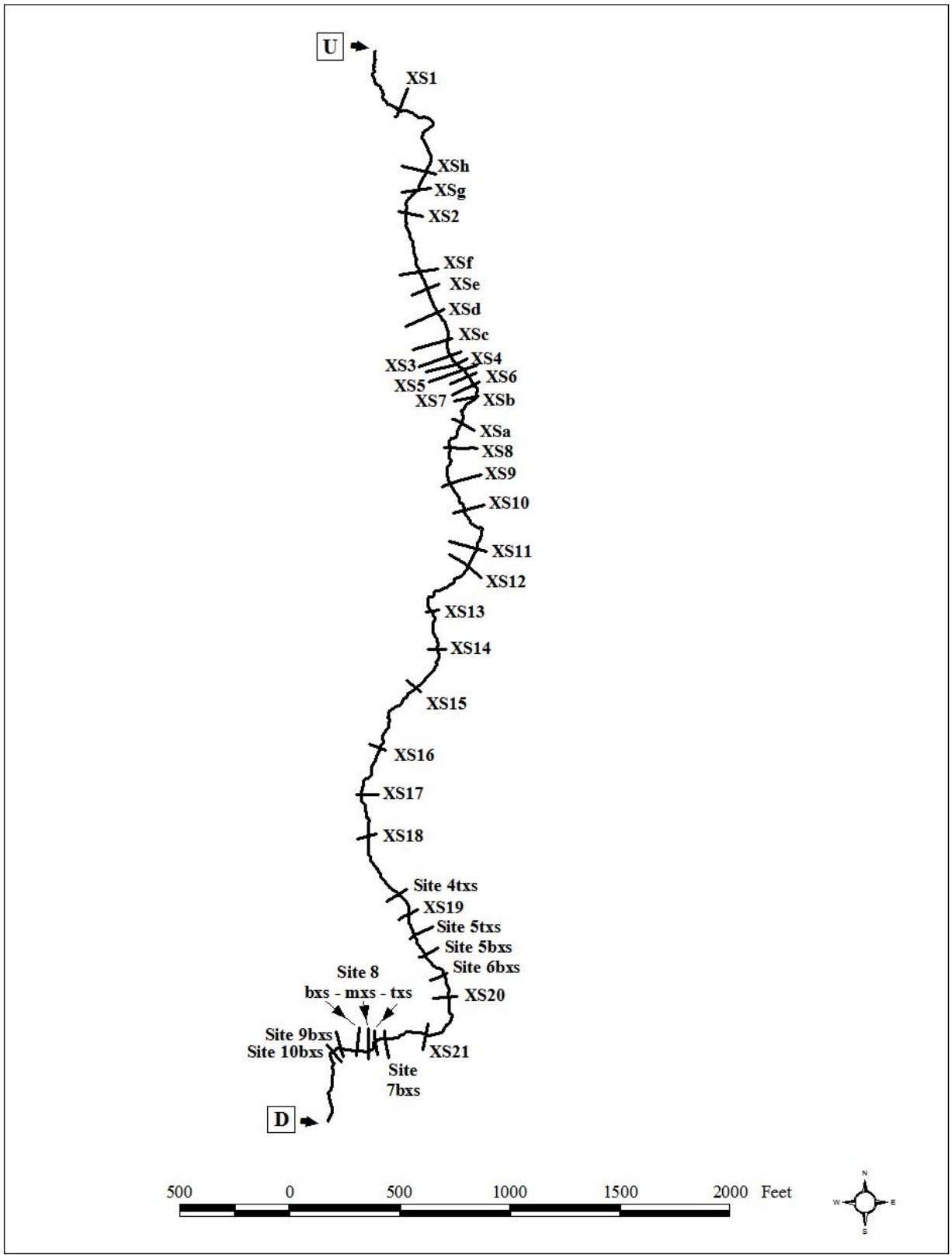


Figure 6. Map depicting the Hunter Creek CDFW wood loading reach (July 2012 Surveyed Channel Profile) and locations of the long-term channel monitoring cross sections.

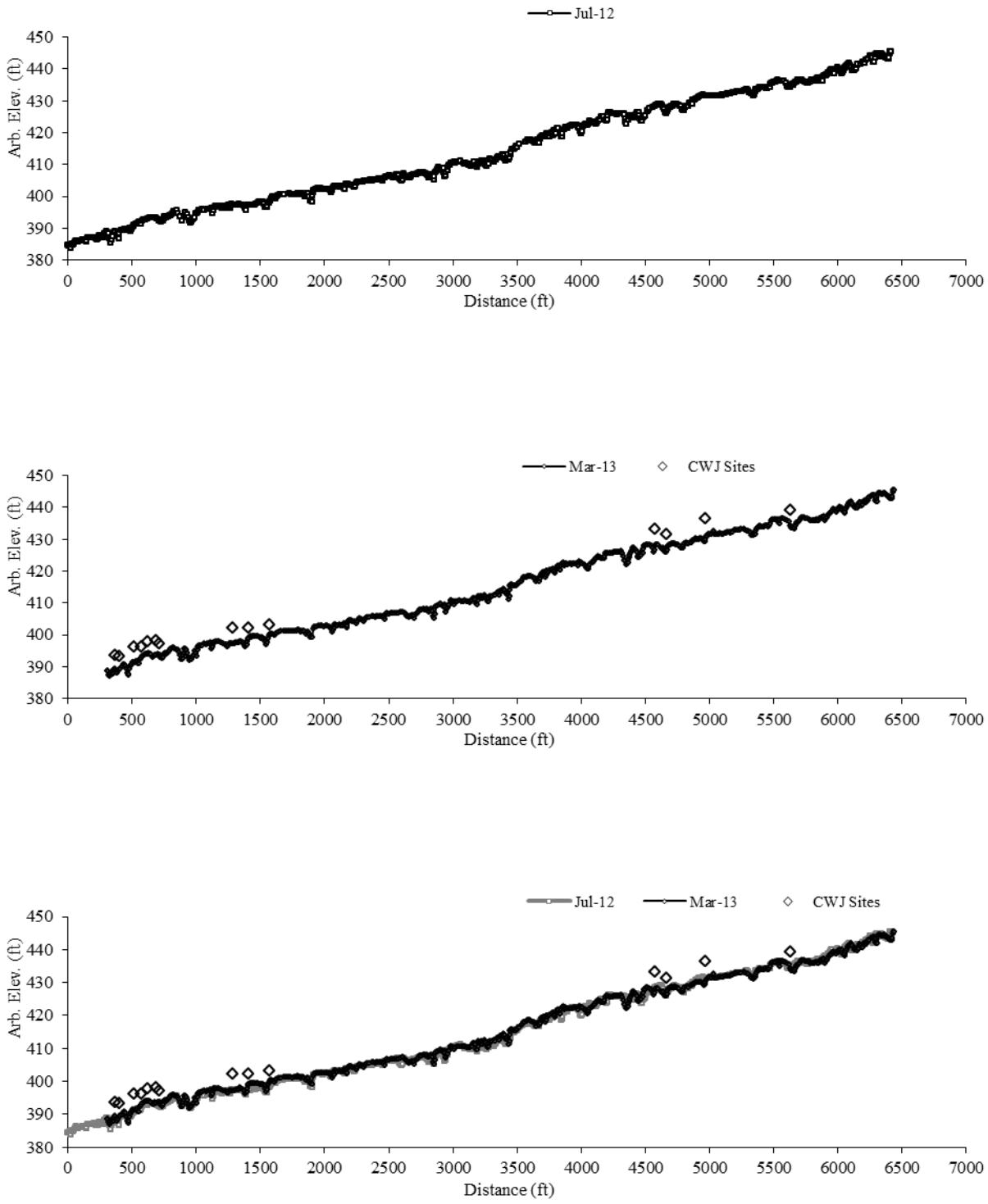


Figure 7. Channel profile survey data collected in the Hunter Creek CDFW wood loading reach (July 2012 - Pre-Project, March 2013 - Post-Project; CWJ sites displayed to show location only).

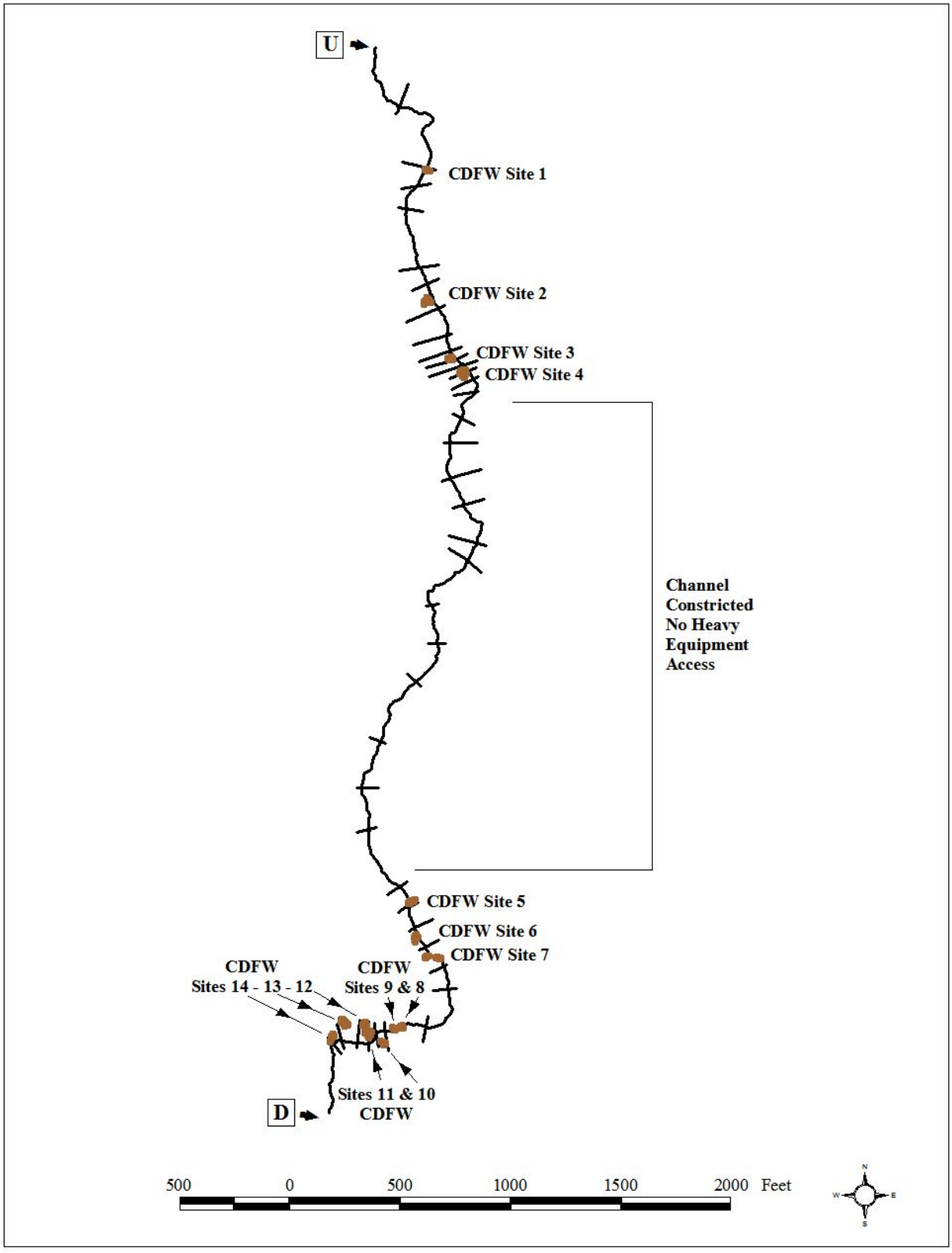


Figure 8. Map depicting the Hunter Creek CDFW wood loading site locations (Brown Markers).

Table 1. Photographic monitoring site information for the "Stream & Floodplain Enhancement of Hunter Creek Project", Lower Klamath River (2010-2013).

Site ID	Longitude*	Latitude*	View
Site 1-1	-124.0228	41.6333	Looking Downstream Towards CDFW CWJ Site 1
Site 2-1	-124.0223	41.6308	Looking Downstream Towards CDFW CWJ Site 4
Site 12-1	-124.0227	41.6238	Looking Downstream Towards CDFW CWJ Site 6
Site 13-3	-124.0225	41.6233	Looking at Right Bank Towards CDFW CWJ Site 7
Site 3-1	-124.0228	41.6223	Looking Downstream Towards CDFW CWJ Sites 8, 9 & 11
Site 3-2	-124.0229	41.6222	Looking at Right Bank Towards CDFW CWJ Site 8
Site 5-3	-124.0230	41.6222	Looking at Right Bank Towards CDFW CWJ Site 9
Site 4-1	-124.0231	41.6222	Looking Downstream Towards CDFW CWJ Site 10
Site 4-3	-124.0233	41.6222	Looking at Left Bank Towards CDFW CWJ Site 10
Site 9-1	-124.0233	41.6222	Looking Downstream Towards CDFW CWJ Site 11
Site 7-1	-124.0232	41.6222	Looking Downstream Towards CDFW CWJ Sites 12 & 13
Site 7-3	-124.0236	41.6222	Looking at Right Bank Towards CDFW CWJ Site 12
Site 6-1	-124.0237	41.6223	Looking Downstream Towards CDFW CWJ Site 13
Site 14-1	-124.0241	41.6223	Looking Upstream Towards CDFW CWJ Sites 11, 12, & 13

**Coordinates - Latitude, Longitude -decimal degrees, geographic coordinate system, WGS 84

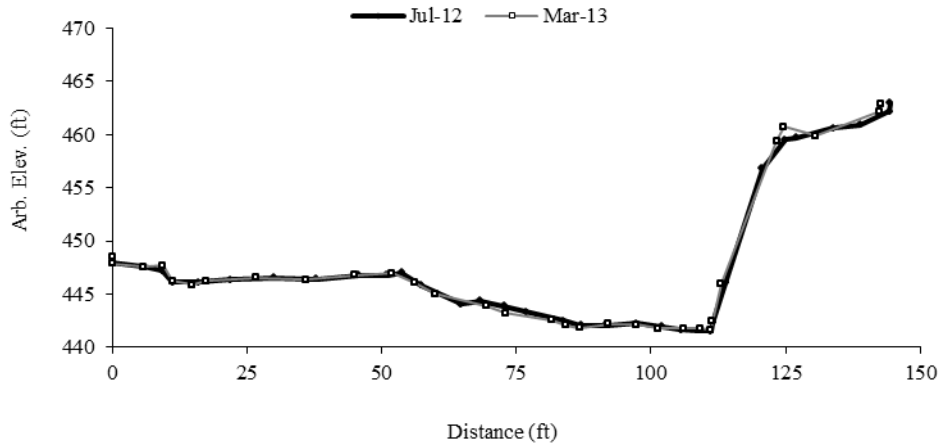
Table 2. As built descriptions for the constructed wood jams installed in the CDFW Hunter Creek wood loading reach during summer 2012.

Feature Number	STATION* (ft)	Feature Type	Key Pieces RTW	Key Pieces Pole	Total Key Pieces	Channel Position	Foundation	Northing**	Easting**
1	5628	Cover/Spider	5	0	5	Left Bank	Riparian Trees, Old Growth Redwood Stump	4609548.5141	414834.7273
2	4964	Cover/Spider	4	0	4	Right Bank	Riparian Trees	4609375.7892	414903.8079
3	4667	Cover/Spider	4	0	4	Right Bank	Riparian Trees	4609313.7722	414956.5063
4	4573	Bar Apex Jam	6	8	14	Right Bank	Riparian Trees, Piles	4609300.5750	414977.9356
5	1567	Cover/Spider	3	0	3	Left Bank	Riparian Trees, Old Growth Redwood Stump	4608586.1347	415161.8239
6	1408	Cover/Spider	6	0	6	Right Bank	Riparian Trees, Old Growth Redwood Stump	4608544.0999	415185.2250
7	1287	Staggered Abutment Jam	8	4	12	Both Banks	Riparian Trees, Old Growth Redwood Stump	4608521.5783	415211.7162
8	715	Cover/Spider	4	0	4	Right Bank	Riparian Trees	4608417.1973	415210.7105
9	686	Cover/Spider	4	0	4	Right Bank	Riparian Trees	4608410.8117	415199.7014
10	619	Cover/Spider	5	0	5	Left Bank	Riparian Trees, Old Growth Redwood Stump	4608386.0544	415195.5550
11	572	Bar Apex Jam	7	8	15	Right Bank	Riparian Trees, Piles	4608390.7978	415169.2057
12	518	Cover/Spider	5	1	6	Right Bank Side Channel	Riparian Trees	4608404.5441	415160.3356
13	402	Cover/Spider	5	0	5	Right Bank Side Channel	Riparian Trees	4608390.6210	415135.2360
14	371	Cover/Spider	3	0	3	Right Bank Side Channel	Riparian Trees	4608370.3953	415123.1152

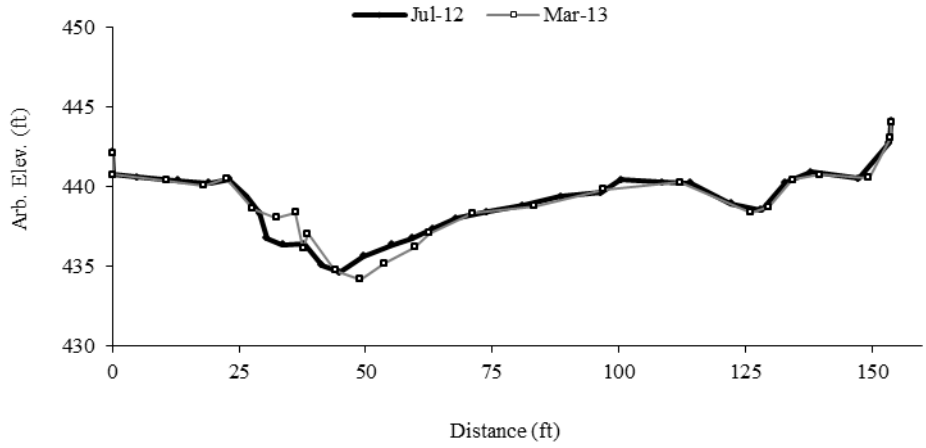
*Station - Distance upstream from bottom of reach

**GIS Coordinates - coordinate systems: projected coordinate system NAD_1983_UTM Zone_10N; geographic coordinate system GCS North American 1983

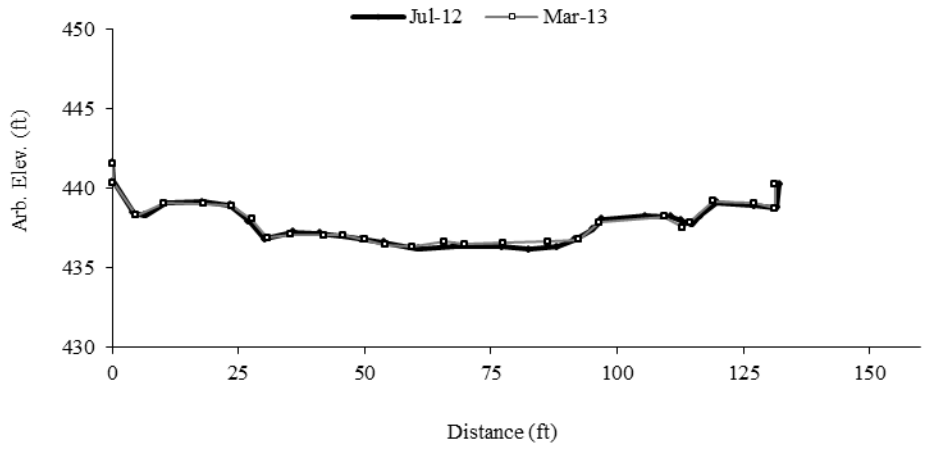
Appendix A. Cross Section Data Collected in the Upper Hunter Creek Wood Loading Reach – CDFW Project Reach (Grant Agreement # P1010527)



Cross Section – XS1



Cross Section – XSh



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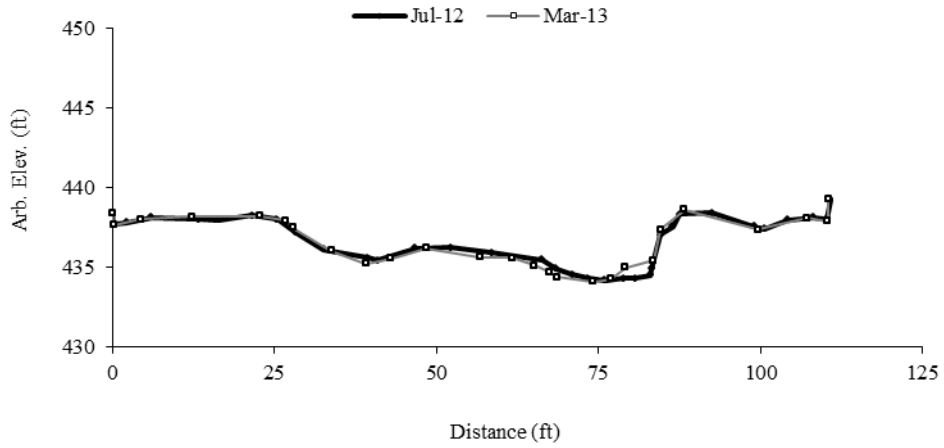

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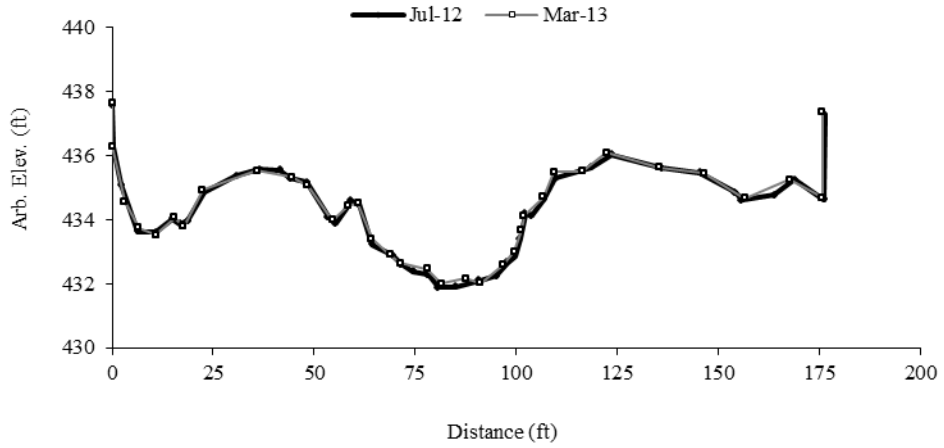
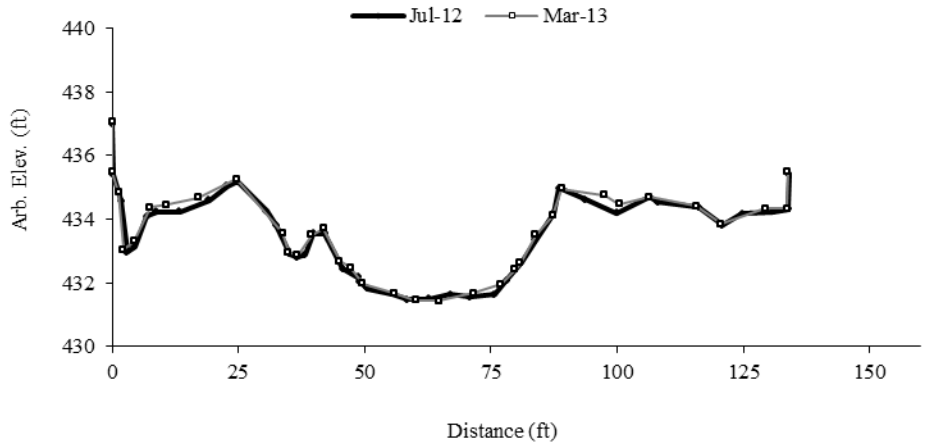
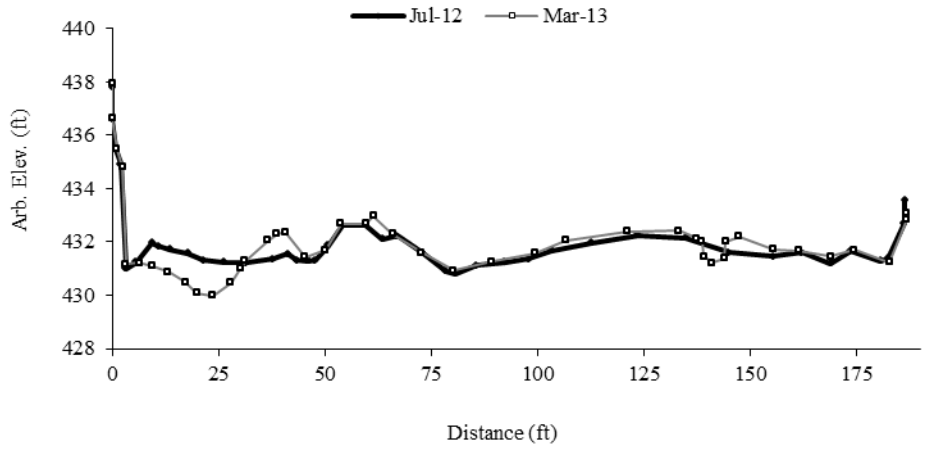


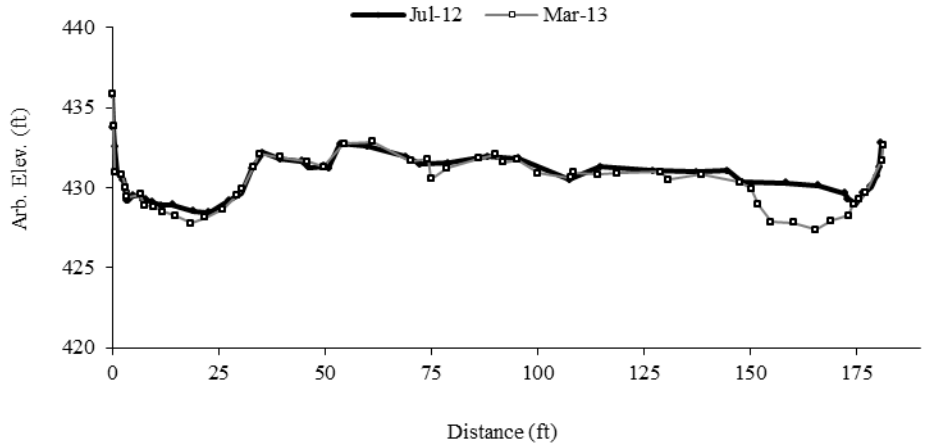
Cross Section – XSf



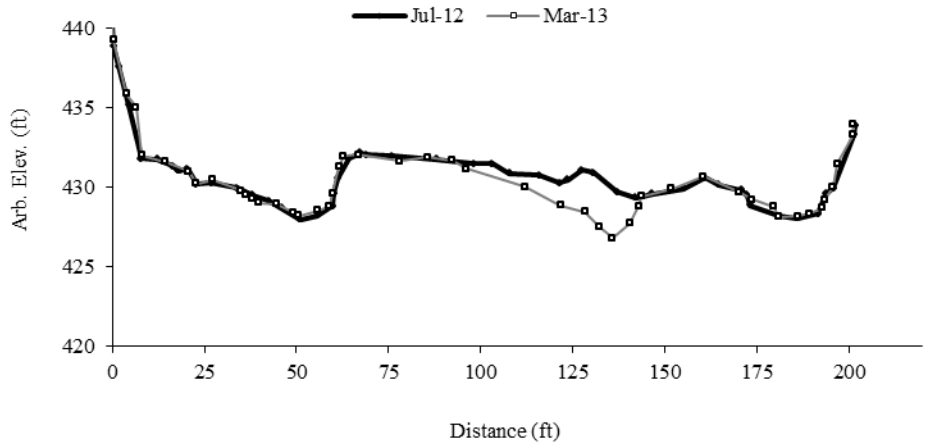
Cross Section – Xse



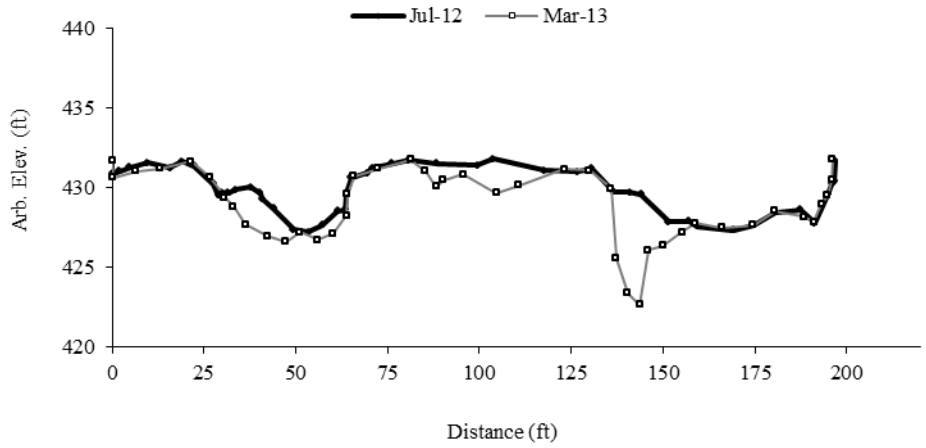
Cross Section – XSd



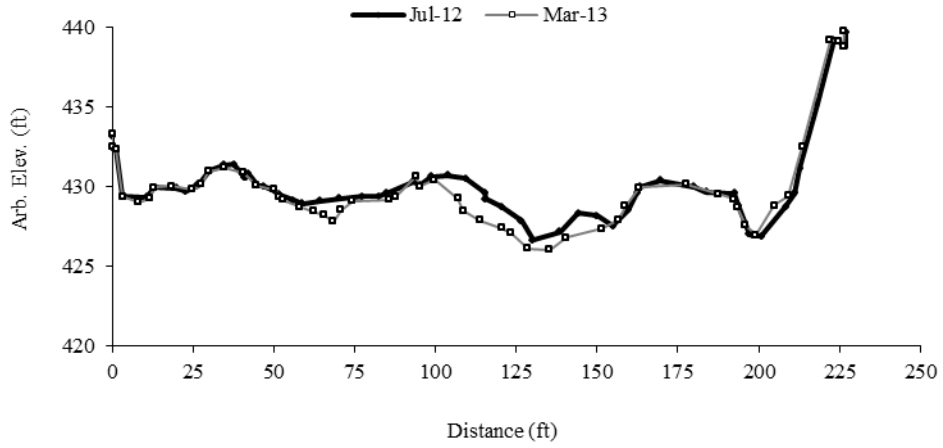
Cross Section – XSc



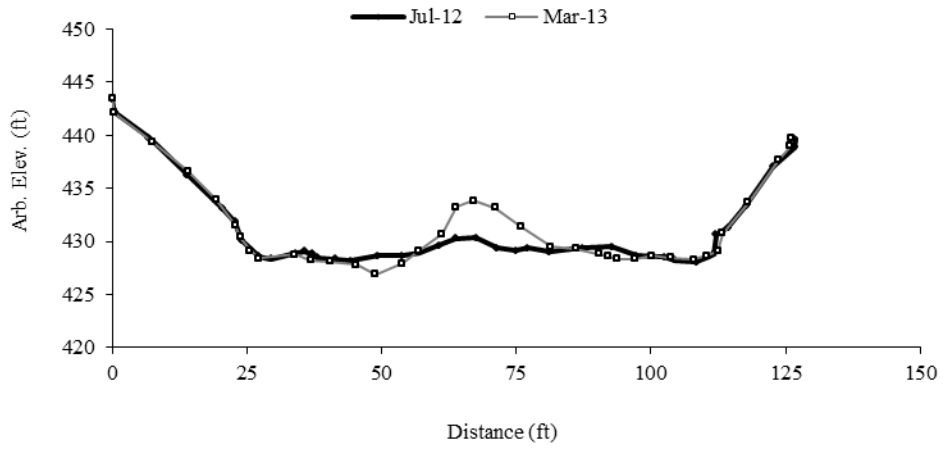
Cross Section – XS3



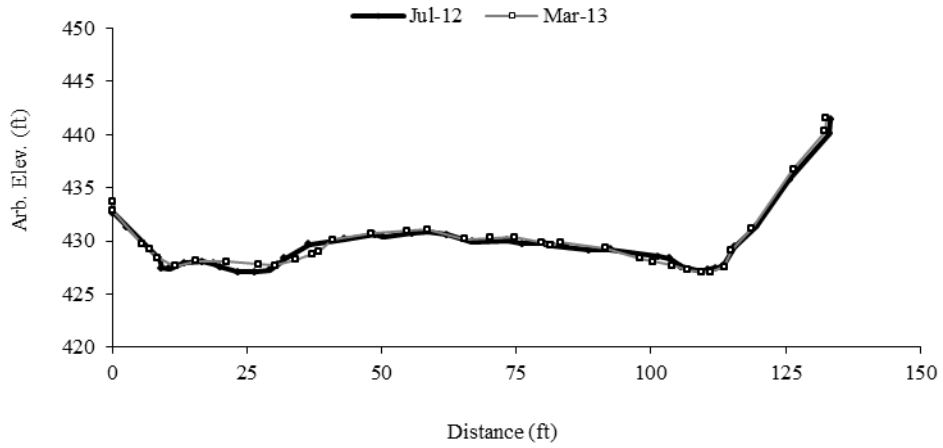
Cross Section – XS4



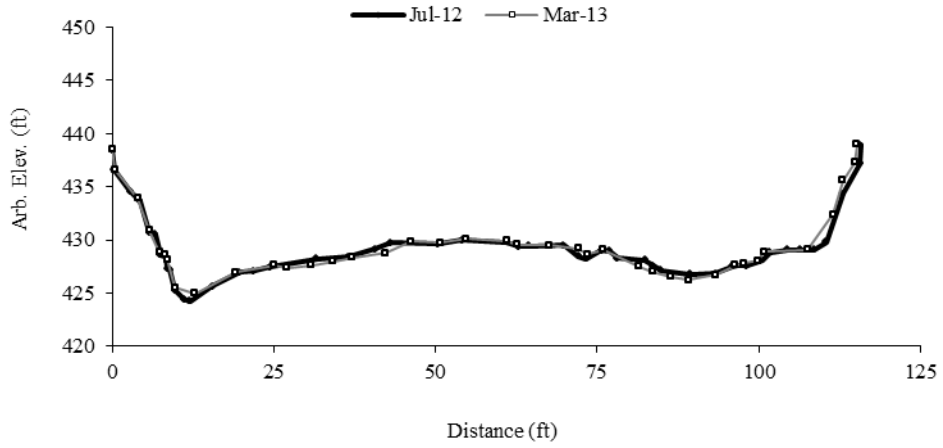
Cross Section – XS5



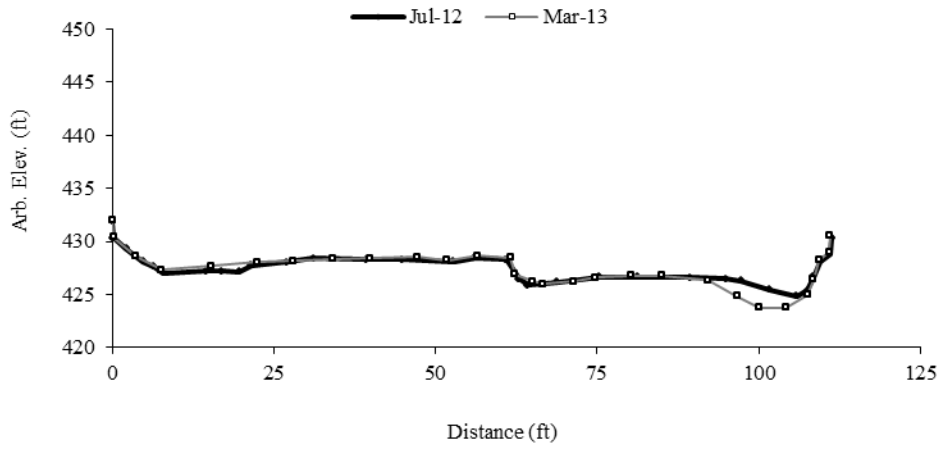
Cross Section – XS6



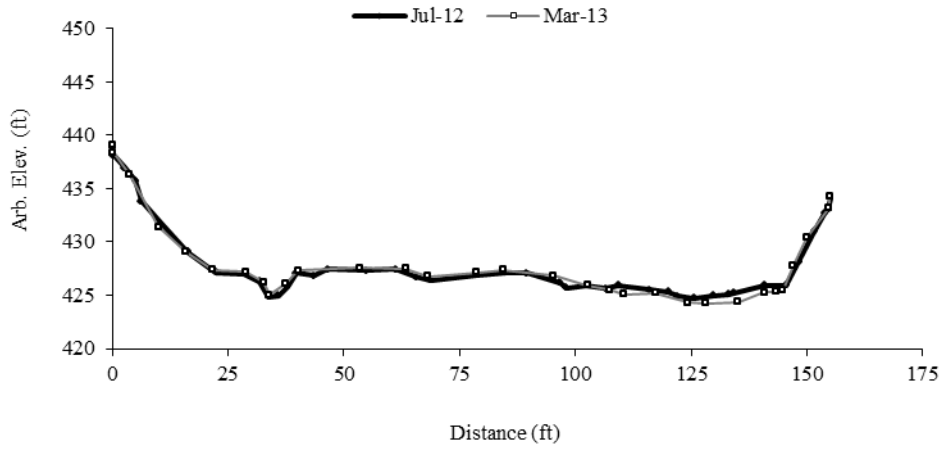
Cross Section – XS6



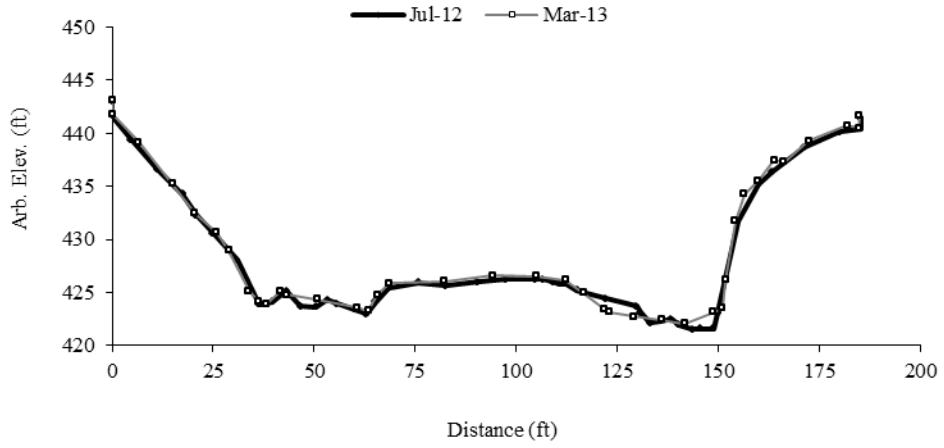
Cross Section – XSb



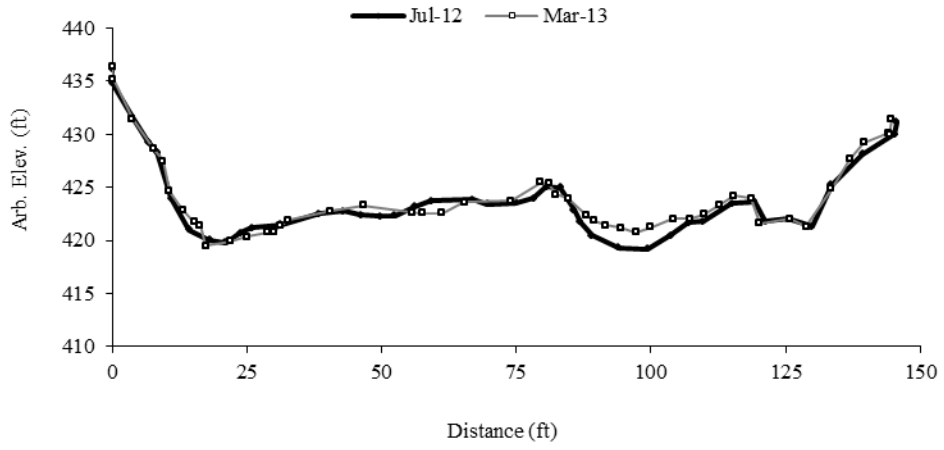
Cross Section – XSa



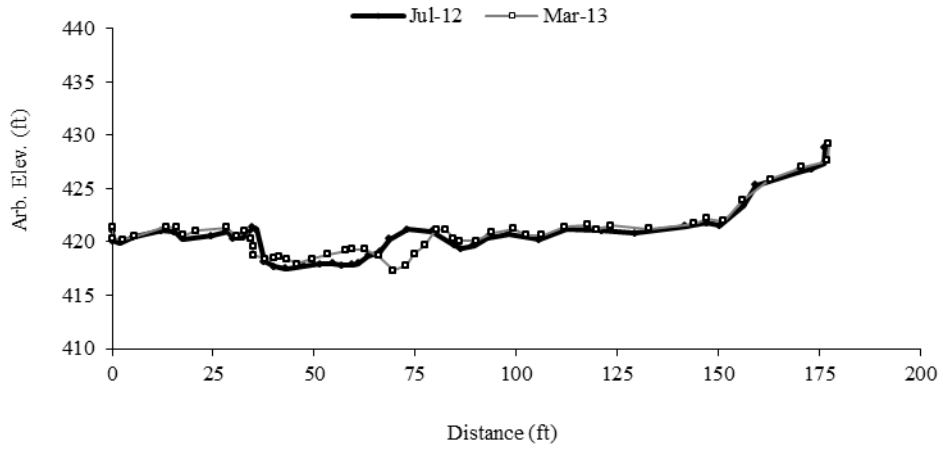
Cross Section – XS8



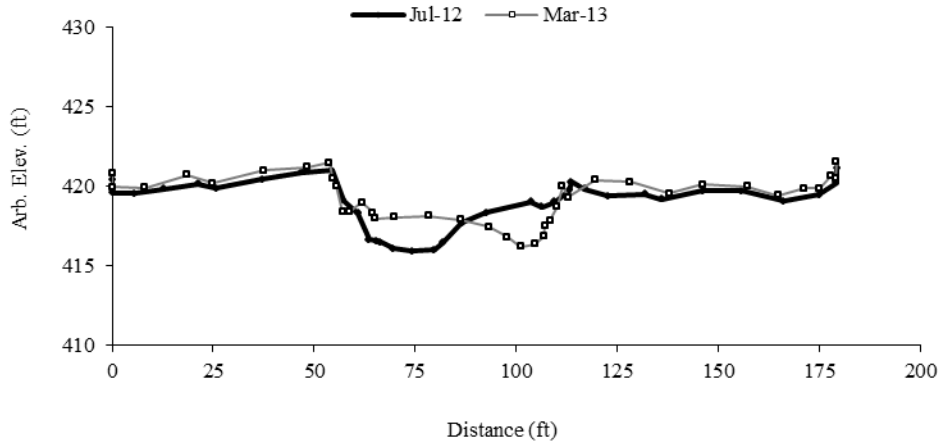
Cross Section – XS9



Cross Section – XS10



Cross Section – XS11



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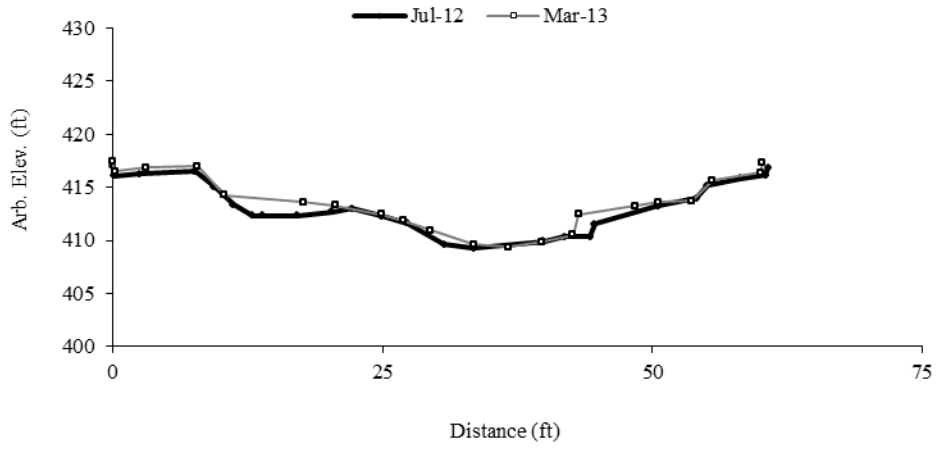
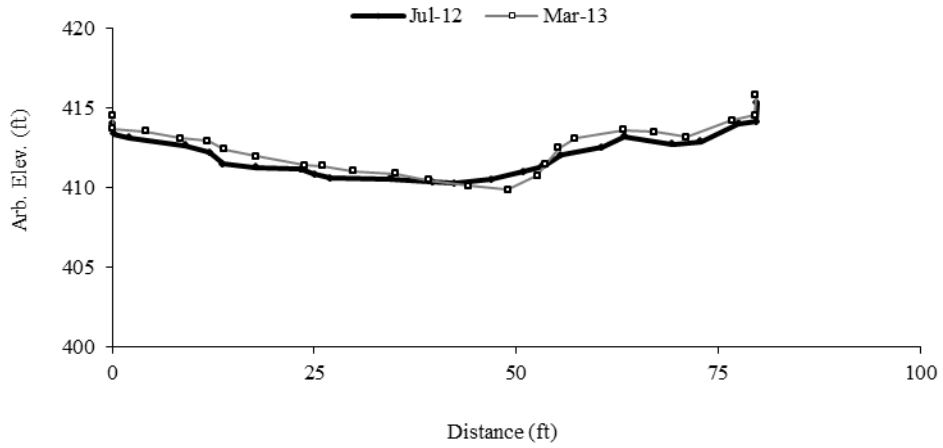
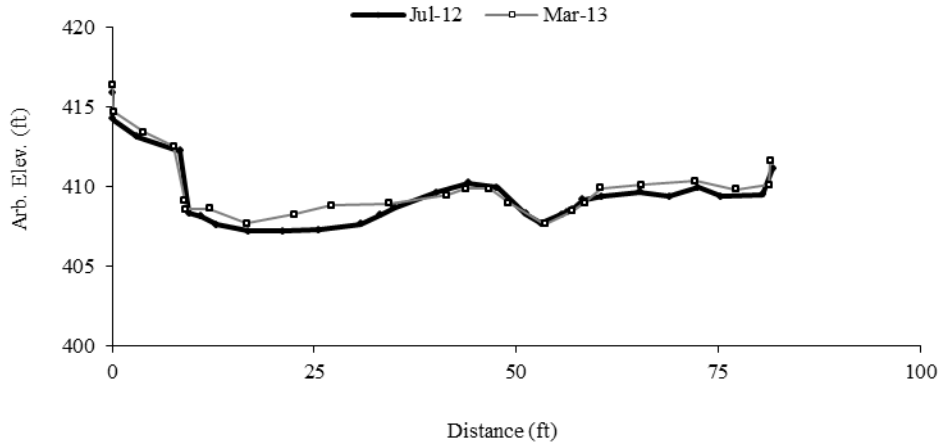


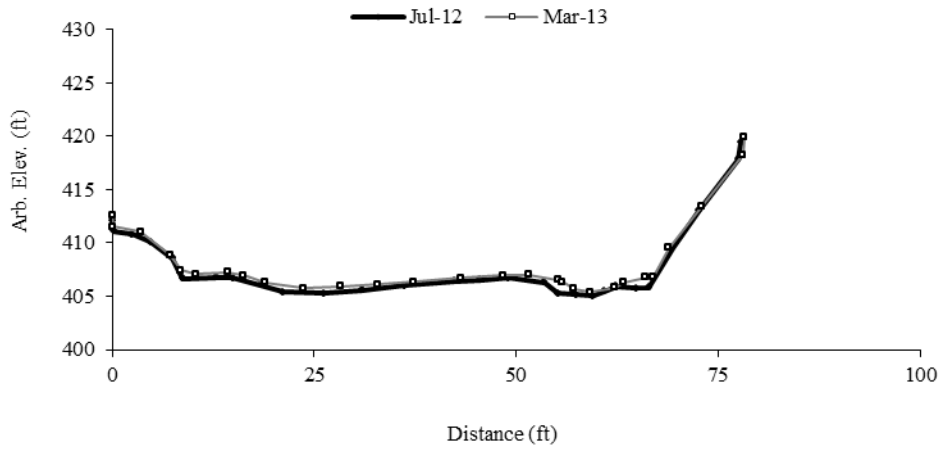
Cross Section – XS13



Cross Section – XS14



Cross Section – XS15



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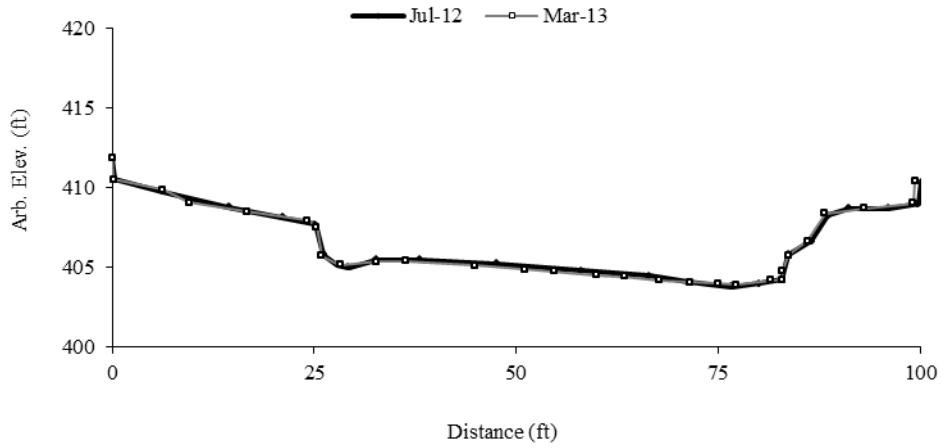
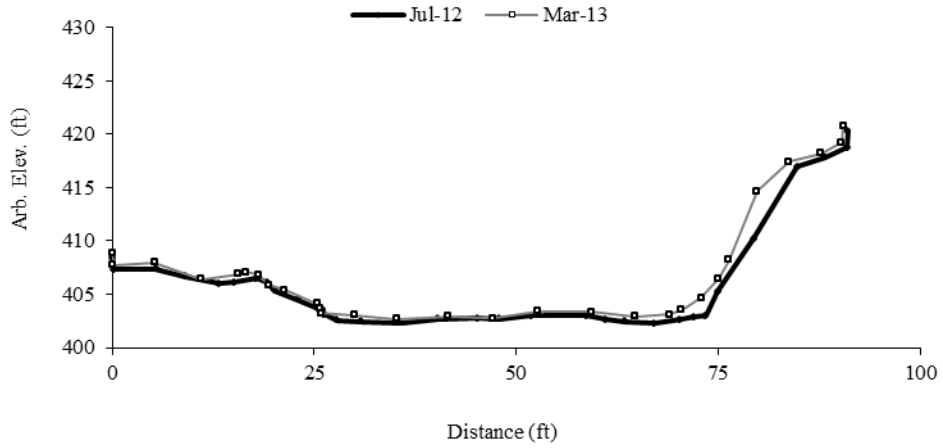


Cross Section – XS17



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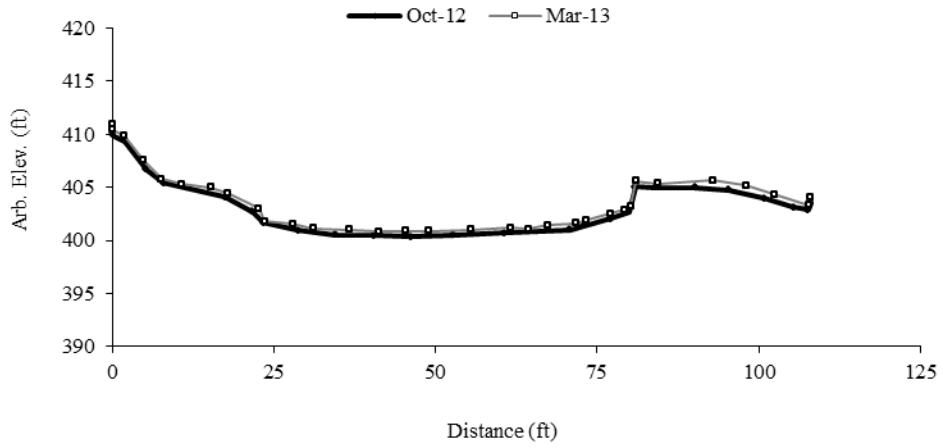
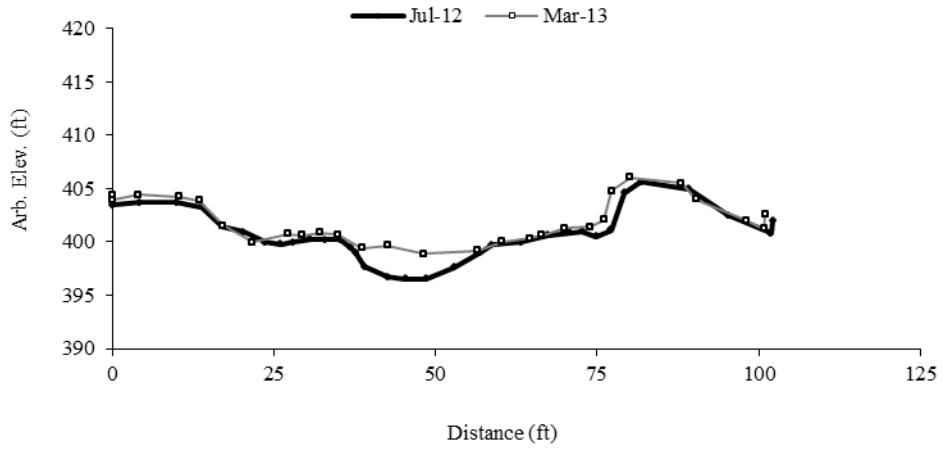


Cross Section – Site 4t XS



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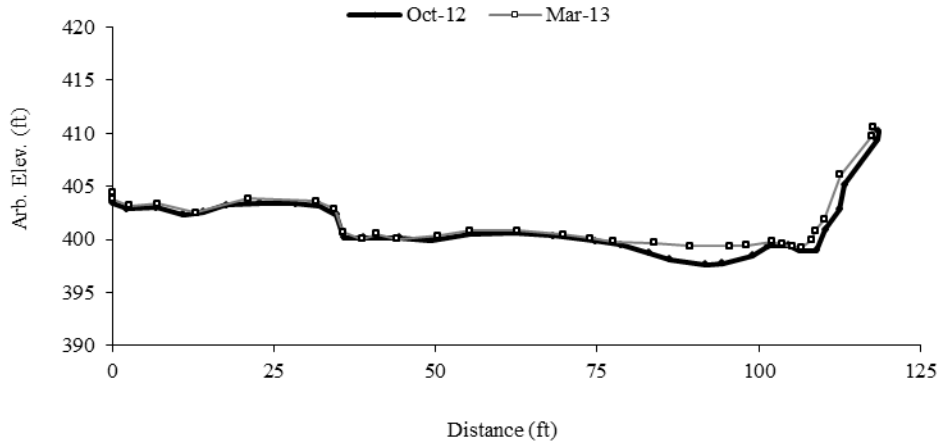
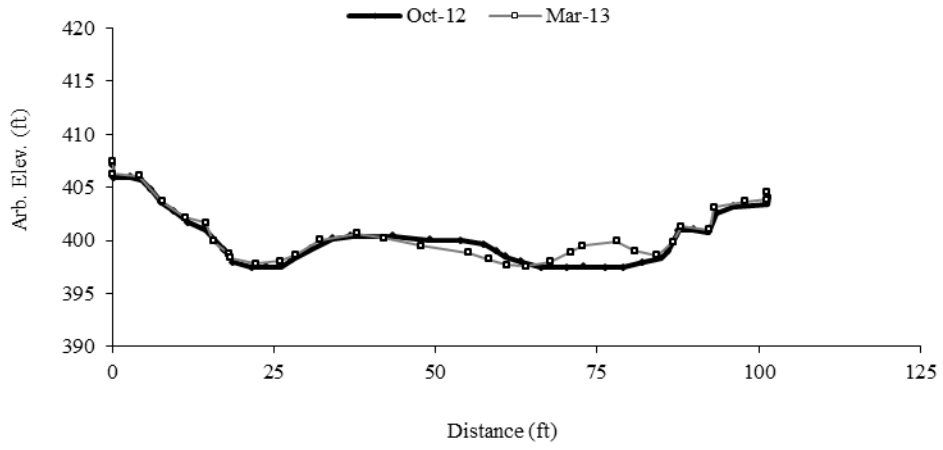
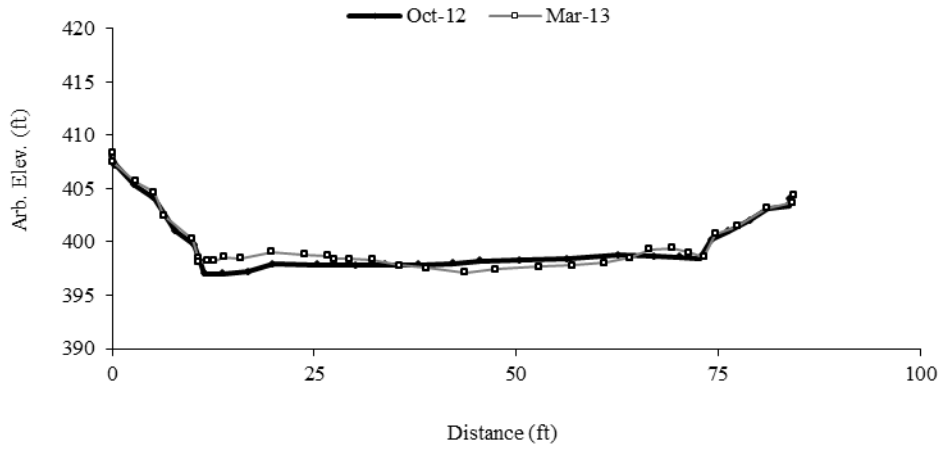


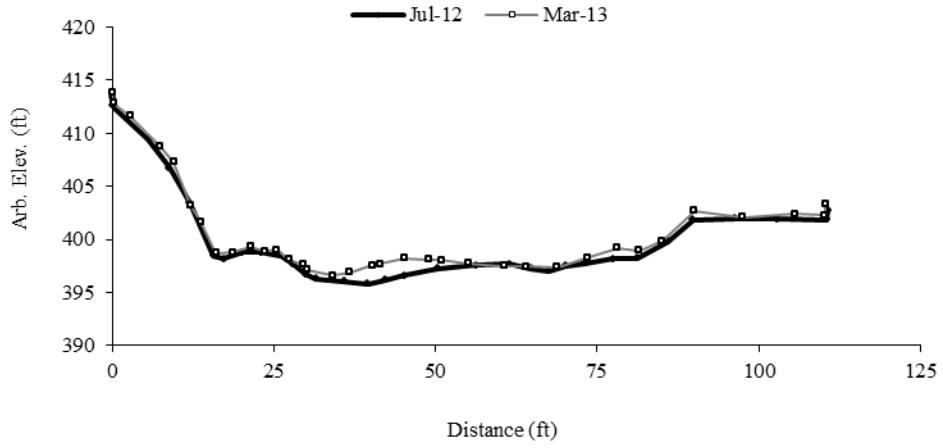
Cross Section – Site 5t XS



Cross Section – Site 5b XS



Cross Section – Site 5b XS



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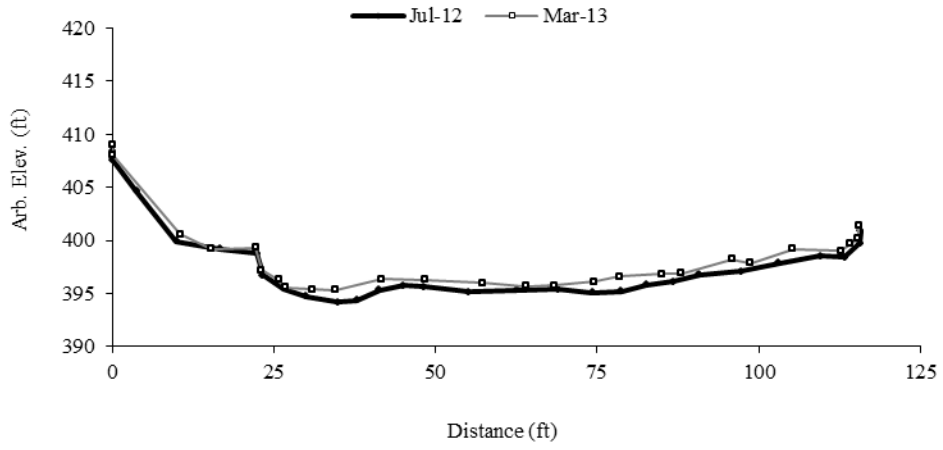
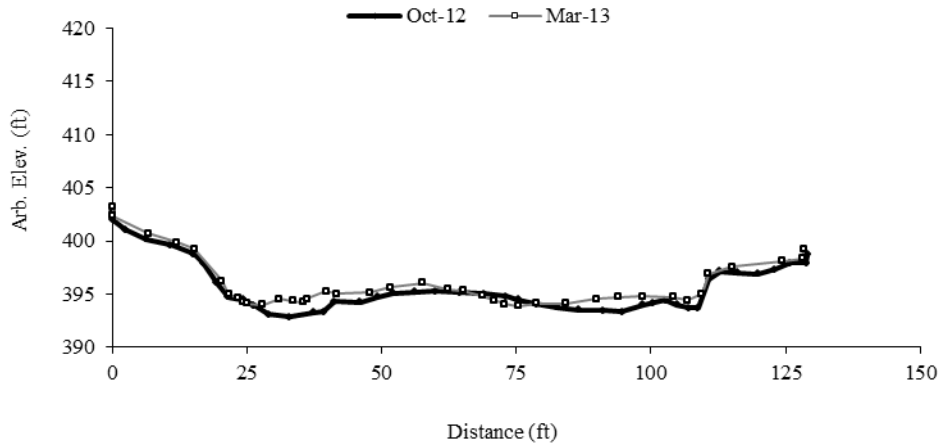
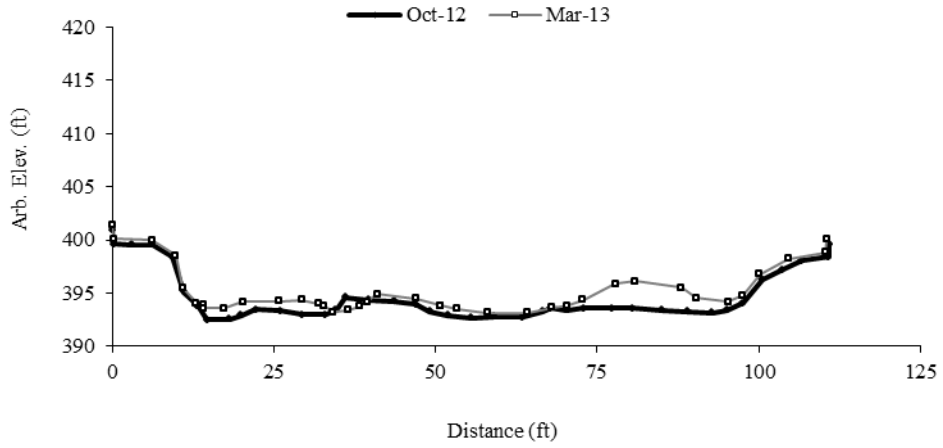


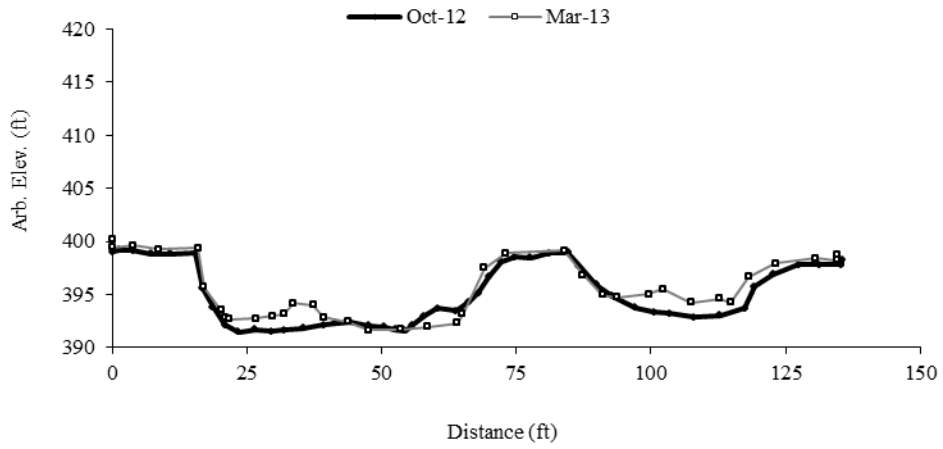
Cross Section – XS21



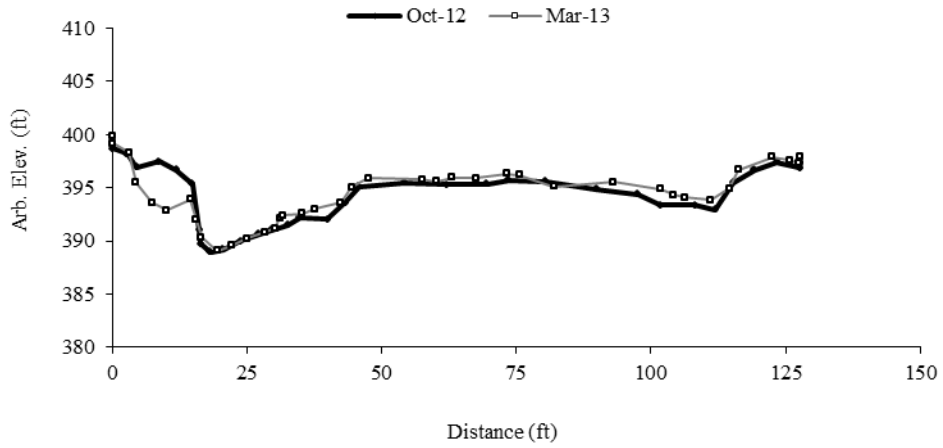
Cross Section – Site 7b XS



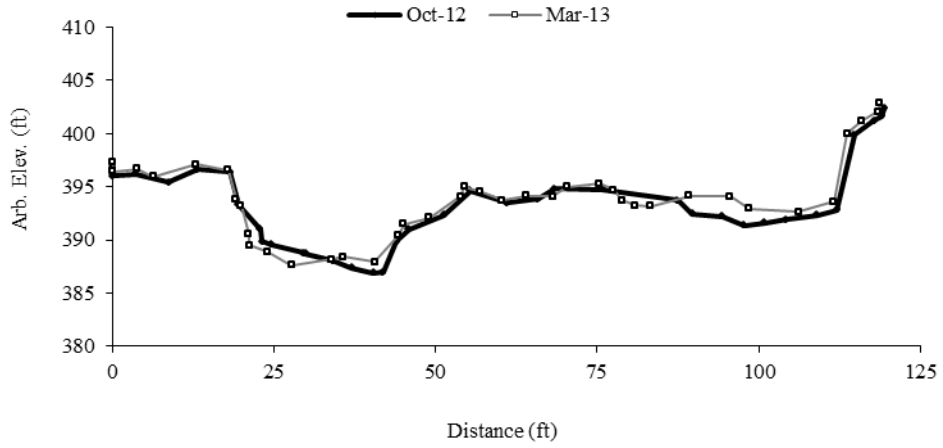
Cross Section – Site 8t XS



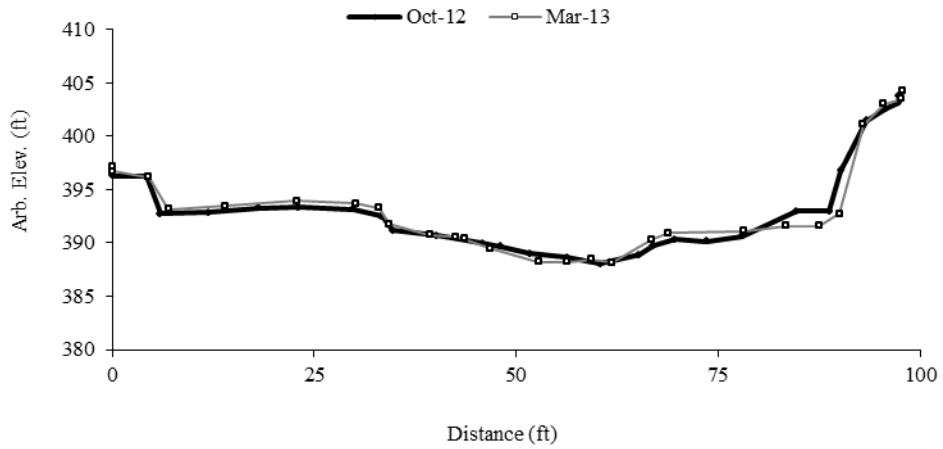
Cross Section – Site 8m XS



Cross Section – Site 8b XS



Cross Section – Site 9b XS



Cross Section – Site 10b XS

Appendix B. Photo-Monitoring of Constructed Wood Jams installed in Hunter Creek during summer 2012 – CDFW Project Reach (Grant Agreement # P1010527)

Left bank abutment jam - CDFW Site 1 - Photo-Site 1-1 (Top - 8/23/12; Bottom – 3/7/13)

a. b.

Bar apex jam - CDFW Site 4 – Photo-Site 2-1 (a - 08/11/12; b - 11/11/12; Bottom - 11/20/13)

a.  b. 

c.  d. 

CDFW Site 6 – Photo-Site 12-1 (08/21/12, 12/04/12, 12/11/12, 3/29/13)

a.  b. 

c.  d. 

CDFW Site 7 – Photo-Site 13-3 (08/21/12, 12/04/12, 12/11/12, 3/29/13)

a.  b. 

c.  d. 

CDFW Sites 8, 9 and 11 – Photo-Site 3-1 (a - 08/21/12, b - 12/04/12, c - 12/11/12, d - 3/29/13)

a.  b. 

c.  d. 

CDFW Site 8 – Photo-Site 3-2 (a - 08/21/12, b - 12/04/12, c - 12/11/12, d - 3/29/13)

a.  b. 

c.  d. 

CDFW Site 9 – Photo-Site 5-3 (a - 08/21/12, b - 12/04/12, c - 12/11/12, d - 3/29/13)

a.  b. 

c.  d. 

CDFW Site 10 – Photo-Site 4-1 (a - 08/21/12, b - 12/04/12, c - 12/11/12, d - 3/29/13)

a.  b. 

c.  d. 

CDFW Site 10 – Photo-Site 4-3 (a - 08/21/12, b - 12/04/12, c - 12/11/12, d - 3/29/13)

a.  b. 

c.  d. 

CDFW Site 11 – Photo-Site 9-1 (a - 08/21/12, b - 12/04/12, c - 12/11/12, d - 3/29/13)

a.  b. 

c.  d. 

CDFW Sites 12-13 – Photo-Site 7-1 (a - 08/21/12, b - 12/04/12, c - 12/11/12, d - 3/29/13)

a.  b. 

c.  d. 

CDFW Site 12 – Photo-Site 7-3 (a - 08/21/12, b - 12/04/12, c - 12/11/12, d - 3/29/13)

a.  b. 

c.  d. 

CDFW Site 13 – Photo-Site 6-1 (a - 08/21/12, b - 12/04/12, c - 12/11/12, d - 3/29/13)

CDFW Sites 11, 12, & 13 – Photo-Site 14-1