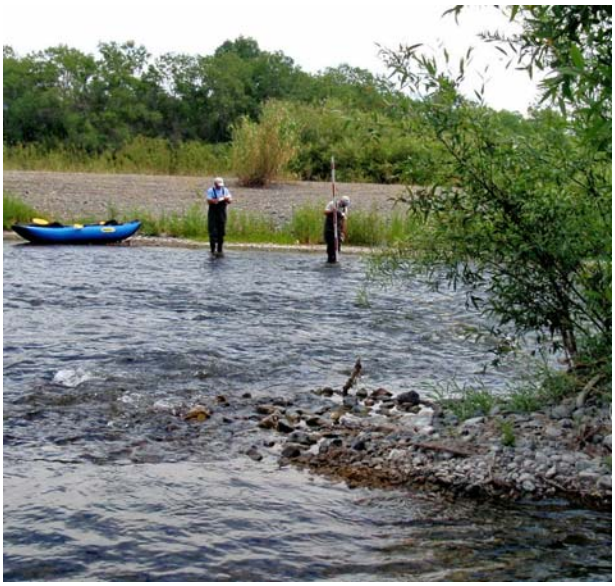
Appendix B-8

RESULTS OF THE FISHERIES MONITORING PLAN TO MEET STATE WATER RESOURCES CONTROL BOARD ORDER WR 2009 – 0034 EXEC



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Executive Summary

During summer and early fall 2009, Sonoma County Water Agency biologists conducted habitat, juvenile fish, and adult fish surveys in the mainstem Russian River to document the effects of flow reduction per State Board Order WR 2009 – 0034 EXEC. Sampling locations and methods were guided by a monitoring plan that was approved by the National Marine Fisheries Service and California Department of Fish and Game.

The timing of the flow reduction (early July to early October) occurred after most steelhead, coho salmon, and Chinook salmon smolts outmigrated to the ocean. Therefore, our data collection efforts during summer focused on rearing habitat for juvenile fish. We sought to document changes to physical habitat in seven reaches of the mainstem Russian River between Ukiah and Mirabel. Specific locations overlapped spatially with fish monitoring sites. Habitat surveys were conducted in June, before flow reduction, and in August when the Order was being implemented. Average wetted width, depth, and cross sectional area were measured at 179 transects in 63 discrete habitat units. Stream velocity was also measured at 21 habitat units.

Snorkeling using multiple divers in 500-m-long reaches was used to assess fish populations. A total of 12 sites were surveyed between August 17 and 25, 2009. Snorkel survey methods implemented during 2009 were similar to techniques used during a prior study in 2002. Eight of the survey sites sampled in 2002 were re-sampled in 2009 to allow comparisons between years.

Starting September 1, 2009, Chinook salmon presence in areas downstream and upstream of Mirabel Dam was evaluated by divers. These dive surveys were to continue until 200 adult Chinook salmon passed Mirabel Dam or until the Fisheries Monitoring Plan expired on October 2, 2009. During the early migration season, three lower River sites were sampled weekly, including Vacation Beach Dam, Johnson's Beach Dam, and Mirabel Dam. To assess potential habitat conditions at lower flow, a site at Geyserville was sampled every two weeks during the early season. After 200 salmon passed Mirabel Dam, effort was to shift to upstream sites at Mirabel Dam, Healdsburg Dam, Digger's Bend, and Geyserville. However, this sampling scheme was not implemented because 200 adult salmon did not pass Mirabel Dam prior to October 2, 2009. Water temperature, visibility, and dissolved oxygen were measured at each site.

During the June pre-flow reduction sampling period, discharge ranged from 115-187 cubic feet per second (cfs) and declined to 63-146 cfs in August. Overall, flow declined by an average of 33 cfs at the sampling reaches between the pre- and post flow reduction surveys. Flow reduction was most pronounced at three downstream sites above and below Healdsburg where flow declined between 41 and 74 cfs. In upstream reaches from Ukiah to Geyserville, average wetted width, depth, cross sectional area (width x depth), and velocity in pools and flatwater habitats generally changed little between surveys. Cross sectional area is a general measure of available living space for fish. In shallow riffle habitats, cross sectional area decreased by as much as 29 percent. In downstream reaches near Healdsburg, the cross sectional area of pool and flatwater habitats declined by 13 to 29 percent and by 20 to 40 percent in riffles.

A total of 16,384 fish of 13 species were counted during August dive surveys. Most of these fish consisted of native and non-native warm water species. Only 18 juvenile steelhead were detected at our 12 survey sites. These steelhead were found at artificial cascade habitats (Norgard Dam in Ukiah Valley and Healdsburg Dam at in Healdsburg), a boulder riffle in the Canyon Reach above Comminsky Station, and at the confluence of Dry Creek. The largest concentration of steelhead was observed at the Dry Creek confluence. In comparison to the eight sites previously sampled during 2002, there were 8 steelhead detected during 2009 and 788 steelhead during 2002.

Water visibility was poor in upper Ukiah Valley and was fair to good in reaches farther downstream. Water temperatures ranged from 16.0 degrees C in upper Ukiah Valley and gradually increased to 23.3 degrees C in Healdsburg. River water temperature below Dry Creek was 15.6 degrees C. All of the eight comparison study sites were 1-4 degrees C cooler in 2009 than in 2002.

Overall, steelhead abundance appeared to be very low during summer 2009 in the upper Russian River. Rearing steelhead were found in relatively large numbers in the Canyon Reach in summer 2002, but few were present this year even though water conditions in the Canyon Reach appeared suitable for steelhead rearing. In fact, water temperatures were cooler in 2009 than in 2002. The low abundance of rearing steelhead is most likely due to poor returns of adult spawners. Russian River steelhead hatchery returns were the lowest on record during winter 2008-2009.

No adult Chinook salmon were observed during fall dive surveys from September 1 to 29. There were likely few adult Chinook salmon migrating through the lower Russian River during September 2009. The Russian River estuary was closed from September 6 to October 5, preventing salmon from entering the river during the early migration season. The first salmon was recorded at the Mirabel Dam video counting station on October 7 after the estuary was breached. A supplemental dive survey was conducted on October 22, 2009 upstream of the Healdsburg dam and approximately 10 adult Chinook salmon were observed. As of November 21, more than 1,771 Chinook salmon have passed the video counting station.

TABLE OF CONTENTS

INTRODUCTION ……..….1

METHODS ……3

HABITAT SURVEYS……....…….....…...……..…..3

JUVENILE DIVE SURVEYS …….……...……4

ADULT CHINOOK DIVE SURVEYS ……..…..…4

VIDEO MONITORING ……5

RESULTS ……..5

HABITAT SURVEYS.....……..…...……..5

Ukiah Reach……..…….6
Comminsky Station Reach…….6
Cloverdale Reach……...7
Geyserville Reach……10
Diggers Bend Reach.……...10
Healdsburg Reach……11
Below Dry Creek Reach……..11
Summaries……12

JUVENILE STEELHEAD SURVEYS…….……...…….……12

ADULT CHINOOK SALMON SURVEYS……13

ADULT CHINOOK SALMON VIDEO MONITORING ……13

REFERENCES...……..20

LIST OF FIGURES

Figure 1. Study site and fish, habitat, and flow station locations……2

Figure 2. Cumulative proportion of Chinook salmon that passed Mirabel Inflatable Dam from 2000 to 2009.……19

LIST OF TABLES

Table 1. Daily average stream flows recorded at USGS stations near each of the seven habitat monitoring reaches ……5

Table 2. Overall cross sectional areas measured in pool, riffle and flatwater habitats at each of the seven study reaches, Pre and Post flow reduction surveys ……8

Table 3. Stream flows and average transect velocities measured in Pool, riffle, and Flatwater habitats Pre and Post flow reduction surveys……9

Table 4. Steelhead observations during summer 2002 and 2009 in the upper Russian River. Each site consisted of a 0.5 km river section. Location of Site C04 was slightly different between survey years. Site numbers correspond to Steelhead Distribution Study Report (Cook 2003)…….14

Table 5. Observations of non-salmonids during dive surveys from 2002 and 2009. Each site consisted of a 0.5 km section of river. Location of Sites C04 was slightly different in 2002 and 2009……..15

Table 6. Fish observations during early-fall Chinook salmon migration season 2009 in the lower Russian River……..17

Table 7. Weekly Chinook salmon counts at the Mirabel Dam video fish counting station, Russian River, 2000-2009....……18

LIST OF APPENDICES

Appendix A. Ukiah Reach Cross Sections - Pre and Post Flow Reduction Surveys……A-1

Appendix B. Comminsky Station Reach Cross Sections - Pre and Post Flow Reduction Surveys……..……..B-1

Appendix C. Cloverdale Reach Cross Sections - Pre and Post Flow Reduction Surveys……..…….C-1

Appendix D. Geyserville Reach Cross Sections - Pre and Post Flow Reduction Surveys……D-1

Appendix E. Diggers Bend Reach Cross Sections - Pre and Post Flow Reduction Surveys……E-1

Appendix F. Healdsburg Bend Reach Cross Sections - Pre and Post Flow Reduction Surveys……F-1

Appendix G. Below Dry Creek Reach Cross Sections - Pre and Post Flow Reduction Surveys……G-1

Appendix H. Average Widths, Depths and Cross Sectional Areas for each Habitat Unit at each of the Seven Reaches, Pre and Post Flow Reduction Surveys…….……..….H-1

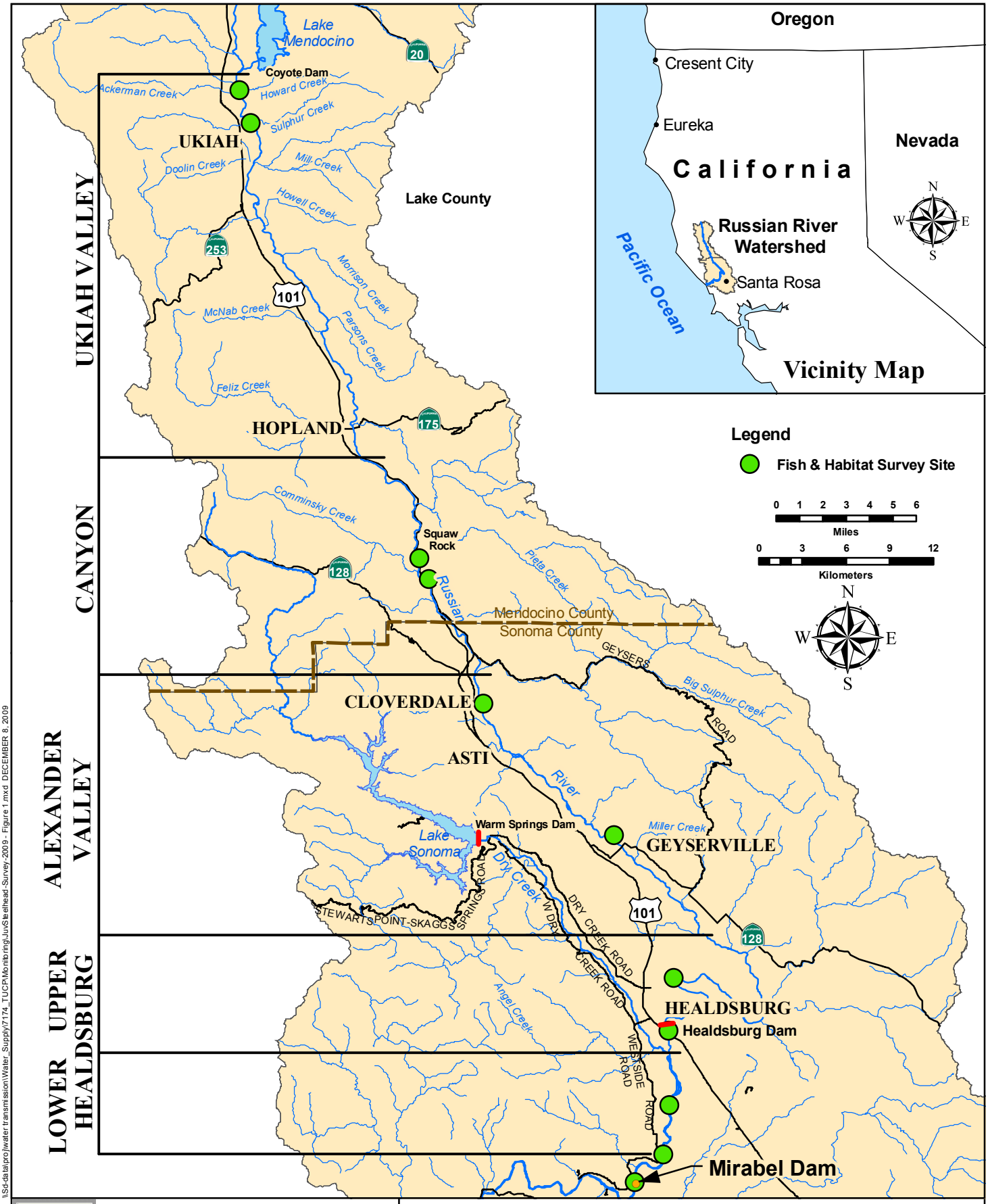
Appendix I. List of Transects excluded from Analysis……..I-1

INTRODUCTION

On April 6, 2009, the Sonoma County Water Agency filed a petition with the State Water Resources Control Board requesting a Temporary Urgency Change in the flow requirements for the Russian River. The request was made to prevent depletion of storage in Lake Mendocino which would severely impact threatened or endangered Russian River fish species, create serious water supply impacts in Mendocino County and in Sonoma County's Alexander Valley, and affect Lake Mendocino and Russian River recreation.

From April 6 through June 30, 2009, the Petition allowed instream flow requirements in the upper Russian River (from its confluence with the East Fork of the Russian River to its confluence with Dry Creek) to be reduced from 185 cubic feet per second (cfs) to 75 cfs, and the requirements for the lower Russian River (downstream of its confluence with Dry Creek) to be reduced from 125 cfs to 85 cfs. After July 1 through October 2, 2009, flows would be further reduced based on inflow to Lake Mendocino. If total inflow into Lake Mendocino was greater than or equal to 25,000 acre feet (AF), then flows would not be changed. However, if inflow into Lake Mendocino was less than the 25,000 AF a further reduction in the minimum instream flow requirements for the upper Russian River to 25 cfs (measured at Healdsburg) and 35 cfs in the lower River (measured at Hacienda Bridge) from July to October.

Species of concern during the period of reduced flow include rearing juvenile steelhead in the upper Russian River (primarily above Cloverdale), and native species such as Sacramento sucker, Sacramento pikeminnow, and Russian River tule perch. Juvenile salmonids emigrate to the ocean from approximately March through June (primarily mid-April through mid-May). Adult Chinook salmon are the earliest returning salmonids, migrating from approximately September through December, and may also have been affected by the reduction in flow. Reduced summer flows may impact fish through altering physical habitat. Reduced flows were anticipated to result in a reduction in stream width, depth, cross sectional area, and velocity. We sought to document changes to physical habitat and fish habitat use in five reaches of the mainstem Russian River between Ukiah and the upstream end of the Wohler Pool. Habitat sampling locations overlapped spatially with fish monitoring sites (Figure 1).



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SONOMA COUNTY WATER AGENCY

DISCLAIMER

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Figure 1

Fish and Habitat Monitoring Locations

METHODS

HABITAT SURVEYS

The River between Ukiah and the Wohler Pool was divided into five segments based on features of the river channel. Physical habitat data were collected to characterize the fish sampling sites and to assess changes associated with a reduction in summer stream flow. The fish sampling sites in the Ukiah Valley, Canyon, and Dry Creek to Wohler reaches are in close proximity, and a single habitat monitoring reach was surveyed to assess the effects of a reduction in stream flow. In the Alexander Valley and Healdsburg reaches, the fish sampling sites were spatially isolated, and two habitat monitoring reaches were measured. In all, physical data were collected at seven reaches in 63 distinct habitat units.

Primary habitat types in Russian River are pool, riffle, and flatwater (runs and glides). Although each of the major habitat types can be subdivided into several categories (e.g., main channel and corner pools, high and low gradient riffles, etc.), the larger categories (pool, riffle, flatwater) were deemed sufficient to assess overall changes to physical habitat resulting from a reduction in flow. Definitions of the three habitat types followed standard protocols (following Flosi et al. 1998 and Bisson et al. 1982).

Within each reach, physical data were collected on 3 pools, 3 riffles, and 3 flatwaters. Habitat selection began at the upstream end of each fish sampling site and progressed downstream until the required units were measured. At all sampling locations, the physical habitat monitoring extended beyond the 500-meter-long fish sampling stations.

The length of each habitat unit was measured using a laser range finder. Transects were established at intervals to capture the average width, depth, cross sectional area, velocity profiles, and shelter rating of each unit. Each site was marked with GPS and flagged. In most habitat units, physical data were collected at two to three transects in riffles, three transects in flatwaters, and four transects in pools. Transects were evenly spaced throughout the length of the habitat unit (10%, 25%, 50%, and 75% for pools; 25%, 50%, and 75% for flatwaters and most riffles; and at 33% and 66% for the short riffles with two measured transects).

At each transect, a calibrated measuring tape was stretched across the river and attached with clamps to rebar driven into the streambanks perpendicular to the flow. The wetted width of each transect was recorded, and depth and shelter rating (see below) were recorded at 3 foot intervals. Stream velocities were collected at the 50 percent transect (middle of the unit) within riffle and flatwater habitats, and from at the 10 percent transect (upstream end) in pools. Velocity measurements were recorded at three foot intervals at 60 percent of the total depth for each cell measured.

Permanent photo stations were established at each habitat unit. At each transect, photos were taken looking upstream, downstream, and across the transect. In addition, a photo was taken from mid-channel at the upstream end of each habitat unit measured. Photos were taken from river right for consistency. Photo monitoring stations were marked using GPS.

Instream shelter within each habitat unit was rated according to the Department of Fish and Game *California Salmonid Stream Habitat Restoration Manual (*Flosi et al. 1998). Instream shelter was rated based on the percentage cover provided by boulders, large woody debris, overhanging vegetation, etc. The upper Russian River provides habitat for approximately 15 native species. Since many of these species have different habitat requirements, it was impractical to establish a standardized rating system to assess cover. However, this qualitative rating system described changes to the percentage of overall cover within each habitat type. Habitat ratings were recoded at three foot increments.

JUVENILE DIVE SURVEYS

Survey methods implemented during 2009 were similar to techniques used during a 2002 study (Cook 2003). A total of 12 sites were surveyed between August 17 and 25, 2009 (Figure 1). Eight of the survey sites sampled in 2002 were re-sampled in 2009 to allow comparisons between years. Each survey reach was 500 m long. A dive survey started at the lower end of the study site and divers visually searched for fish in an upstream direction. To increase the accuracy of fish counts, each reach was partitioned into three dive lanes. All fish observed during surveys were identified to species when feasible. Several species of native minnows (family Cyprinidae) have similar characteristics and can be difficult to identify underwater. These fish were grouped as "cyprinids" and consisted of mostly juvenile fish. Fish were grouped into three size classes (<100 mm TL, 101-300 mm TL, and >300 mm TL). In general, steelhead <100 mm TL are young-of-the-year, fish 101-300 mm in length are age 1-2, and fish greater than 300 mm are age 3+. At the end of a survey, fish data from all divers was recorded on a data form for each site. In addition, water temperature, transparency (Secchi depth), and dissolved oxygen was recorded.

ADULT CHINOOK DIVE SURVEYS

Starting September 1, 2009, Chinook salmon presence in areas downstream and upstream of the Mirabel Dam was evaluated by divers. These dive surveys were to continue until 200 adult Chinook salmon passed Mirabel Dam or until the Fisheries Monitoring Plan expired on October 2, 2009. During the early migration season three lower River sites were sampled weekly, including Vacation Beach Dam, Johnson's Beach Dam, and Mirabel Dam. To assess potential habitat conditions at lower flow, a site at Geyserville (pool above Highway 128 Bridge) was sampled every two weeks during the early season. After 200 salmon passed Mirabel Dam, effort would shift to upstream sites at Mirabel Dam, Healdsburg Dam, Digger's Bend, and Geyserville. However, this sampling scheme was not implemented because 200 adult salmon did not pass Mirabel Dam prior to October 2, 2009. Dive surveys were conducted similar to the summer 2009 Juvenile Steelhead Monitoring. Fish were identified to species and grouped into size categories. Water temperature, visibility, and dissolved oxygen were measured at each site.

VIDEO MONITORING

Two video monitoring stations have been operated at the upstream ends of the fish ladders at the Mirabel Inflatable Dam since 2000. The video monitoring stations are operated from approximately August 15 of each year until the dam is deflated with the onset of heavy rains (typically mid-November to mid-January). The video monitoring stations provide information on anadromous fish passage during this time frame. The data collected to date indicates that the Russian River supports a self-sustaining run of Chinook salmon. Steelhead typically migrate after the dam is deflated, therefore no estimates of their abundance are available.

RESULTS

HABITAT SURVEYS

Physical measurements were collected in seven reaches along the Russian River between the City of Ukiah and the Wohler Pool (Figure 1). At these seven reaches, a total of 63 habitat units were measured, including 204 transects (82 pools, 59 riffles, and 63 flatwaters). Although each transect was marked with flagging and GPS coordinates were recorded for each transect, in some cases individual transects could not be relocated exactly (or the channel configuration had changed substantially between surveys). As a conservative approach, we excluded transects where the Pre and Post flow reduction contour data did not follow the same general pattern. In all, we excluded 25 transects. The analysis used for this report includes data for 179 individual transects (73 pools, 49 riffles, and 57 flatwaters habitats). Graphs of cross sectional areas for each transect analyzed are presented in Appendices A-G. Measured widths, depths, and cross sectional areas for each transect are presented in Appendix H. Appendix I lists transects excluded from the analysis (however, graphs of all transects are included in the appropriate appendices). Photographs were taken at all transect stations during Pre- and Post flow reduction surveys and are available on CD.

Actual flow releases in the upper Russian River were maintained above the minimum levels set by the TUCP. Flows were essentially unchanged in the upper (Ukiah) Reach, and were reduced by about 13 to 20 cfs at the three middle reaches (Comminsky Station, Cloverdale, and Geyserville reaches). At the three lower reaches (Digger's Bend, Healdsburg, and Below Dry Creek), flow reductions were on the order of 69 to 74 cfs (Table 1).

Table 1. Daily average stream flows recorded at USGS stations near each of the seven habitat monitoring reaches.

Reach	Pre-flows	Post flows
Ukiah	106 – 118	115
Comminsky Station	123	103
Cloverdale	110	93
Geyserville	106	93
Digger's Bend	138	64
Healdsburg	132	63
Below Dry Creek	187 – 213	146 - 182

Data were collected over approximately 70 miles of river at 179 separate transects. Changes to the river channel between the sampling events, or a slight adjustment in the location of transects between surveys could introduce error into the measurements. A reduction in stream flow would be expected to result in a narrower, shallower river with lower water velocities. While this was often the case, in some instances, a reduction in flow resulted in an increase in the calculated average stream depth. Some habitat types, riffles and flatwaters in particular, had extensive areas of very shallow water. A reduction in stream flow and the corresponding reduction in the water surface elevation dewatered extensive shallow areas. The removal of these shallow areas resulted in an overall increase in the average depth across transects. Similarly, a reduction in flow may appear to increase the overall stream velocity by reducing the amounts of low velocity habitat across an individual transect. Width measurements were based on the "wetted width" which could also result in small differences in measures between the Pre- and Post surveys. Channel geomorphology also influences how changing stream flow affects available habitat, with wide shallow channels being more susceptible to changes in flow compared to narrow, deep channels. The following is a description of habitat changes in each reach.

Ukiah Reach

Pools: Stream flow increased by 4.0 to 9.0 cfs at the three Pool sites between the Pre- and Post surveys. Overall, average pool widths decreased from 58.3 to 57.0 ft (1.3 ft) and average depths decreased from 3.5 to 3.4 ft (0.1 ft). Cross sectional areas decreased from 164.2 to 158.5 ft^2 (2.0 percent reduction in potential living space) (Table 2).

Riffles: Stream flow decreased by 3.0 cfs at Riffles habitats 1 and 2, and increased by 4.0 cfs at Riffle 3 between the Pre- and Post flow reduction surveys. Overall, average widths decreased from 57.1 to 56.6 ft (0.5 ft) and average depths were unchanged (1.0 ft Pre- and Post surveys. Cross sectional areas increase, on average, from 50.9 to 52.0 ft^2 (2.0 percent increase in potential living space) (Table 2). Average cross sectional velocities decreased from 1.41 to 1.06 feet per second (fps) between the Pre- and Post surveys (Table 3).

Flatwaters: Stream flow decreased by 3.0 cfs at Flatwater 1 (only one transect included in the analysis), and increased by 4.0 cfs at Flatwaters 2 and 3 between the Pre- and Post flow reduction surveys. Overall, average widths increased between the two surveys from 48.7 to 49.6 ft (0.9 ft) and average depths decreased from 2.0 to 1.9 ft (0.1 ft). Cross sectional areas in Flatwaters 2 and 3 were measured to increase from 86.8 to 90.6 ft^2 (2.8 percent increase in potential living space) (Table 2).

Comminsky Station Reach

Pools: Stream flow decreased from 123 to 103 cfs (20 cfs) at Pool habitats between the Pre- and Post flow reduction surveys. Overall, average widths were measured to increase from 89.0 to 90.1 ft (1.1 ft) and depths decreased from 3.8 to 3.6 ft (0.2 ft). Cross sectional areas were measured to decrease from 308.1 to 297.8 ft^2 (3.3 percent decrease in potential living space) (Table 2). Average cross sectional velocities decreased from

0.51 to 0.33 fps between the Pre- and Post surveys (Table 3).

Riffles: Stream flow decreased from 123 to 103 cfs (20 cfs) at Riffle habitats between the Pre- and Post flow reduction surveys. Overall, widths decreased from 65.1 to 64.9 ft (0.2 ft) and depths decreased from 1.2 to 1.1 ft (0.1 ft). Cross sectional areas in riffles were measured to decrease from 65.2 to 58.3 ft^2 (10.6 percent decrease in potential living space) (Table 2). Average cross sectional velocities decreased from 1.62 to 1.40 fps between the Pre- and Post surveys (Table 3).

Flatwaters: Stream flows decreased from 123 to 103 cfs (20 cfs) at Flatwater habitats between the Pre- and Post flow reduction surveys. Although flow releases decreased by 20 cfs between the Pre- and Post surveys, average stream widths were measured to increase slightly, from 68.1 to 69.3 ft (0.8 ft). Average depths were measured to decrease from 2.0 to 1.9 ft (0.1 ft). Cross sectional area decreased from 144.5 to 133.5 ft^2 (7.6 percent reduction in potential living space) (Table 2). Average cross sectional velocities increased from 0.23 to 0.34 fps between the Pre- and Post surveys.

Cloverdale Reach

Pool: Stream flow decreased from 110 to 93 cfs (17 cfs) at Pool habitats between the Pre- and Post flow reduction surveys. Overall, average widths decreased from 77.3 to 74.0 ft (3.3 ft), and average depths were unchanged at 2.4 ft Pre- and Post surveys. Cross sectional areas in Pools were measured to decrease from 169.7 to 161.5 ft^2 (3.8 percent decrease in potential living space) (Table 2). Average cross section velocities were unchanged between the Pre- and Post surveys at 0.55 fps, respectively (Table 3).

Riffles: Stream flow decreased from 110 to 93 cfs (17 cfs) riffle habitats. Overall, widths were essentially unchanged (92.9 ft) and depths decreased from 1.1 to 0.9 ft (0.2) between the Pre- and Post flow reduction surveys. Cross sectional areas in riffles decrease from 67.2 to 55.1 ft^2 (18.0 percent decrease in potential living space) (Table 2). Average cross section velocities decreased from 1.42 and 0.46 fps, between the Pre- and Post flow reduction surveys (Table 3).

Flatwaters: Stream flow decreased from 110 to 93 cfs (17 cfs) at Flatwater habitats between the Pre- and Post flow reduction surveys. Overall, widths decreased from 91.3 to 90.4 ft (0.9 ft), and depths decreased from 1.4 to 1.3 ft (0.1 ft). Cross sectional areas in flatwaters were measured to decrease from 120.9 to 110.1 ft (8.9 percent decrease in potential living space) (Table 2). Average cross section velocities decreased from 0.71 and 0.54 fps between the Pre- and Post flow reduction surveys (Table 3).

Table 2. Overall cross sectional areas measured in pool, riffle and flatwater habitats at each of the seven study reaches, Pre- and Post Flow reductions.

Pools					
		Cross Sectional Area			
Reach	**Average Change in flow (cfs)**	**Pre- (ft^2) (June)**	**Post (ft^2) (August)**	**Difference (ft^2)**	**% Change**
Ukiah	+6	164.2	158.5	-5.7	-2.0%
Comminsky	-20	308.1	297.8	-10.3	-3.3%
Cloverdale	-17	167.9	161.5	-11.0	-3.8%
Geyserville	-13	165.4	150.7	-14.7	-8.9%
Digger's Bend	-74	357.4	344.2	-13.2	-6.1%
Healdsburg	-69	278.1	246.8	31.3	-13.2%
Below Dry Creek	-48	234.6	231.3	-3.4	-0.2%
Riffles					
		Cross Sectional Area			
Reach	**Average Change in flow (cfs)**	**Pre- (ft^2) (June)**	**Post (ft^2) (August)**	**Difference (ft^2)**	**% Change**
Ukiah	-1	50.9	52.0	+1.1	+2.0%
Comminsky	-20	65.2	58.3	-6.9	-10.6%
Cloverdale	-17	67.2	55.1	-12.1	-18.0%
Geyserville	-13	50.9	36.0	-14.9	-29.2%
Digger's Bend	-74	75.9	45.8	-30.1	-39.6%
Healdsburg	-69	55.1	35.3	-19.9	-36.0%
Below Dry Creek	-72	85.1	67.5	-17.6	-20.7%
Flatwaters					
		Cross Sectional Area			
Reach	**Average Change in flow (cfs)**	**Pre- (ft^2) (June)**	**Post (ft^2) (August)**	**Difference (ft^2)**	**% Change**
Ukiah	-2	86.8	90.6	+3.8	+2.8%
Comminsky	-20	144.5	133.5	-11.0	-7.6%
Cloverdale	-17	120.9	110.1	-15.3	-8.9%
Geyserville	-13	109.1	91.0	-18.1	-16.6%
Digger's Bend	-74	161.1	133.4	-27.7	-17.2%
Healdsburg	-69	94.4	70.5	-23.9	-24.6%
Below Dry Creek	-72	144.3	128.5	-15.8	-11.0%

Table 3. Stream flows and average transect velocities measured in Pool, Riffle, and Flatwater habitats Pre- and Post flow reduction.

Transect	Stream Flow (cfs)			Average Transect Velocity (fps)		
	Pre-	Post	Change	Pre-	Post	Change
Ukiah Reach						
Pool 1, T-1	111	115	+4	N/A		
Riffle 1, T-2	118	115	-3	1.41	1.06	0.35
Flatwater 1, T-2	111	115	+4	N/A		
Comminsky Station Reach						
Pool 1, T-1	123	103	-20	0.51	0.33	-0.18
Riffle 1, T-2	123	103	-20	1.62	1.40	-0.22
Flatwater 1, T-2	123	103	-20	0.23	0.34	+0.11
Cloverdale Reach						
Pool 1, T-1	110	93	-17	0.55	0.55	0.00
Riffle 1, T-2	110	93	-17	1.42	0.46	-0.96
Flatwater 1, T-2	110	93	-17	0.71	0.54	-0.17
Geyserville Reach						
Pool 1, T-1	106	93	-13	0.63	0.26	-0.37
Riffle 1, T-2	106	93	-13	1.99	1.30	-0.69
Flatwater 1, T-2	106	93	-13	0.84	0.56	-0.28
Digger's Bend Reach						
Pool 1, T-1	138	64	-74	1.30	0.7	-0.60
Riffle 1, T-2	138	64	-74	1.66	1.3	-0.36
Flatwater 1, T-2	138	64	-74	0.94	0.86	-0.08
Healdsburg Reach						
Pool 1, T-1	132	63	-69	0.72	0.5	-0.22
Riffle 1, T-2	132	63	-69	1.99	1.47	-0.52
Flatwater 1, T-2	132	63	-69	1.32	0.93	-0.39
Below Dry Creek Reach						
Pool 1, T-1	187	146	41	0.84	0.81	-0.03
Riffle 1, T-2	218	146	72	2.13	2.15	+0.02
Flatwater 1, T-2	218	146	72	1.18	0.98	-0.20

Geyserville Reach

Pool: Stream flow decreased from 106 to 93 cfs (13 cfs) at Pool habitats between the Pre- and Post flow reduction surveys. Overall, widths decreased from 70.8 to 68.1 ft (2.7 ft), and depths decreased from 2.5 to 2.4 ft (0.1 ft). Cross sectional areas in Pools were measured to decrease from 165.4 to 150.7 ft^2 (8.9 percent decrease in potential living area) (Table 2). Average cross sectional velocities decreased from 0.63 to 0.26 fps (Table 3).

Riffles: Stream flow decreased from 106 to 93 cfs (13 cfs) at Riffle habitats between the Pre- and Post flow reduction surveys. Average widths decreased from 54.0 to 48.4 ft (5.6 ft) and depths decreased from 1.0 to 0.8 ft (0.2 ft). Cross sectional areas in riffles decrease from 50.9 to 36.0 ft^2 (29.2 percent decrease in potential living space) (Table 2). Average cross sectional velocities decreased from 1.99 to 1.30 fps (Table 3).

Flatwaters: Stream flow decreased from 106 to 93 cfs (13 cfs) at Flatwater habitats between the Pre- and Post flow reduction surveys. Overall, widths decreased from 61.6 to 57.6 ft (4.0 ft) and depths decreased from 1.8 to 1.6 ft (0.2 ft). Cross sectional areas in flatwaters decrease from 109.1 to 91.0 ft^2 (16.6 percent decrease in potential living space) (Table 2). Average cross sectional velocities decreased from 0.84 to 0.56 fps (Table 3).

Digger's Bend Reach

Pools: Stream flow decreased from 138 to 64 (74 cfs) at Pool habitats between the Pre- and Post flow reduction surveys. Overall, widths decreased from 88.2 to 86.3 ft (1.9 ft), and depths decreased from 4.1 to 4.0 ft (0.1 ft). Cross sectional areas in Pools were measured to decrease from 357.4 to 344.2 ft^2 (6.1 percent reduction in potential living space) (Table 2). Average cross sectional velocities decreased from 1.30 to 0.70 fps (Table 3).

Riffles: Stream flow decreased from 138 to 64 (74 cfs) at riffle habitats between the Pre- and Post flow reduction surveys. Transect widths decreased from 91.3 to 83.6 ft (7.7 ft), and depths decreased from 0.9 to 0.6 ft (0.3 ft). Cross sectional areas in riffles were measured to decrease from 75.9 to 45.8 ft^2 (39.6 percent reduction in potential living space) (Table 2). Average cross sectional velocities decreased from 170 to 1.30 fps (Table 3).

Flatwaters: Stream flow decreased from 138 to 64 (74 cfs) at Flatwater habitats between the Pre- and Post flow reduction surveys. Transect widths decreased from 81.2 to 76.5 ft (4.7 ft) and transect depths decreased from 2.0 to 1.8 ft (0.2 ft). Cross sectional areas were measured to decrease from 161.1 to 133.4 ft^2 (18.1 percent reduction in potential living space) (Table 2). Average cross sectional velocities decreased from 0.94 to 0.86 fps (Table 3).

Healdsburg Reach.

Pools: Stream flow decreased from 132 to 63 cfs (69 cfs) at Pool habitats between the Pre- and Post flow reduction surveys. Overall, widths decreased from 102.9 to 98.2 ft (4.8 ft) and average transect depths decreased from 2.9 to 2.6 ft (0.3 ft). Cross sectional areas in Pool transects were measured to decrease from 278.1 to 246.8 ft^2 (13.2 percent reduction in potential living space) (Table 2). Average velocities decreased from 0.72 to 0.50 fps (Table 3).

Riffles: Stream flow decreased from 132 to 63 cfs (69 cfs) at riffle habitats between the Pre- and Post flow reduction surveys. Widths decreased from 47.2 to 43.0 ft (4.2 ft) and average transect depths decreased from 1.2 to 0.9 ft (0.3 ft). Cross sectional areas in riffles were measured to decrease from 55.1 to 35.3 ft^2 (36.0 percent reduction in potential living space) (Table 2). Average cross sectional velocities decreased from 1.99 to 1.47 fps (Table 3).

Flatwaters: Stream flow decreased by 69 cfs at Flatwater habitats between the Pre- and Post flow reduction surveys. Overall, transect widths decreased from 73.9 to 71.0 ft (2.9 ft), and average depths decreased from 1.2 to 0.9 ft (0.3 ft). Cross sectional areas in Flatwater habitats were measured to decrease from 94.4 to 70.5 ft^2 (24.6 percent decrease in potential living space) (Table 2). Average cross sectional velocities decreased from 1.32 to 0.93 fps (Table 3).

Below Dry Creek Reach

Pools: Stream flow decreased by 41 to 52 cfs at Pool habitats between the Pre- and Post flow reduction surveys. Overall, widths decreased from 71.9 to 69.6 ft (2.3 ft) and depths decreased from 3.6 to 3.5 ft (0.1 ft). Cross sectional areas in Pools were measured to decrease from 234.6 to 231.3 ft^2 (0.2 percent decrease in potential living space) (Table 2). Average cross sectional velocities decreased from 0.84 to 0.81 fps (Table 3).

Riffles: Stream flow decreased 72 cfs between the Pre- and Post flow reduction surveys at Riffle 1. Transect widths and depths in Riffle 1 decreased from 74.7 to 70.3 ft (4.3 ft) and average depth decreased from 1.2 to 1.0 ft (0.2 ft) between the two surveys. Cross sectional area at the three transects measured in Riffle 1 decreased from 85.1 to 67.5 (20.7 percent reduction in potential living space) (Table 2). Average cross sectional velocities increased from 2.13 to 2.15 fps (Table 3).

Stream flow decreased 36 cfs between the Pre- and Post surveys at Riffle 2. Measured width at Transect 2 decreased from 86 to 80 ft, and the average depth did not change (0.9 ft) between the two surveys. Cross sectional area decreased from 76.0 to 70.0 ft^2 (5.3 percent reduction in potential living space).

Stream flow decreased 5 cfs between the Pre- and Post surveys At Riffle 3. Width at the two transects decreased 19.0 and 3.0 feet respectively. Average depth was measured to increase by 0.2 cfs at one transect (a case of very shallow water habitat being lost) and remained unchanged at the other transect. Cross sectional area decreased by 7.6 and 9.5 percent at the two transects.

Flatwaters: Stream flow decreased 72 cfs at Flatwaters 1 and 2, and by five cfs at Flatwater 3. Overall, transect widths at Flatwaters 1 and 2 decreased from 84.2 to 79.8 ft (4.3 feet), and depths decreased from 1.2 to 1.0 ft (0.2 ft). Cross sectional areas decreased by an average of 144.3 to 128.5 ft^2 (11.0 percent decrease in potential living space). Widths, depths, and cross sectional area at Flatwater 3 reacted similarly to those measured in Flatwaters 1 and 2. Widths and depths decreased on average by 5.3 and 0.2 ft, respectively, and the cross sectional area decreased by 12.5 percent. Average cross sectional velocities decreased from 1.18 to 0.98 fps (Table 3).

SUMMARY

Flows were essentially unchanged in the Ukiah Reach, declined by approximately 15 percent in the middle reaches (13 to 20 cfs), and declined by approximately 47 to 65 percent in the lower reaches (69 to 74 cfs). Overall, a reduction in stream flow resulted in a slight decrease in stream widths and depths, and an overall reduction in stream velocities. Of the variables measured, cross sectional area appeared to be the most descriptive in terms of assessing the affects of reduced stream flow on physical habitat. Flow velocities were highly variable and were influenced by channel geomorphology. Cover changed little with a reduction in flow. Cover was found primarily in relatively deep areas that were not subject to large changes in stream width over the range of stream flow reductions observed during this study. Deeper pool habitats changed little despite the reduction in flow. Shallower habitats were susceptible to change and in some instances the amount of available living space in riffles and flatwaters was reduced by approximately 40 percent.

Stream flows in the Ukiah Reach were essentially unchanged between the Pre- and Post surveys (±9 cfs) and measured cross sectional areas in pools, riffles, and flatwaters changed by ±2.8 percent between the Pre- and Post surveys. Since flows were essentially unchanged in this reach of the river, the data collected likely reflect the inherent error associated with this sampling program. Overall, the change in the percent cross sectional areas between the two surveys suggest that this error was likely on the order of 3percent for all habitat types.

JUVENILE STEELHEAD DIVE SURVEYS

A total of 16,384 fish were observed during summer dive surveys consisting of 13 species (Tables 1 and 2). Most of these fish consisted of native and non-native warm water species. Only 18 juvenile steelhead were detected at our 12 survey sites. Steelhead were found at artificial cascade habitats (Norgard Dam in Ukiah Valley and Healdsburg Dam at in Healdsburg), a boulder riffle in the Canyon Reach above Comminsky Station, and at the confluence of Dry Creek. The largest concentration of steelhead, 10 fish, was observed at the Dry Creek confluence. In comparison to the eight sites previously sampled during 2002, eight steelhead were detected during 2009 and 788 steelhead were found during 2002 (Table 4).

Water visibility and temperature conditions for steelhead were poor to good during 2009

surveys (Table 1). Water visibility was poor (<1 m) in upper Ukiah Valley and was fair to good (> 2 m) at lower reaches. Water temperatures ranged from 16.0 C in upper Ukiah Valley and gradually increased to 23.3 C in Healdsburg. River water below Dry Creek was substantially cooler (15.6 C). All of the eight comparison study sites were 1-4 C cooler in 2009 than in 2002.

Rearing steelhead were found in relatively large numbers in the Canyon Reach in summer 2002, but few were present this year even though water temperatures were cooler in the Canyon Reach in 2009 than in 2002. The low abundance of rearing steelhead may be due to low adult spawning. The two hatcheries in the Russian River basin had the lowest steelhead returns on record this past winter.

ADULT CHINOOK SALMON DIVE SURVEYS

A total of five adult Chinook salmon (dive) surveys were conducted during September, 2009 (Table 6). No Chinook salmon were observed. The Russian River mouth was closed from September 6 to October 5, which would prevent adult salmon entering the river. The first salmon recorded at the underwater camera at Mirabel Dam was on October 7. A supplemental dive survey was conducted on October 22, 2009 upstream of the Healdsburg dam where approximately 10 adult Chinook salmon were observed.

ADULT CHINOOK SALMON VIDEO MONITORING

Adult Chinook salmon typically begin their spawning migration in the Russian River during September but immigration does not peak until mid-October to mid-November. Closure of the sand bar at the mouth of the Russian River prevented early arriving Chinook from migrating into the Russian River until flows were increased on October 2 and the mouth opened on October 5. Through November 22, a total of 1,643 adult Chinook salmon were counted at the Mirabel fish counting station (Table 7). Video monitoring is on going and will continue until the Mirabel Inflatable Dam is deflated later this winter. As of November 22, the 2009 adult Chinook run ranks 7th out of the 10 years of sampling. Although Chinook salmon were prevented from entering the river until early October, run timing is similar to other years (Figure 2.) Based on the number of Chinook salmon observed passing Mirabel Dam and recent observations of Chinook salmon spawning in the upper Russian River, it does not appear that low flow conditions during summer 2009 affected adult Chinook salmon.

Table 4. Steelhead observations during summer 2002 and 2009 in the upper Russian River. Each site consisted of a 0.5 km river section. Location of Site C04 was slightly different between survey years. Site numbers correspond to Steelhead Distribution Study Report (Cook 2003).

Location	Site	Vis. (m)	Temp (C)	Steelhead (mm)			TOT
				1-100	101-300	>300	
2002							
Ukiah Valley, below Forks	U01	1-2	20	21	33	1	55
Ukiah Valley, above Perkins Bridge	U02	1-2	20.5	6	1		7
Ukiah Valley, Norgard Dam	U04	1-2	20	51	109	1	161
Canyon, above Squaw Rock	C04	1-2	20	57	56		113
Canyon, above Comminsky Station	C05	1-2	18.9	411	24		435
Alexander Valley, below Crocker Bridge	A01	1-2	22				
Alexander Valley, above Geyserville Bridge (Hwy 128)	A07	1-2	23	1			1
Healdsburg, Healdsburg Dam	H10	>2	24	4	12		16
TOTAL				**551**	**235**	**2**	**788**
2009							
Ukiah Valley, below Forks	U01	0-1	16				
Ukiah Valley, above Perkins Bridge	U02	0-1	18				
Ukiah Valley, Norgard Dam	U04	0-1	16.7	3	2		5
Canyon, below Squaw Rock	(C04)	1-2	17.7				
Canyon, above Comminsky Station	C05	1-2	17.7	1	1		2
Alexander Valley, below Crocker Bridge	A01	1-2	21.1				
Alexander Valley, above Geyserville Bridge (Hwy 128)	A07	>2	22.2				
Healdsburg, Healdsburg Dam	H10	>2	23.3		1		1
TOTAL				**4**	**4**	**0**	**8**
2009 New							
Ukiah Valley, Feliz Creek confluence		1-2	17.2				
Healdsburg, Digger's Bend		>2	21.7				
Lower Healdsburg, Dry Creek confluence		>2	26.7		10		10
Lower Healdsburg, above Riverfront Park		>2	16.7				
TOTAL				**0**	**10**	**0**	**10**

Table 5. Observations of non-salmonids during dive surveys from 2002 and 2009. Each site consisted of a 0.5 km section of river. Location of Site C04 was slightly different in 2002 and 2009.

Location	**Site**	Small Mouth Bass	Large Mouth Bass	Sac Sucker	Tule Perch	Hard-head	Sac Pike-minnow	Cyp-rinids	TS Stickle-back	Carp	Green Sunfish	Bluegill	Sculpin
2002													
Ukiah Valley, below Forks	U01	0		83	0	0	0	66	10	0	0		0
Ukiah Valley, above Perkins Bridge	U02	2		85	0	4	13	600	0	0	0		1
Ukiah Valley, Norgard Dam	U04	1		511	61	1	0	578	300	0	0		2
Canyon, above Squaw Rock	C04	0		298	119	10	9	1760	0	0	0		0
Canyon, above Comminsky Station	C05	2		1819	608	23	1	1737	0	0	0		0
Alexander Valley, below Crocker Bridge	A01	37		1764	1212	40	6	6304	0	0	0		0
Alexander Valley, above Geyserville Bridge (Hwy 128)	A07	5		239	353	18	14	1200	0	0	0		1
Healdsburg, Healdsburg Dam	H10	370		196	79	91	6	605	0	1	27		1
TOTAL		**417**	**0**	**4995**	**2432**	**187**	**49**	**12,850**	**310**	**1**	**27**	**0**	**5**
2009													
Ukiah Valley, below Forks	U01												
Ukiah Valley, above Perkins Bridge	U02												
Ukiah Valley, Norgard Dam	U04	0	0	0	0	0	0	0	0	0	0	0	0
Canyon, below Squaw Rock	(C04)	4	0	115	19	36	23	2060	10	1	0	0	1
Canyon, above Comminsky Station	C05	5	0	449	281	201	29	2589	0	0	0	0	0
Alexander Valley, below Crocker Bridge	A01	3	1	196	116	90	53	1775	0	0	0	0	0
Alexander Valley, above Geyserville Bridge (Hwy 128)	A07	14	0	222	40	102	33	1575	0	0	0	0	0
Healdsburg, Healdsburg Dam	H10	309	0	160	53	1438	43	83	0	0	1	9	0
TOTAL		**335**	**1**	**1142**	**509**	**1867**	**181**	**8082**	**10**	**1**	**1**	**9**	**1**

Table 5. Observations of non-salmonids during dive surveys from 2002 and 2009. Each site consisted of a 0.5 km section of river. Location of Site C04 was slightly different in 2002 and 2009.

Location	**Site**	Small Mouth Bass	Large Mouth Bass	Sac Sucker	Tule Perch	Hard-head	Sac Pike-minnow	Cyp-rinids	TS Stickle-back	Carp	Green Sunfish	Bluegill	Sculpin
2009 New													
Ukiah Valley, Feliz Creek confluence		5	0	47	85	17	1	0	5	0	0	0	0
Healdsburg, Digger's Bend		470	2	450	2	219	45	86	0	0	4	1	0
Lower Healdsburg, Dry Creek confluence		1	0	377	13	245	4	415	101	0	0	0	0
Lower Healdsburg, above Riverfront Park		4	0	241	124	26	27	1185	0	0	0	0	0
TOTAL		**480**	**2**	**1115**	**224**	**507**	**77**	**1686**	**106**	**0**	**4**	**1**	**0**

Table 6. Fish observations during early-fall Chinook salmon migration season 2009 in the lower Russian River.

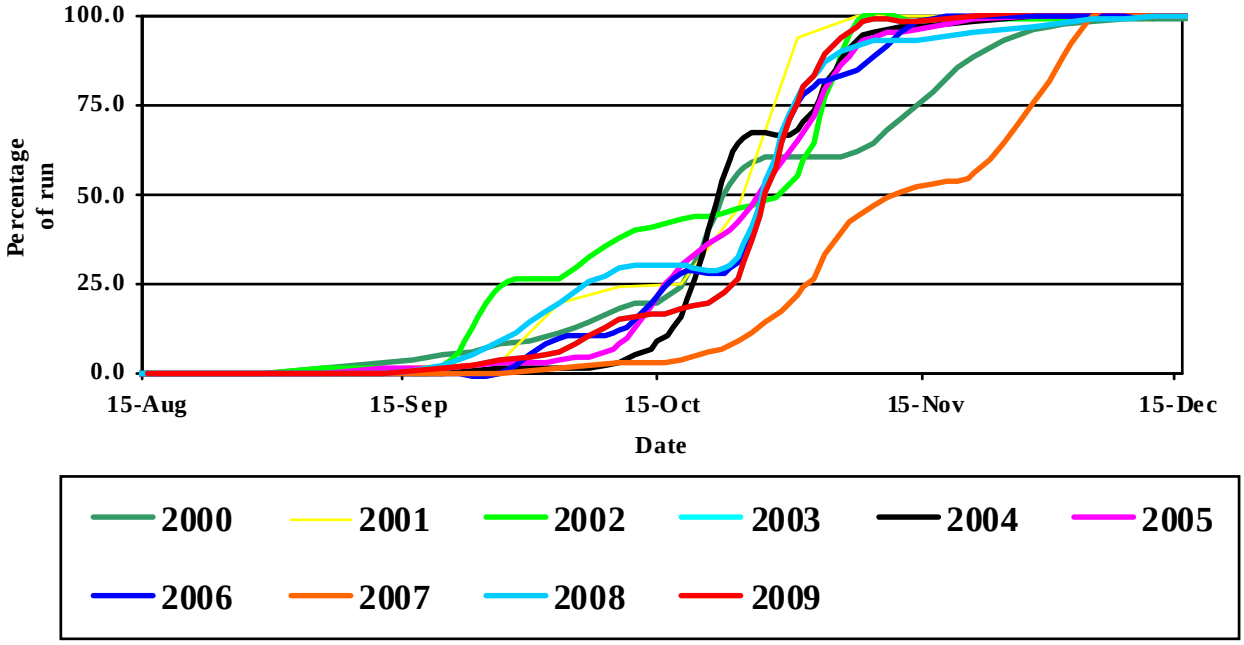
Location and Date	Water Temp (C)	Water Visib. (m)	Dissolve Oxygen (mg/l)	Chin-ook	Steel-head	SM Bass	LM Bass	Sac Sucker	Hard-head	Tule Perch	Sac Pike-minnow	Carp	Hitch/G Shiner	Blue-gill	Black Crappie	Am Shad
Johnson Dam (below)																
9/1/2009	23.3	0-1				present				10		1				
9/8/2009	22.2	0-1	7.5			16		2		6						
9/15/2009	21.3	1-2	8.22			14				2		10				
9/22/2009	22.3	1-2	8.45			14				4		13				
9/29/2009	20.2	0-1	8.82			6		6				12				
Vacation Beach Dam (below)																
9/8/2009	22.2	0-1	7.5		1	12		52		27	14		30			
9/1/2009	23.3	1-2			2	present		present		present	present			present		
9/15/2009	21.6	1-2	8.34		4	12	2	200		12	13	5	15			
9/22/2009	22.5	1-2	8.33		1	4		193	12	3	17	5	40		1	
9/29/2009	19.5	1-2	8.25		2	21		400			25				25	2 (adult)
Geyserville Bridge Pool																
9/1/2009	22.2	1-2				present		present	present	present	present	present				
9/15/2009	23.4	1-2	10.22			8		200	2	23	17					
9/29/2009	20.4	>2	10.41			5		250	60	7		9				
Mirabel Dam (below)																
9/1/2009	17.2	1-2			12	present				present						
9/8/2009	19.9	1-2	8.49		10	1			1	18						
9/15/2009	19.3	1-2	9.17		8	1				22						
9/22/2009	20.4	>2	8.38		8	5		2		2						
9/29/2009	18.1	>2	9.41		13	1				25						

Table 7. Weekly Chinook salmon counts at the Mirabel Dam video fish counting station, Russian River, 2000 – 2009.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1-Aug	0	0	0	0	0	0	0		0	
8-Aug	0	0	0	0	0	0	0		0	
15-Aug	0	0	1	0	0	0	0	0	1	0
22-Aug	1	0	8	0	0	1	0	0	0	0
29-Aug	0	3	7	2	1	4	0	0	2	0
5-Sep	9	1	18	7	1	4	0	0	18	0
12-Sep	38	7	19	20	3	14	3	0	83	0
19-Sep	23	12	65	23	8	14	4	1	124	0
26-Sep	50	17	1,223	181	16	31	8	2	98	0
3-Oct	31	240	113	146	42	27	318	10	13	78
10-Oct	115	51	628	515	52	112	88	39	21	562
17-Oct	81	10	272	232	651	556	529	26	502	177
24-Oct	466	300	153	532	2,287	307	114	103	173	283
31-Oct	63	661	505	2,969	185	611	1,535	249	13	135
7-Nov	24	81	2,337	1,289	1,189	668	299	429	24	335
14-Nov	182		20	47	221	127	458	152	19	41
21-Nov	200		37	95	57	63	54	96	9	128
28-Nov	111		14	45	60	33		375		24
5-Dec	19		54		16			477		6[1]
Total	**1,445**	**1,383**	**5,474**	**6,103**	**4,788**	**2,572**	**3,410**	**1,963**	**1,125**	**1,769**

[1]Note: this report was finalized on December 8, 2009, video monitoring was still in progress at this time.

Figure 2. Cumulative proportion of Chinook salmon that passed Mirabel Inflatable Dam from 2000 to 2009.



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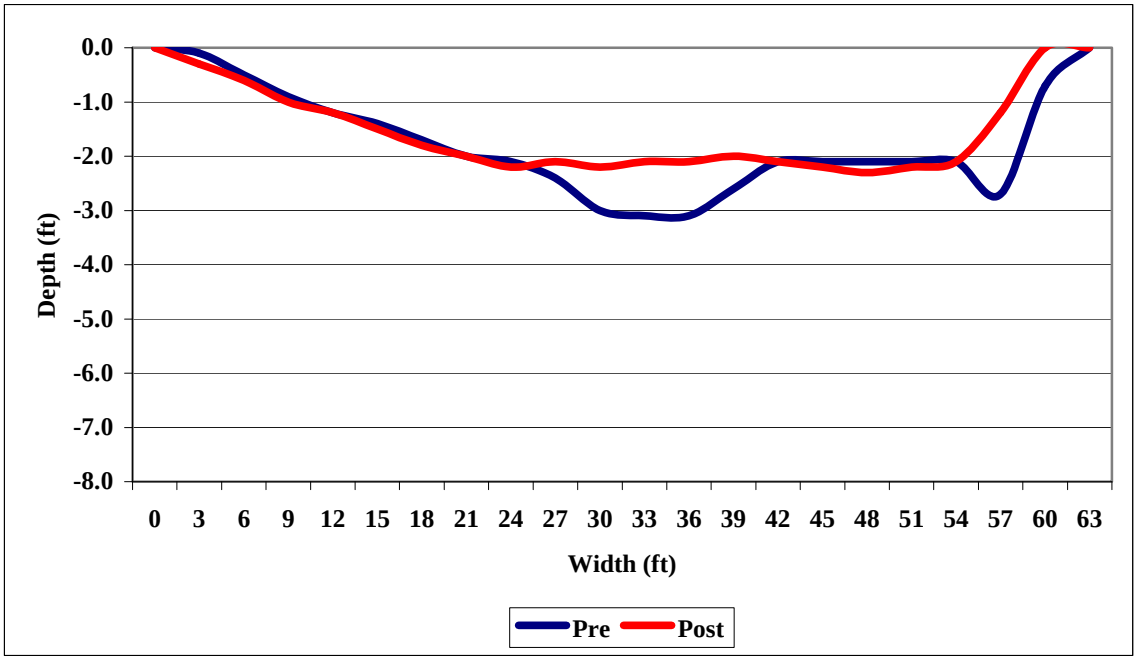
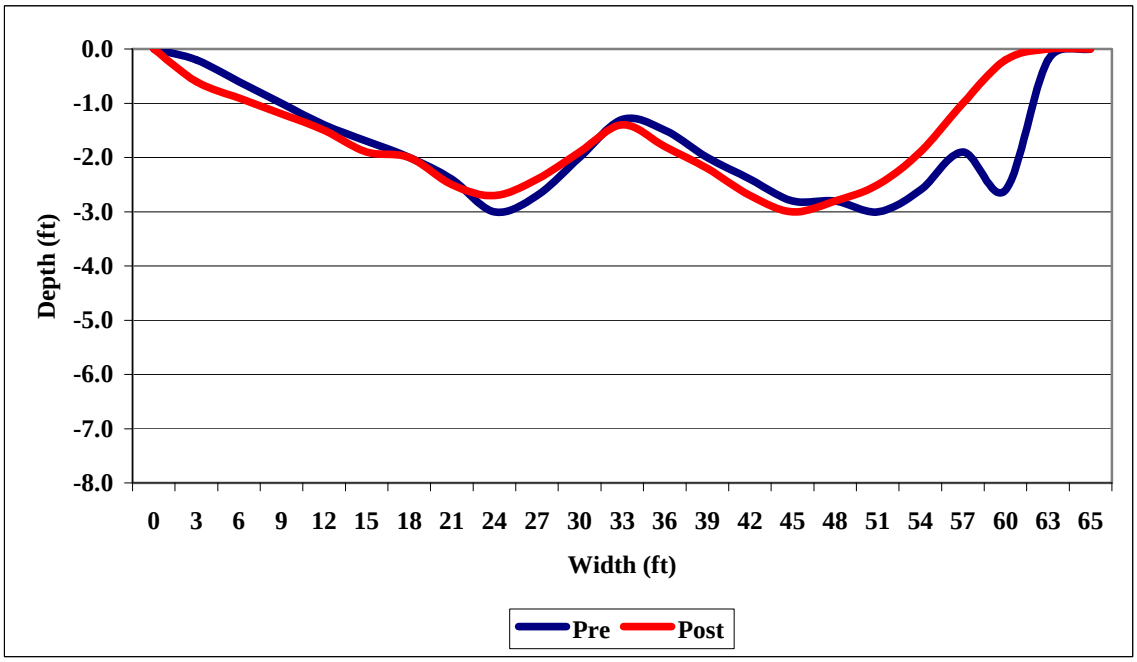
APPENDIX A

UKIAH REACH CROSS SECTIONS

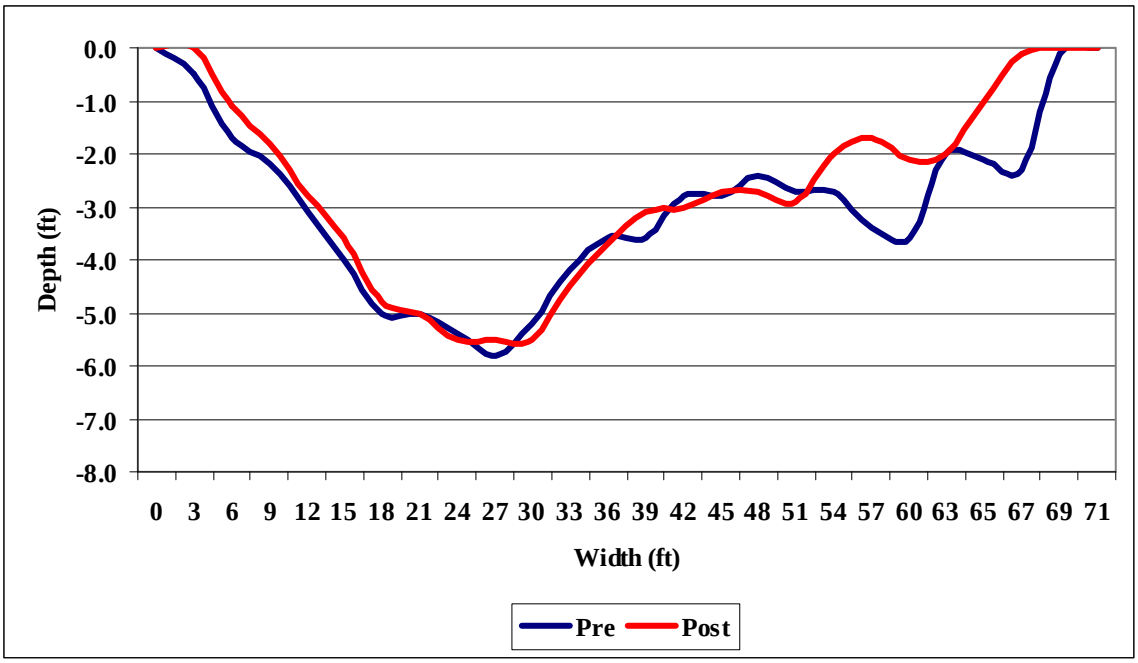
PRE AND POST FLOW REDUCTION SURVEYS



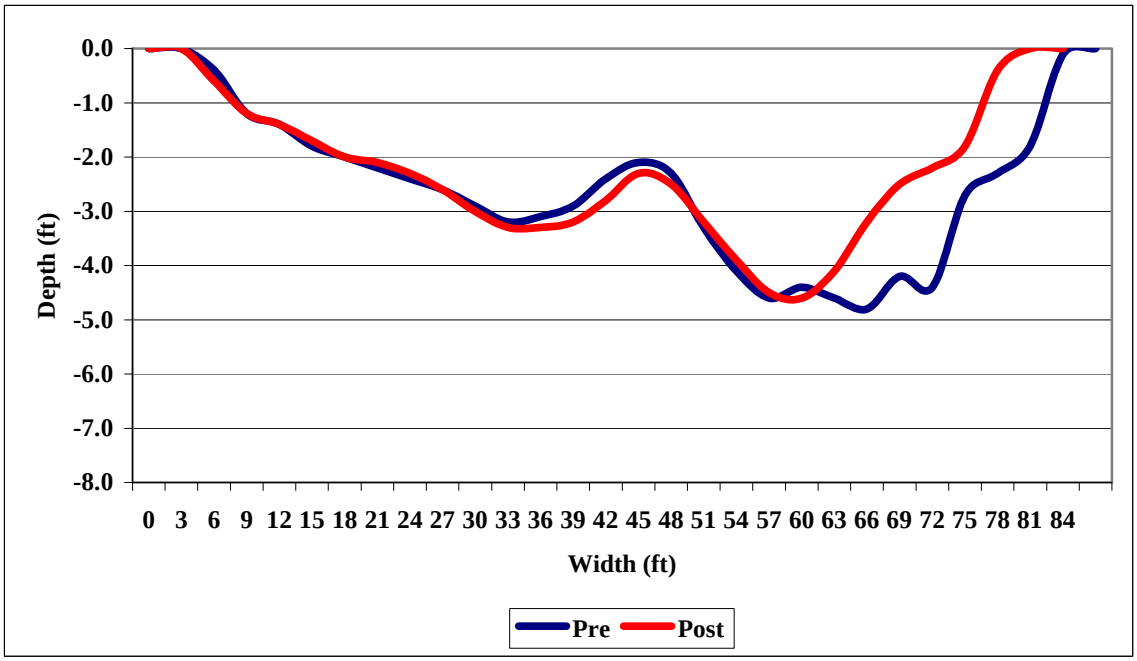
Appendix A-1. Pre and Post cross sections at Pool 1 Transect 1 – Ukiah Reach



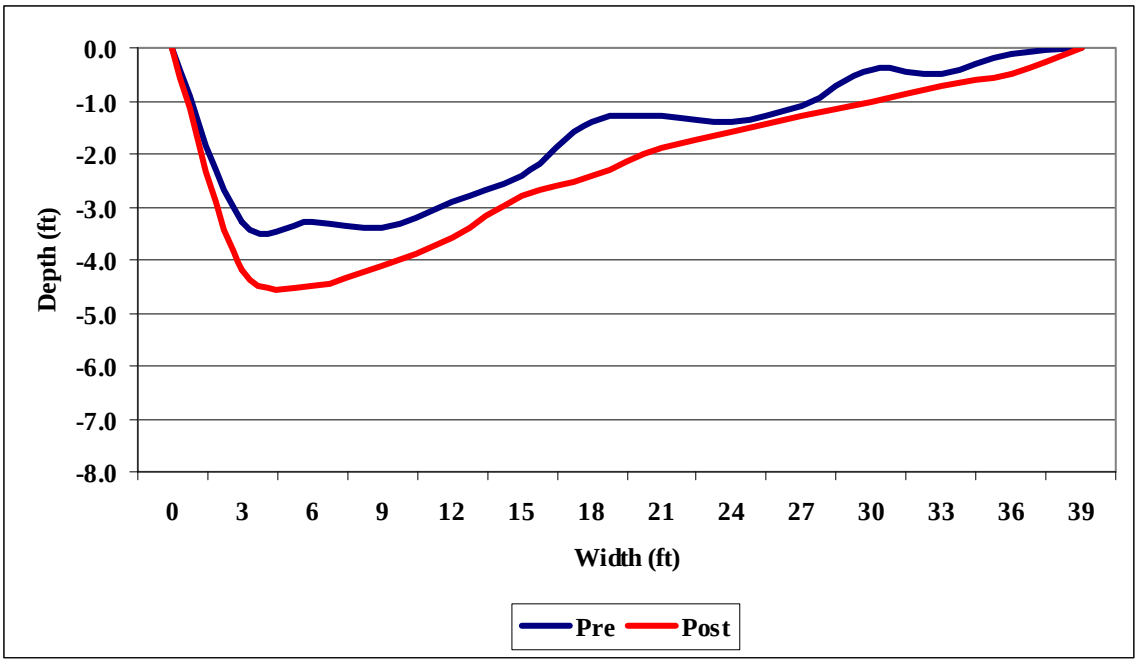
Appendix A-2. Pre and Post cross sections at Pool 1 Transect 2 – Ukiah Reach



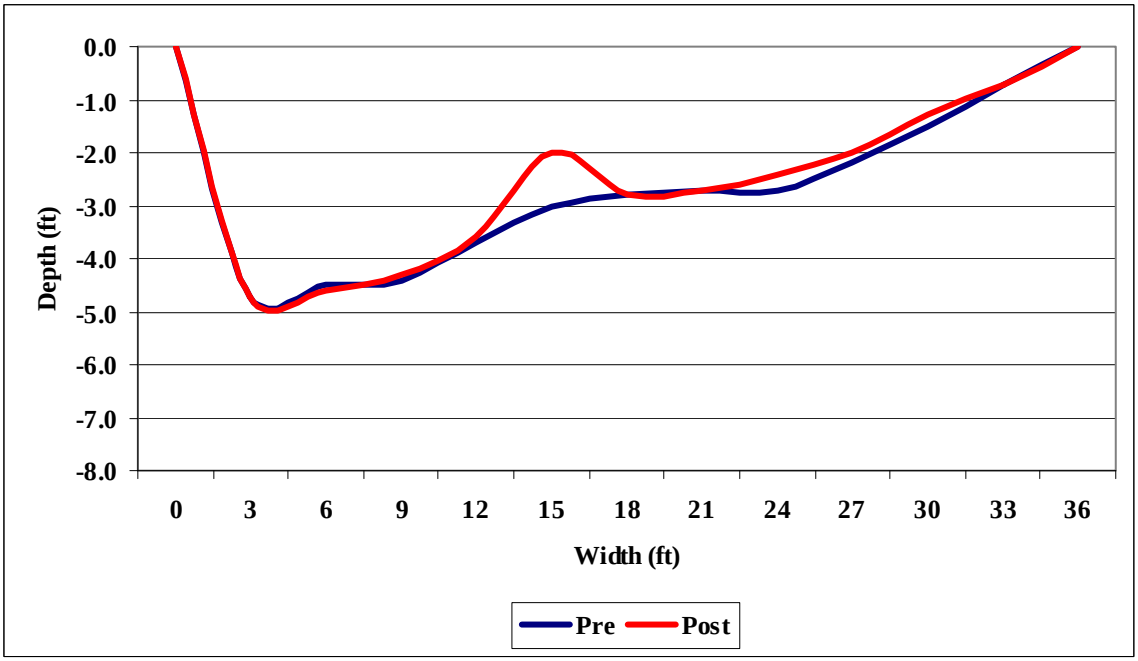
Appendix A-3. Pre and Post cross sections at Pool 1 Transect 3 – Ukiah Reach



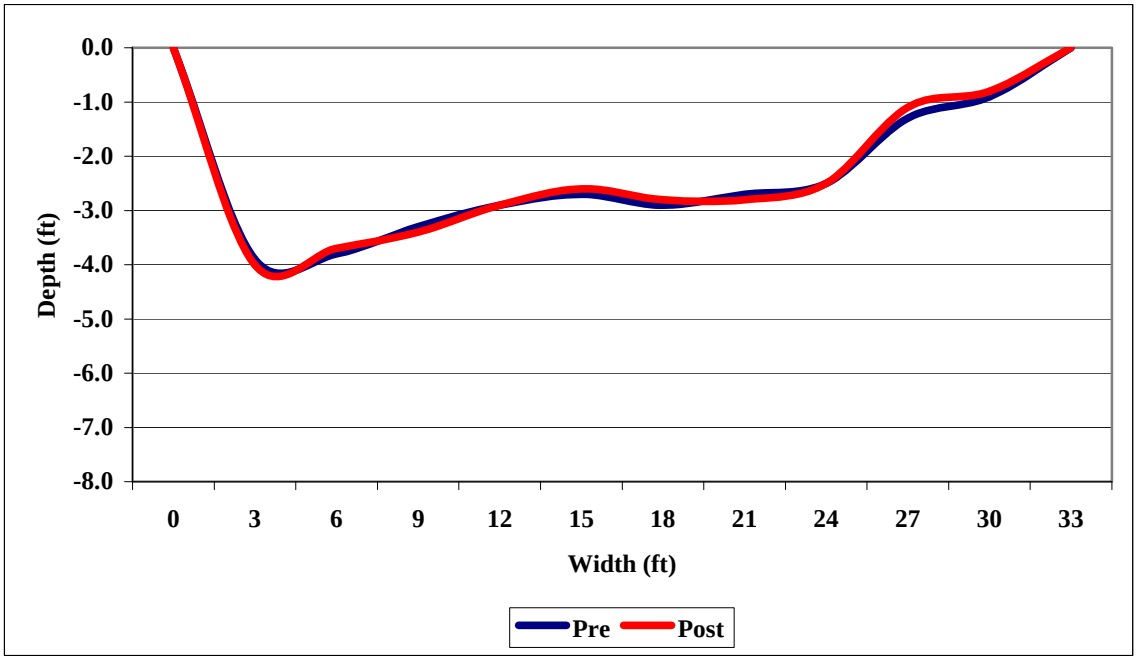
Appendix A-4. Pre and Post cross sections at Pool 1 Transect 4 – Ukiah Reach



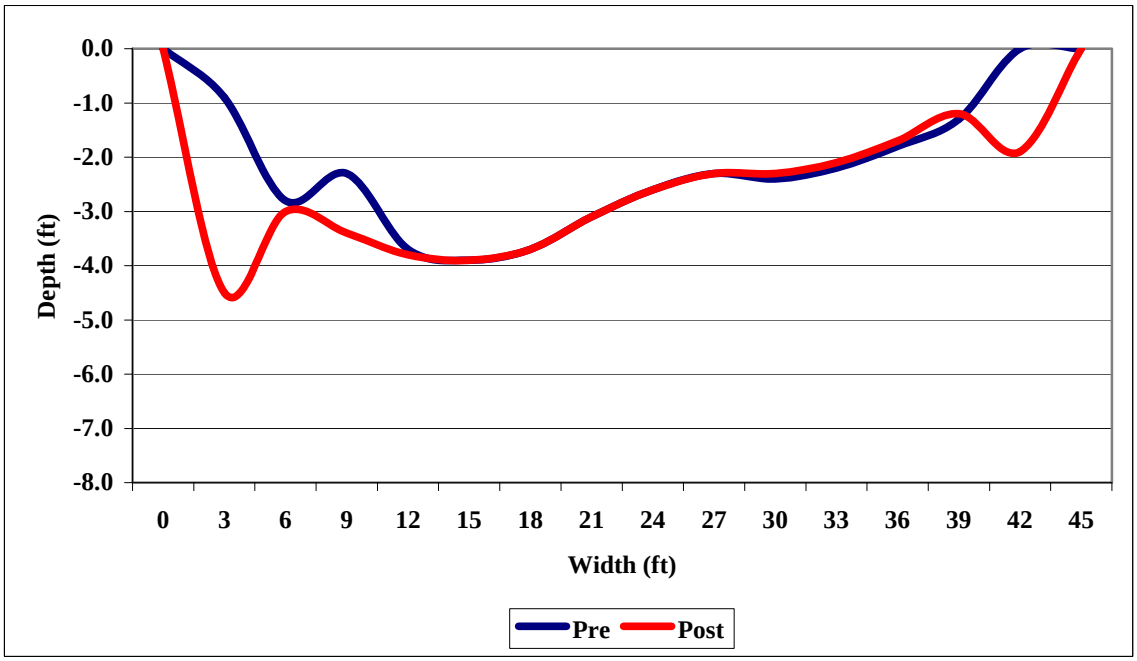
Appendix A-5. Pre and Post cross sections at Pool 2 Transect 1 – Ukiah Reach



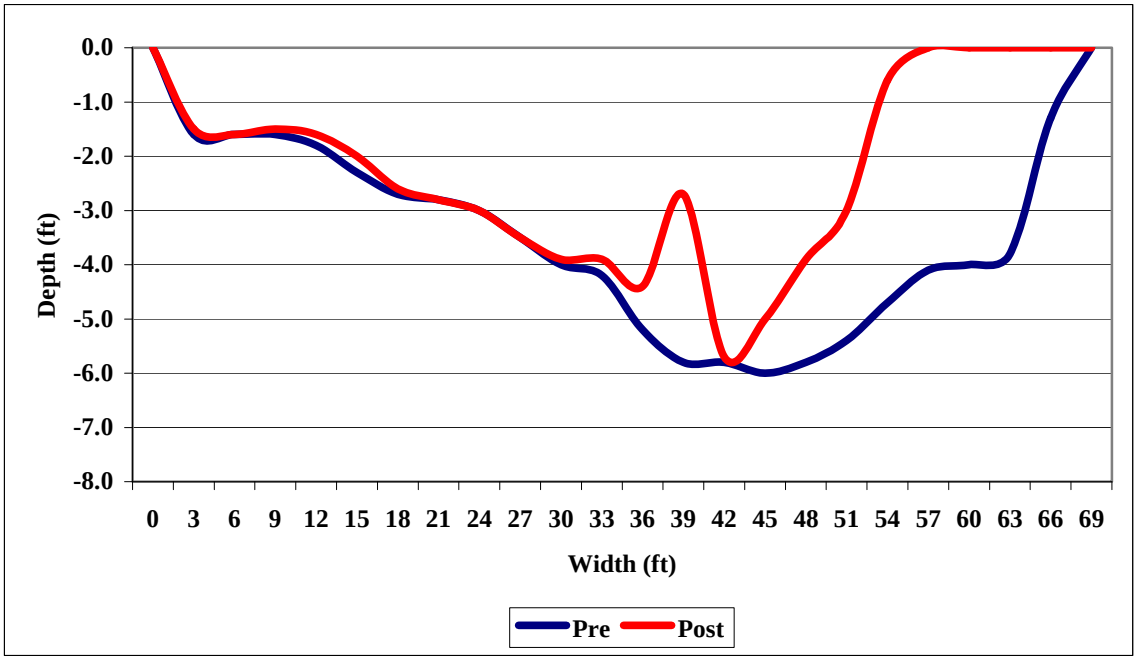
Appendix A-6. Pre and Post cross sections at Pool 2 Transect 2 – Ukiah Reach



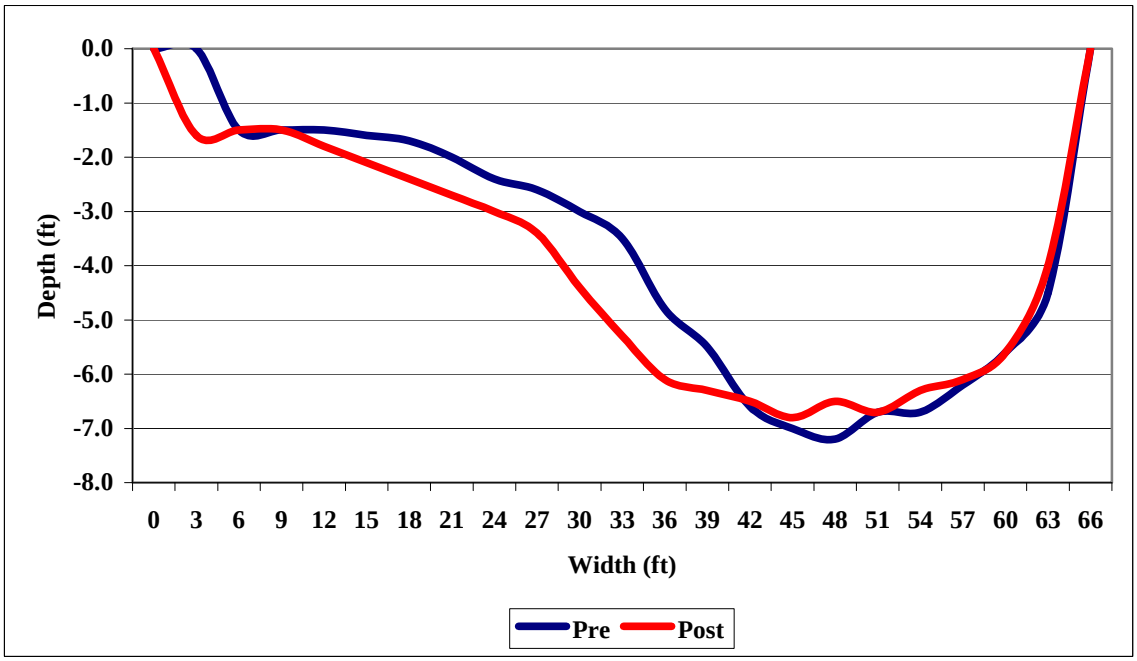
Appendix A-7. Pre and Post cross sections at Pool 2 Transect 3 – Ukiah Reach



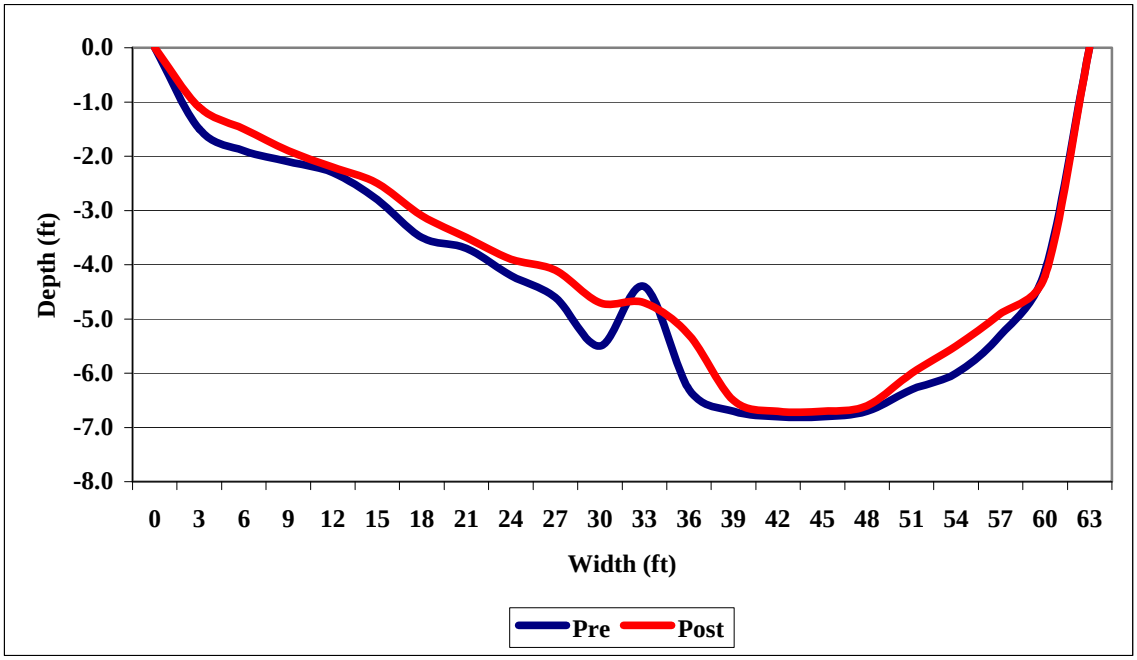
Appendix A-8. Pre and Post cross sections at Pool 2 Transect 4 – Ukiah Reach



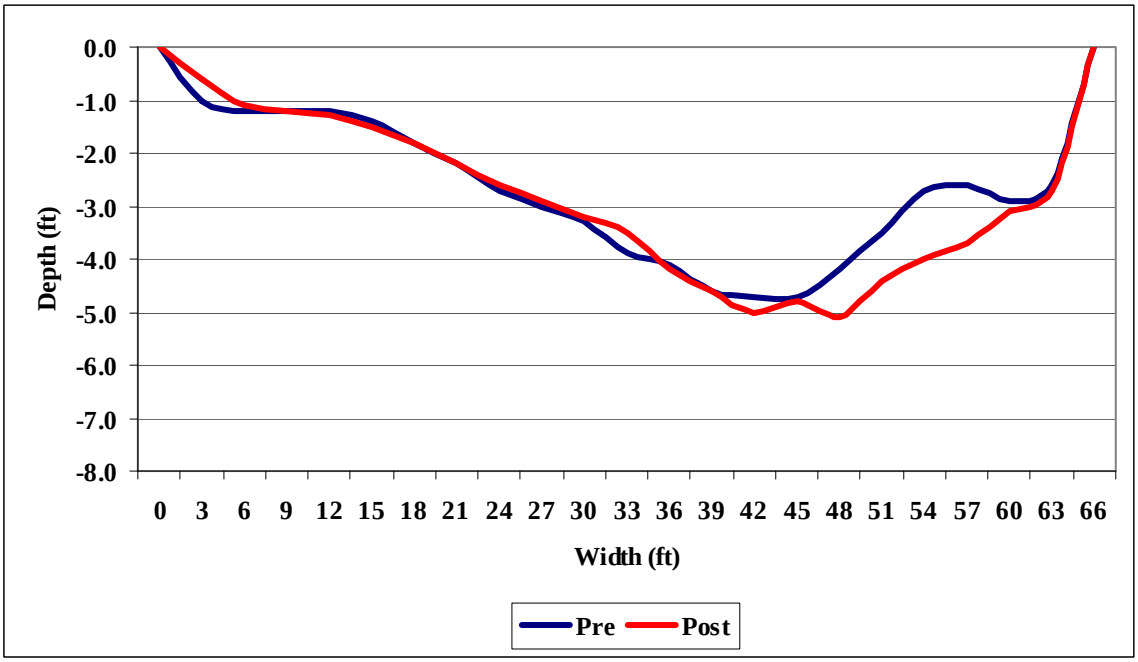
Appendix A-9. Pre and Post cross sections at Pool 3 Transect 1 – Ukiah Reach



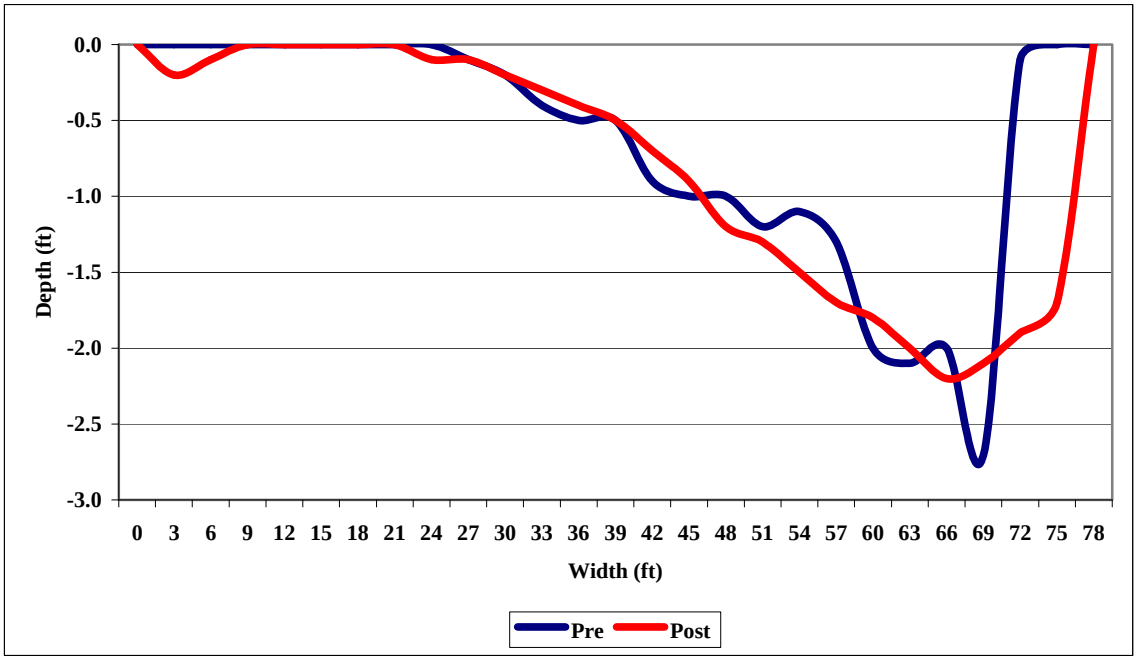
Appendix A-10. Pre and Post cross sections at Pool 3 Transect 2 – Ukiah Reach



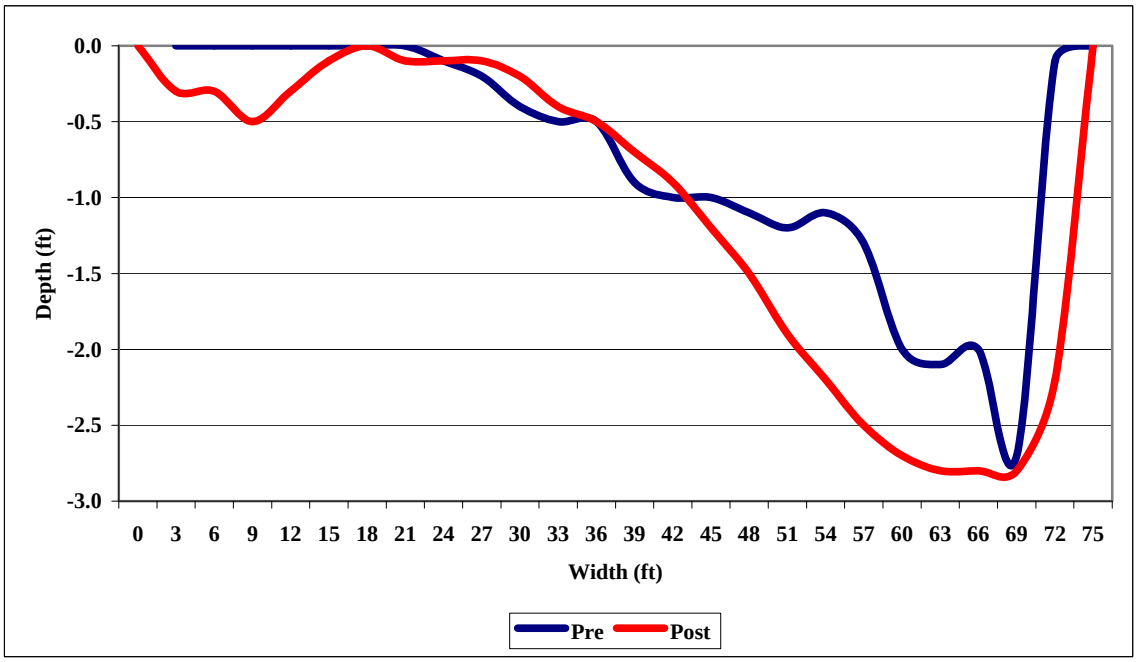
Appendix A-11. Pre and Post cross sections at Pool 3 Transect 3 – Ukiah Reach



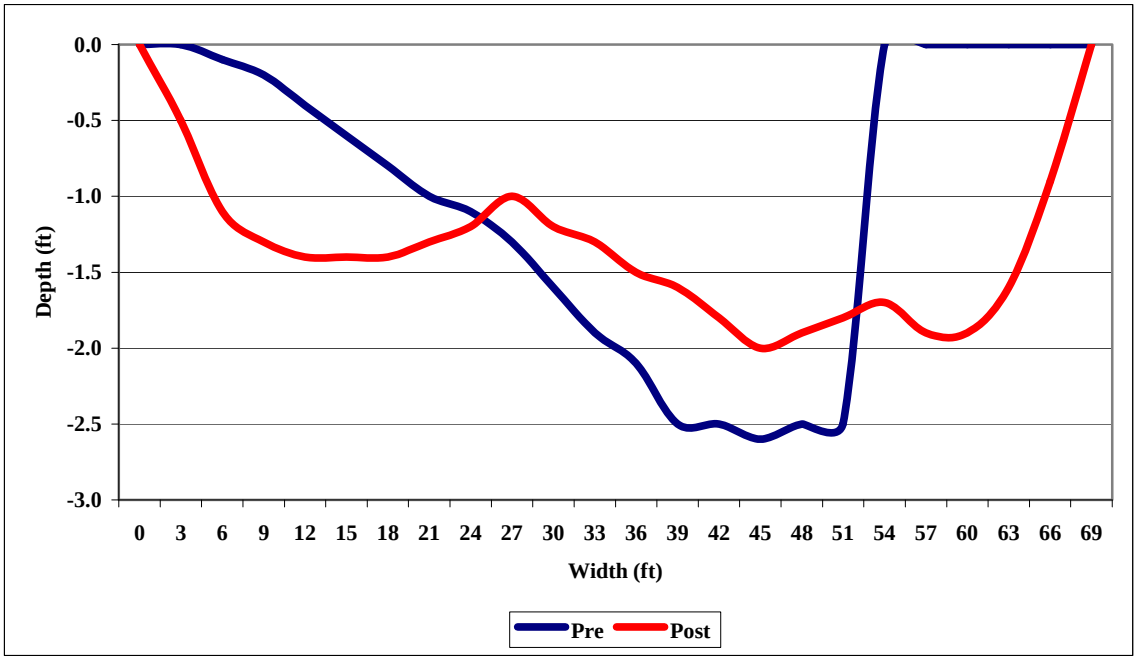
Appendix A-12. Pre and Post cross sections at Pool 3 Transect 4 – Ukiah Reach



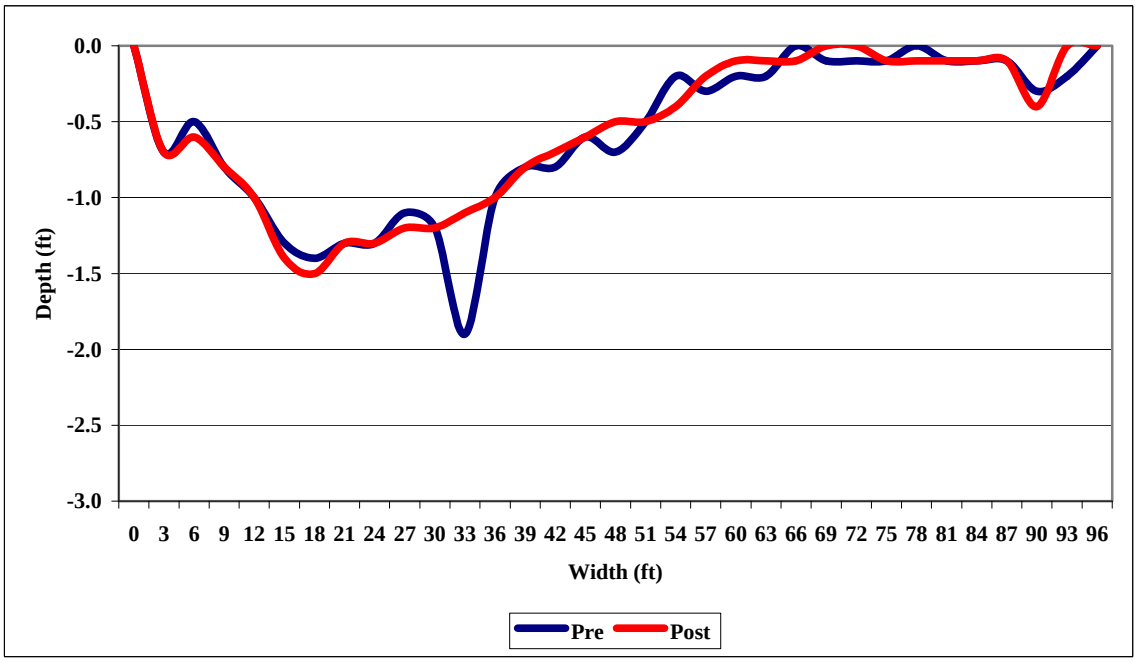
Appendix A-13. Pre and Post cross sections at Riffle 1 Transect 1 – Ukiah Reach



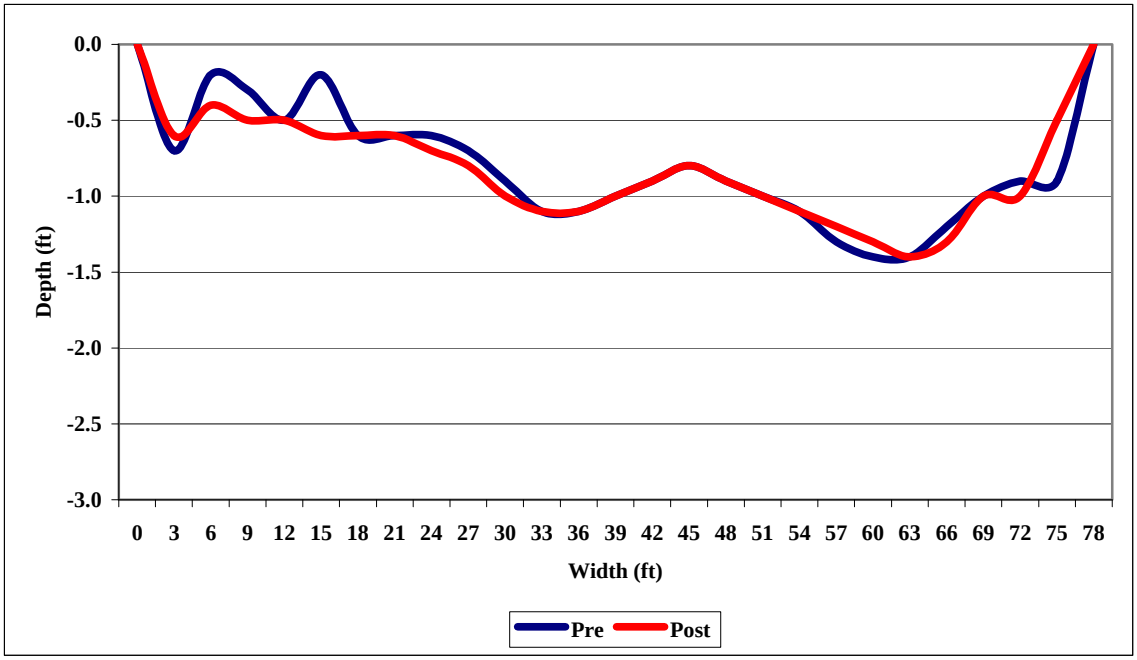
Appendix A-14. Pre and Post cross sections at Riffle 1 Transect 2 – Ukiah Reach



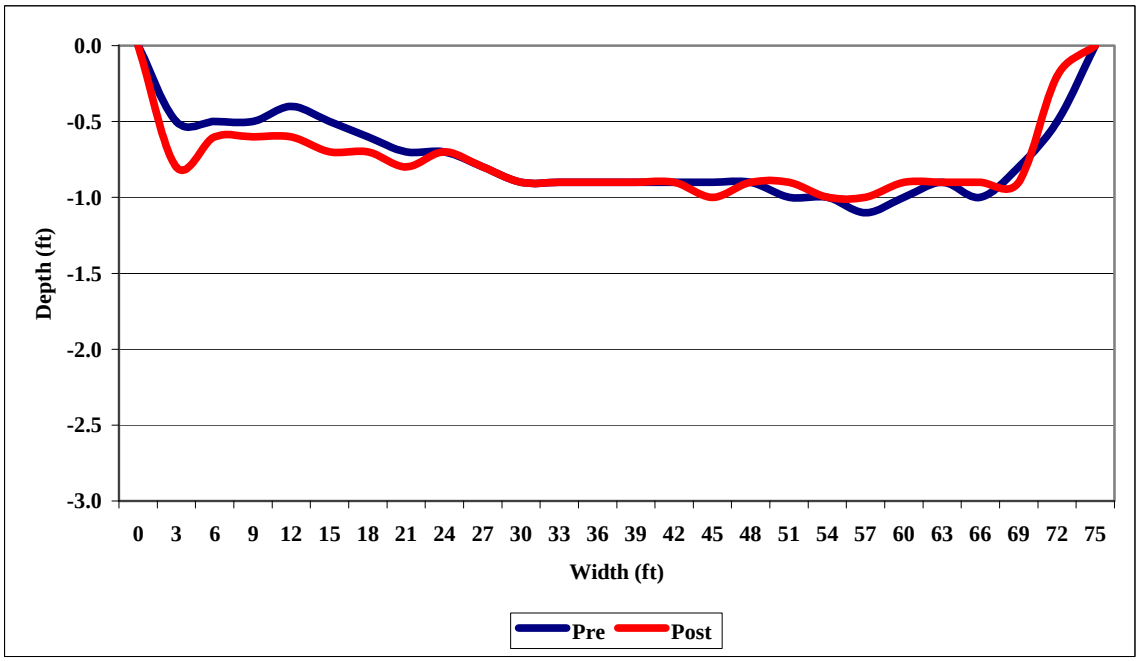
Appendix A-15. Pre and Post cross sections at Riffle 1 Transect 3 – Ukiah Reach



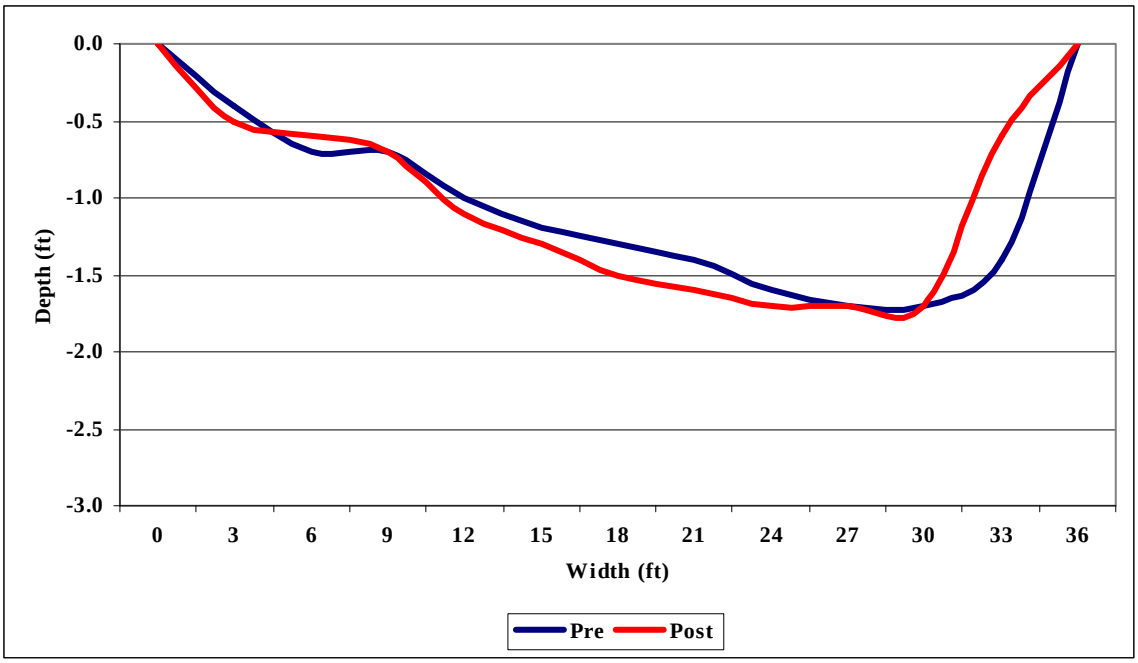
Appendix A-16. Pre and Post cross sections at Riffle 2 Transect 1 – Ukiah Reach



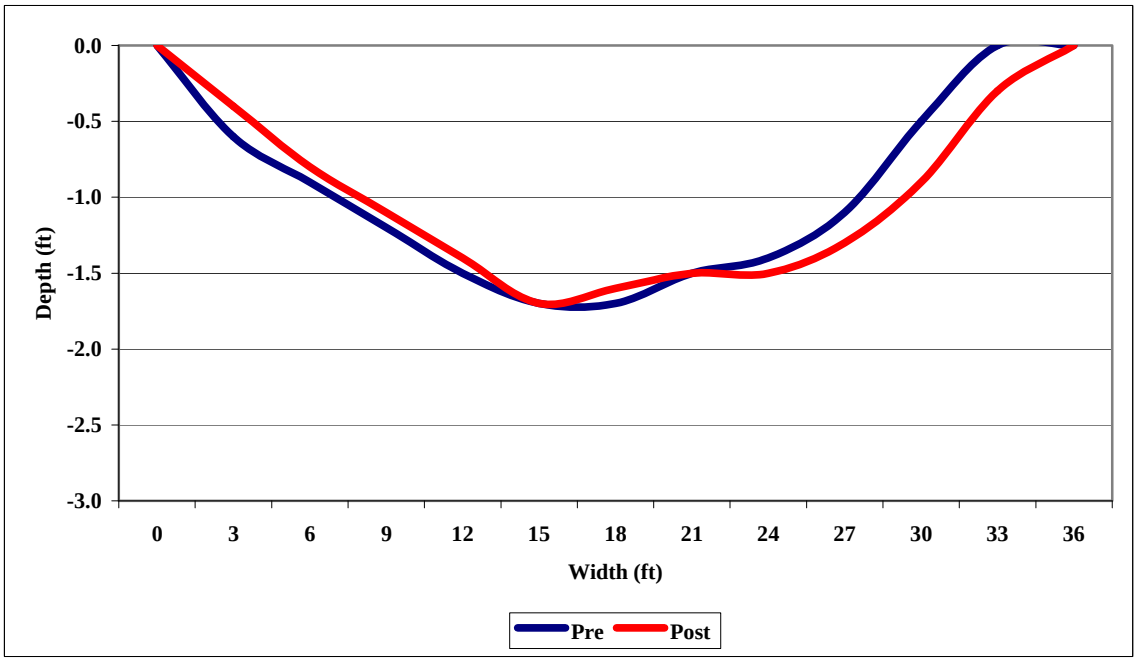
Appendix A-17. Pre and Post cross sections at Riffle 2 Transect 2 – Ukiah Reach



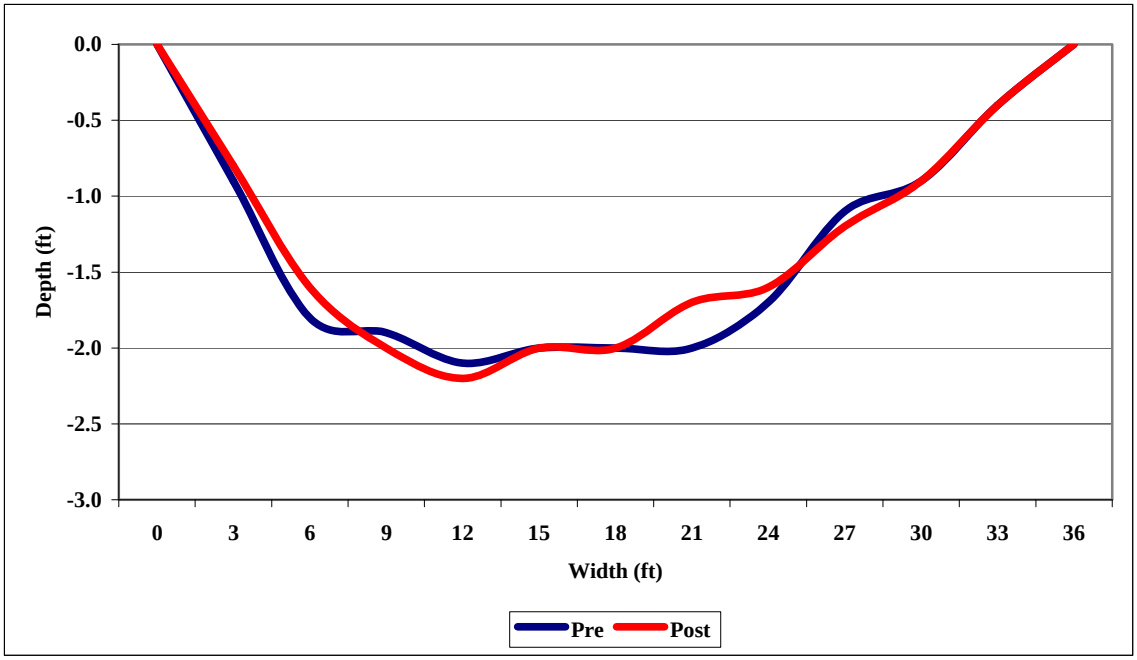
Appendix A-18. Pre and Post cross sections at Riffle 2 Transect 3 – Ukiah Reach



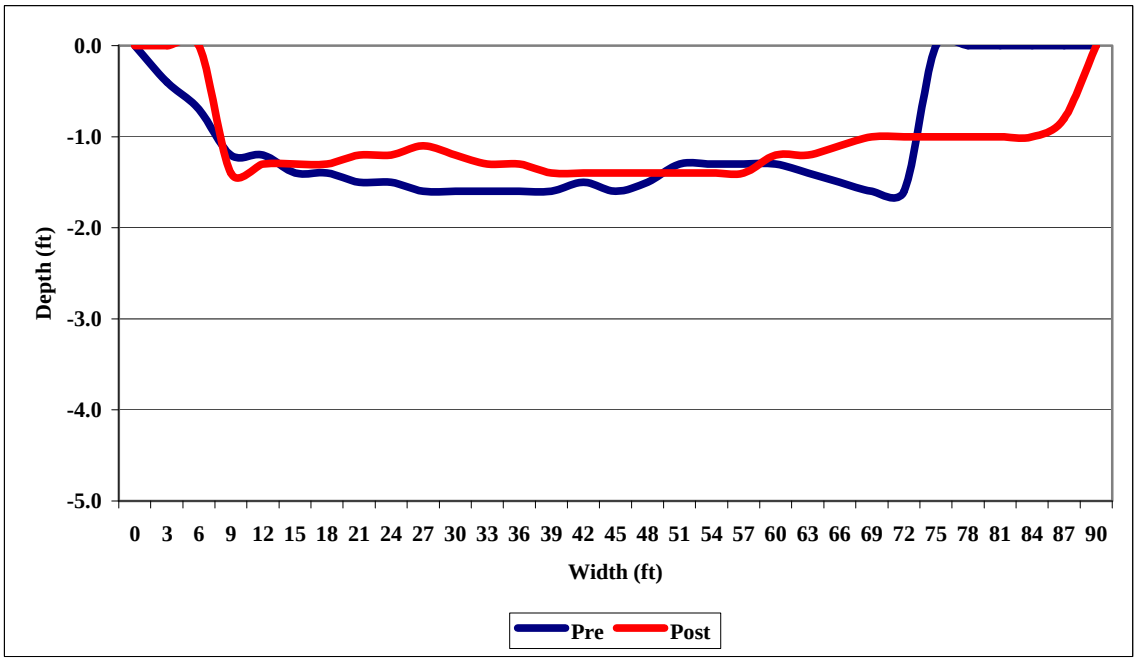
Appendix A-19. Pre and Post cross sections at Riffle 3 Transect 1 – Ukiah Reach



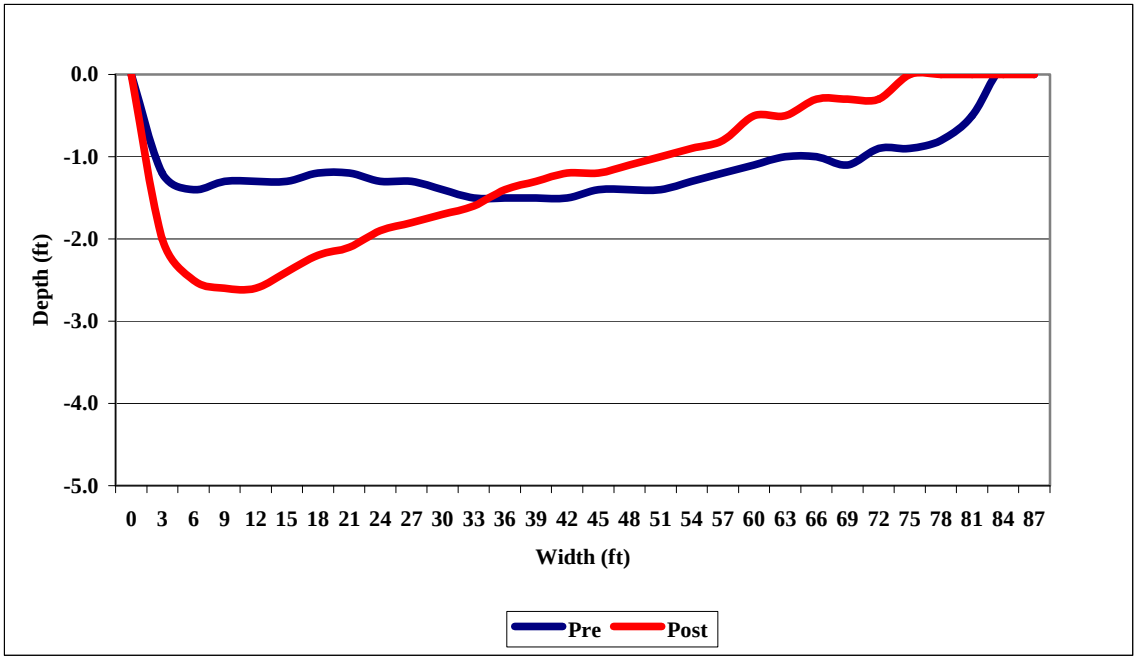
Appendix A-20. Pre and Post cross sections at Riffle 3 Transect 2 – Ukiah Reach



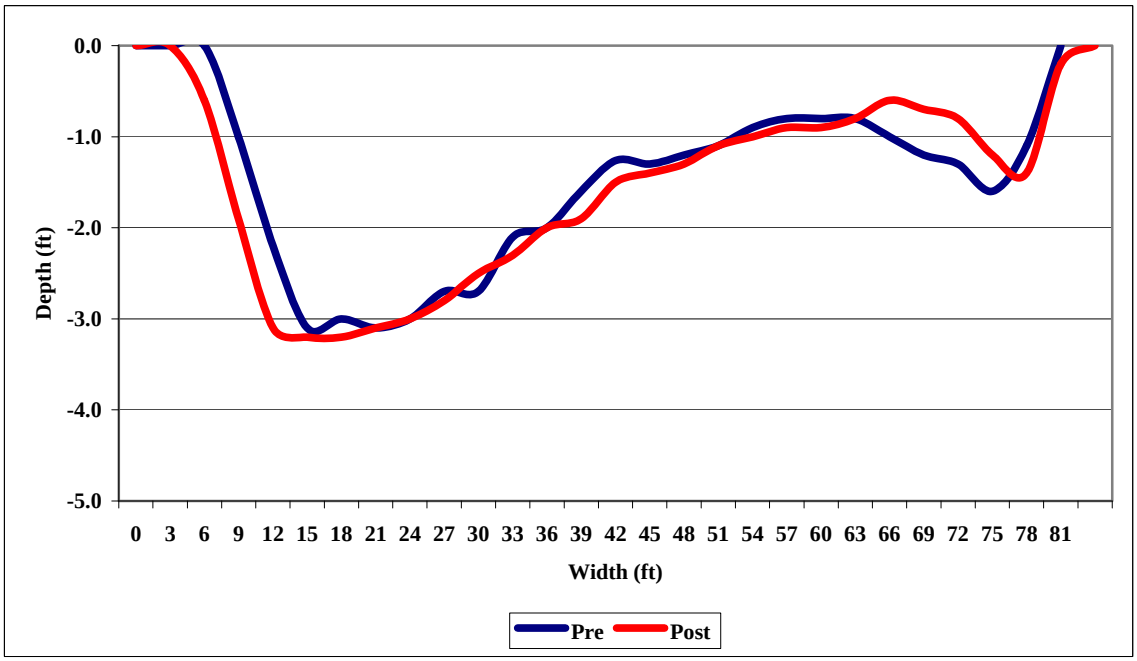
Appendix A-21. Pre and Post cross sections at Riffle 3 Transect 3 – Ukiah Reach



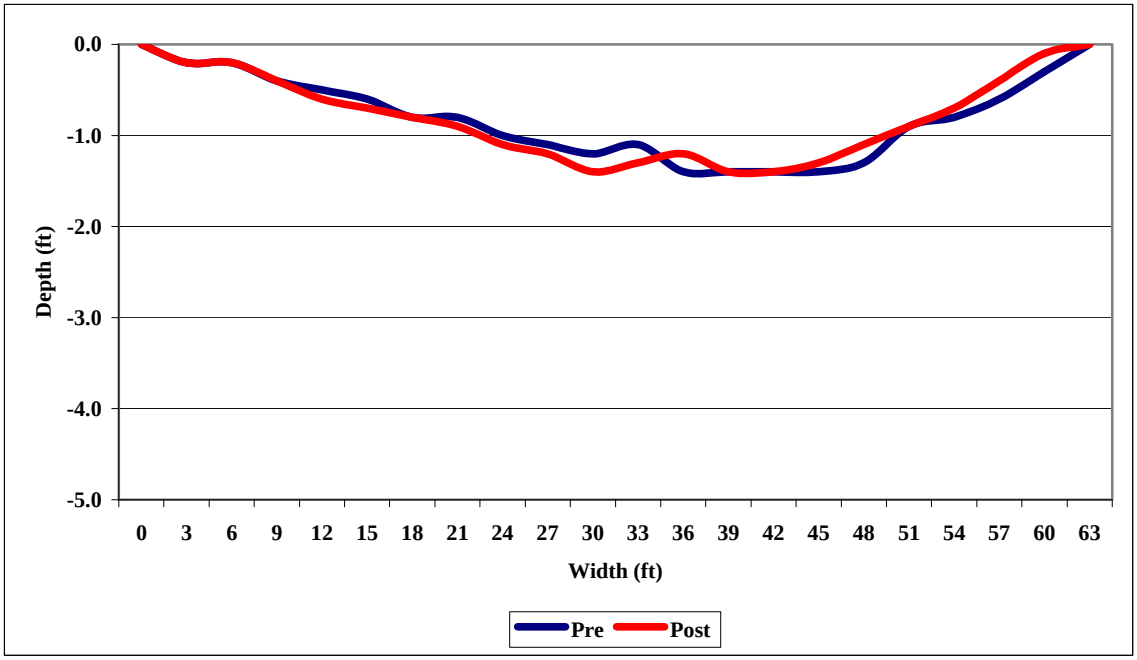
Appendix A-22. Pre and Post cross sections at Flatwater 1 Transect 1 – Ukiah Reach



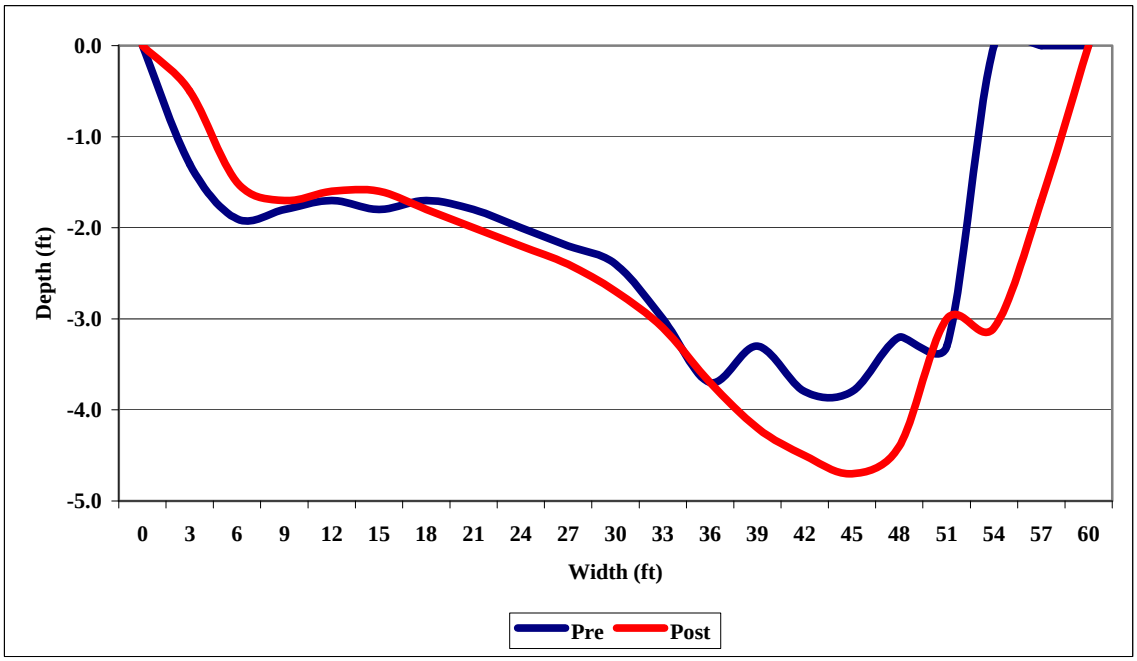
Appendix A-23. Pre and Post cross sections at Flatwater 1 Transect 2 – Ukiah Reach



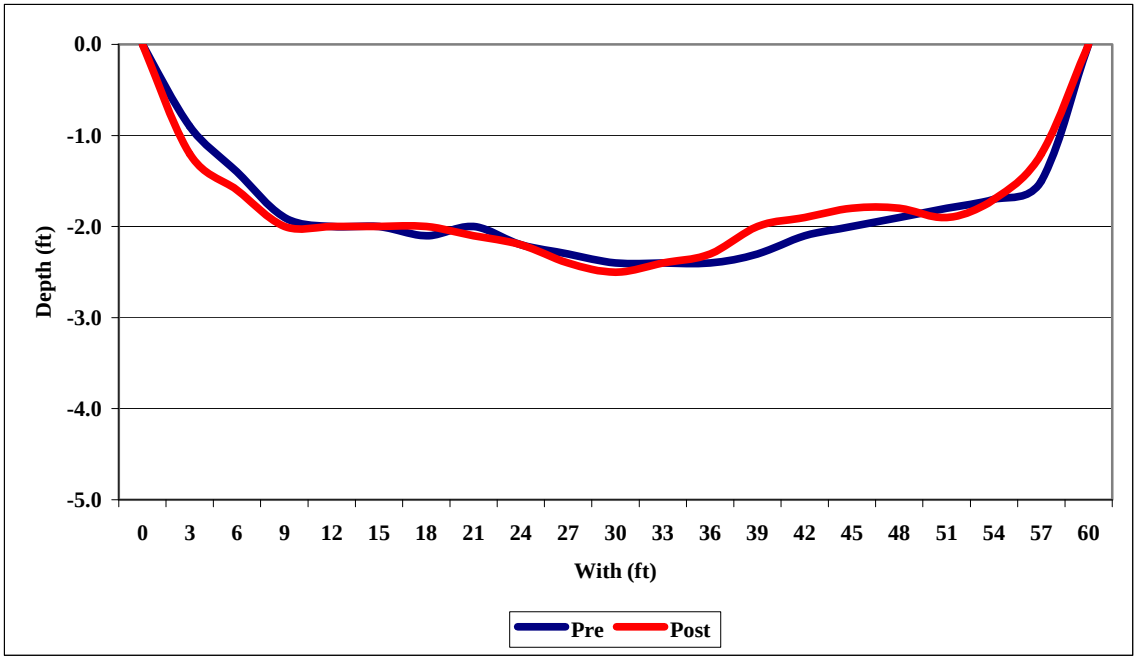
Appendix A-24. Pre and Post cross sections at Flatwater 1 Transect 3 – Ukiah Reach



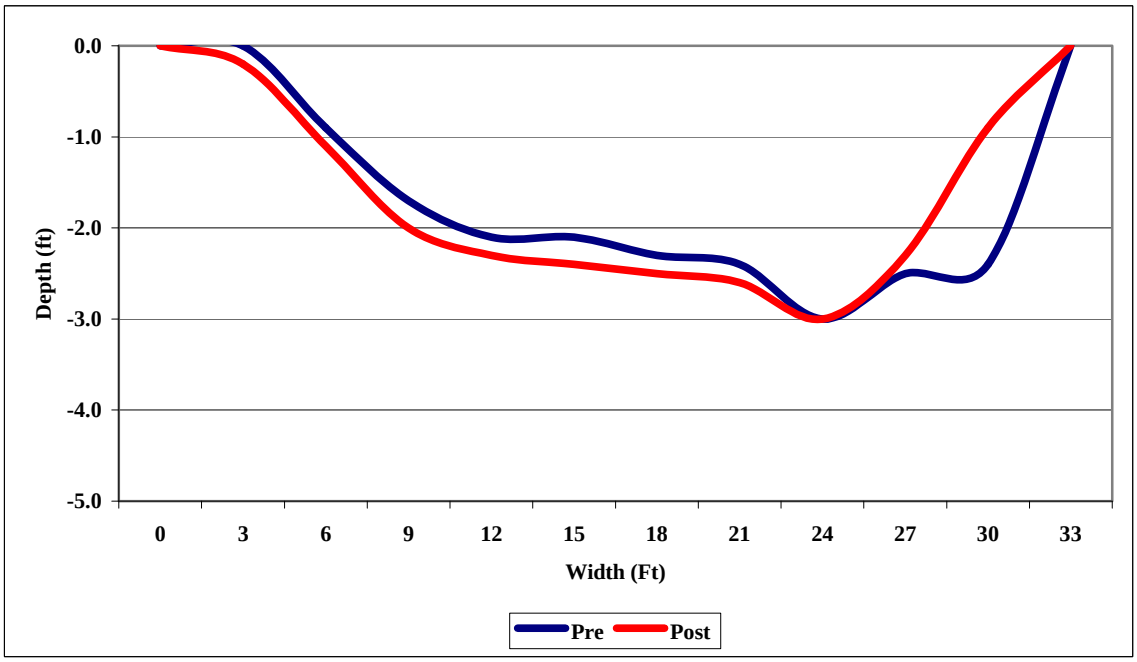
Appendix A-25. Pre and Post cross sections at Flatwater 2 Transect 1 – Ukiah Reach



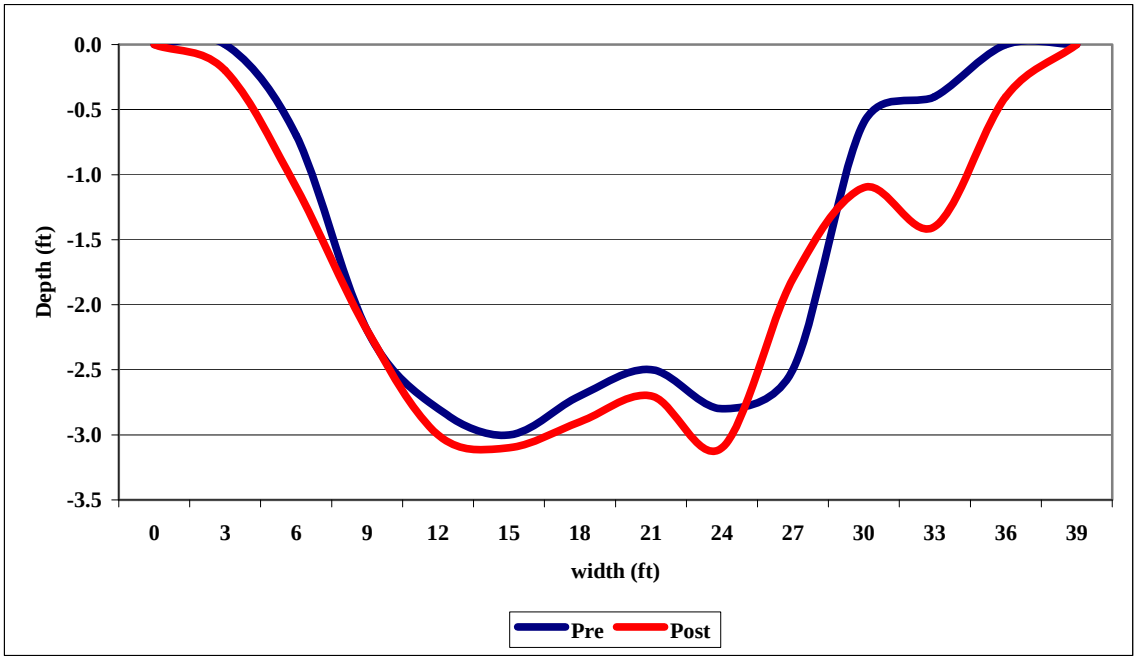
Appendix A-26. Pre and Post cross sections at Flatwater 2 Transect 2 – Ukiah Reach



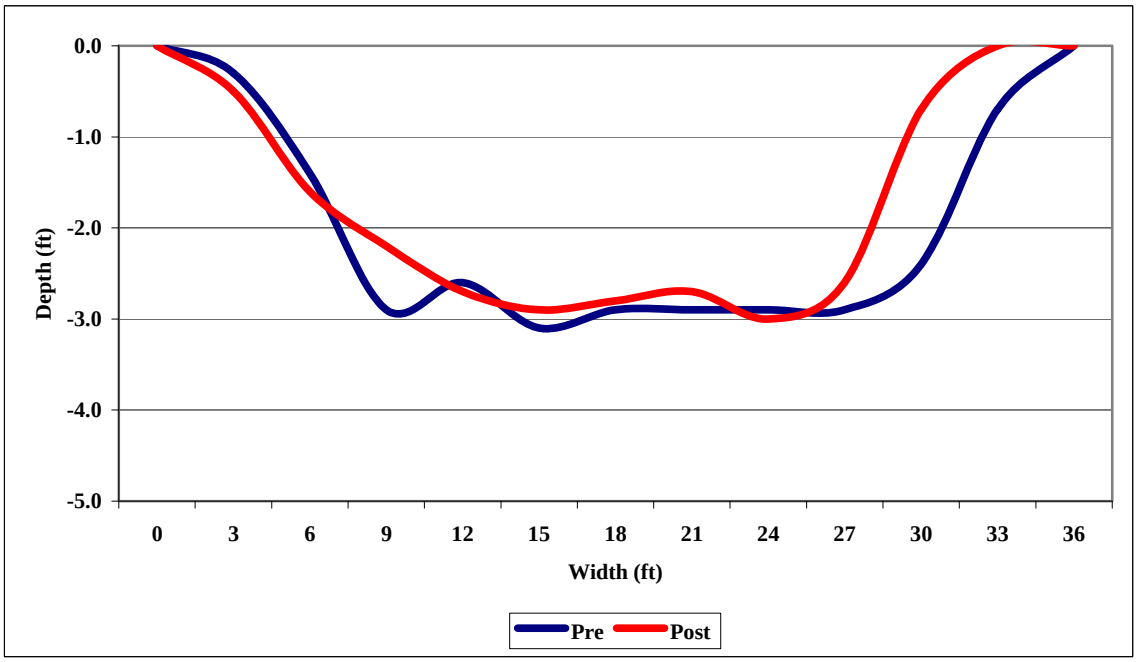
Appendix A-27. Pre and Post cross sections at Flatwater 2 Transect 3 – Ukiah Reach



Appendix A-28. Pre and Post cross sections at Flatwater 3 Transect 1 – Ukiah Reach



Appendix A-29. Pre and Post cross sections at Flatwater 3 Transect 2 – Ukiah Reach

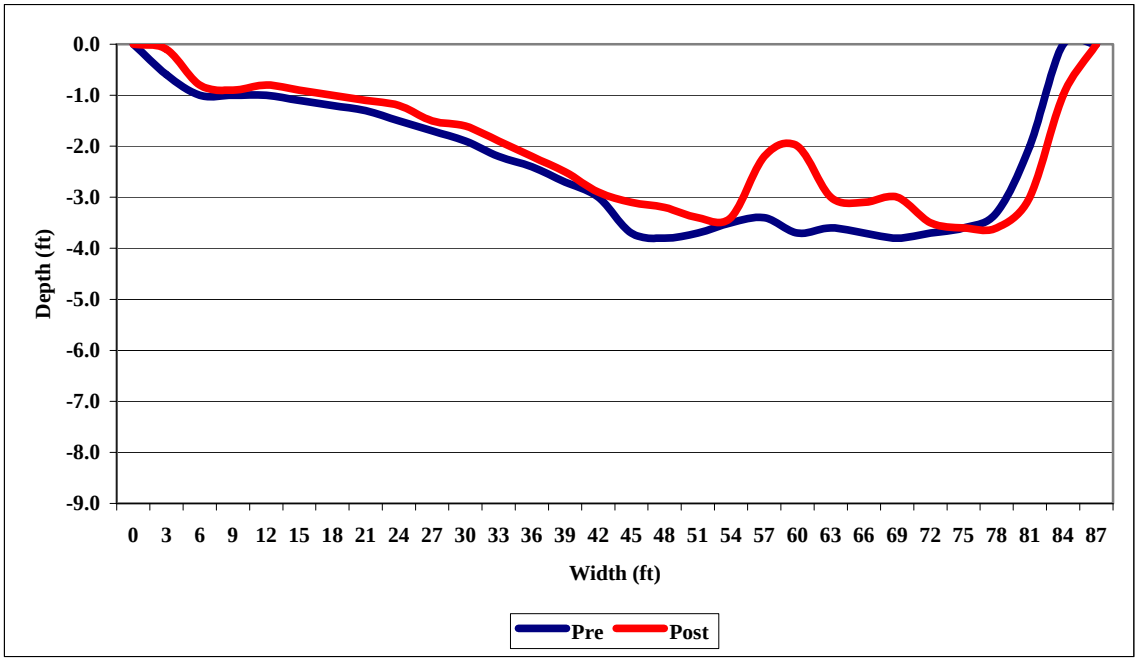


Appendix A-30. Pre and Post cross sections at Flatwater 3 Transect 3 – Ukiah Reach

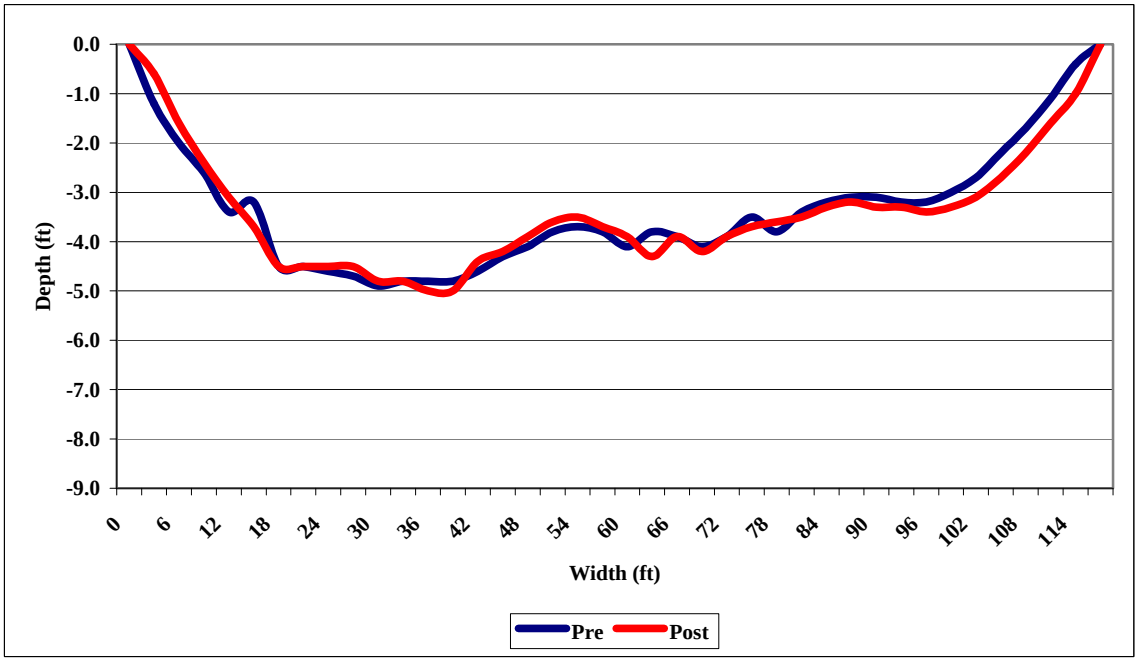
APPENDIX B

COMMINSKY STATION REACH CROSS SECTIONS

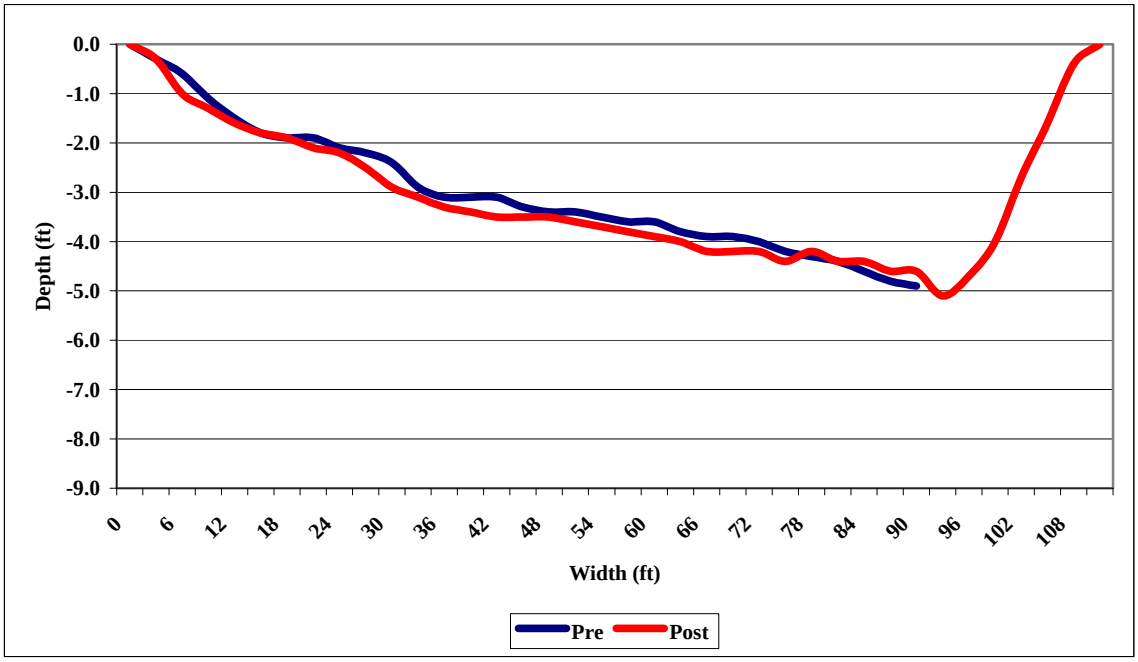
PRE AND POST FLOW REDUCTION SURVEYS



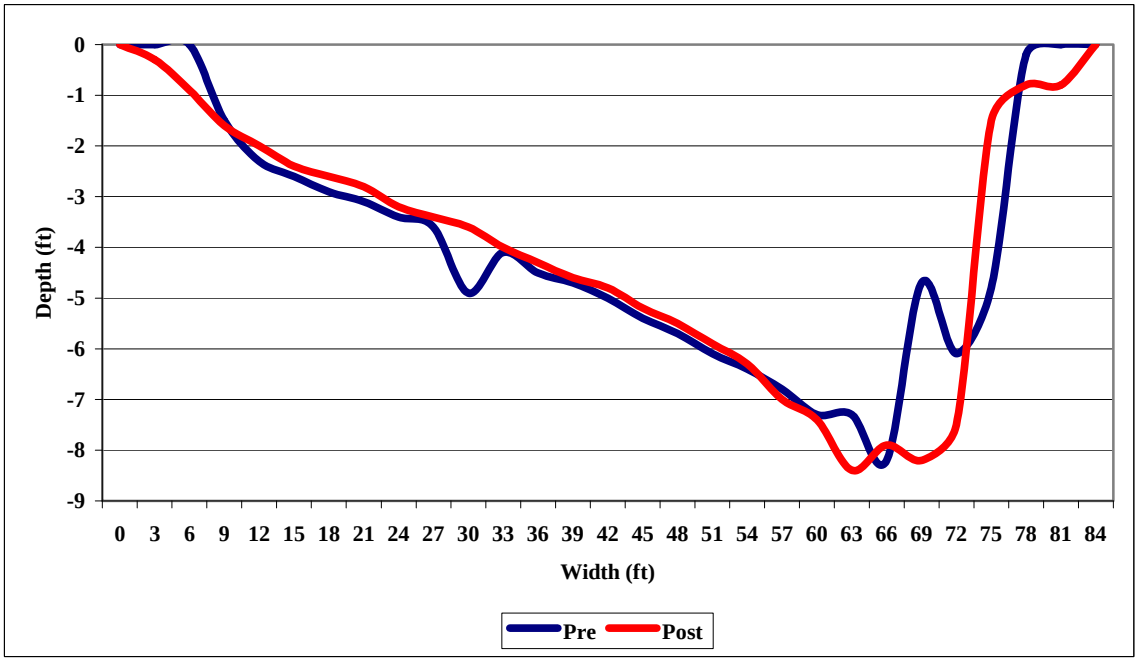
Appendix B-1. Pre and Post cross sections at Pool 1 Transect 1 – Comminsky Station Reach



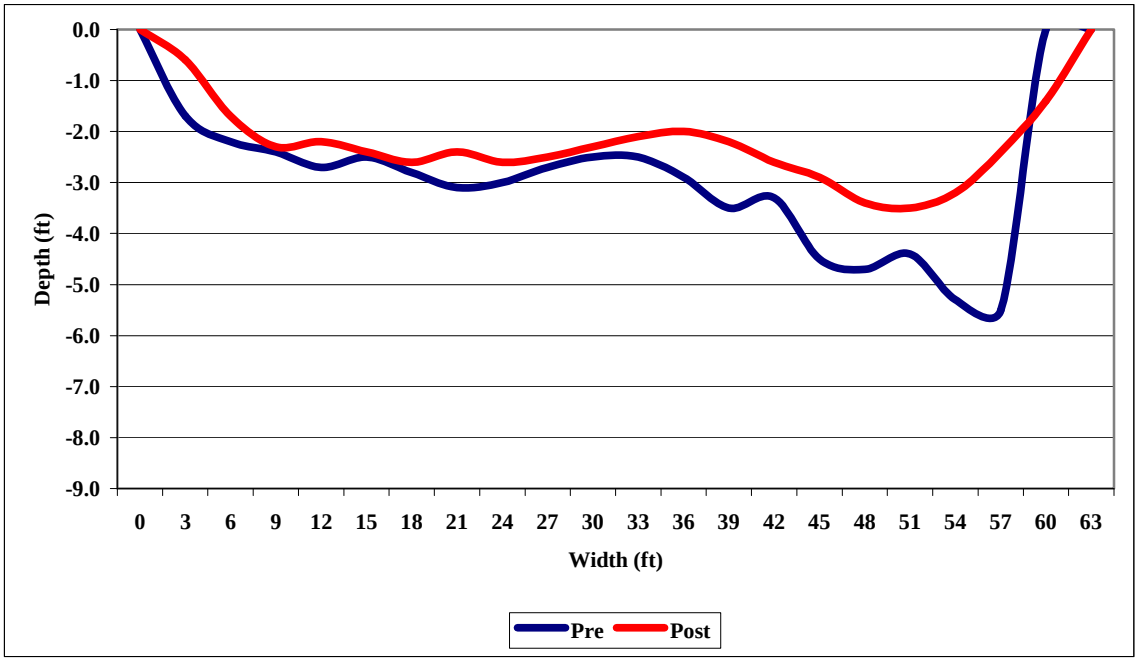
Appendix B2. Pre and Post cross sections at Pool 1 Transect 2 – Comminsky Station Reach



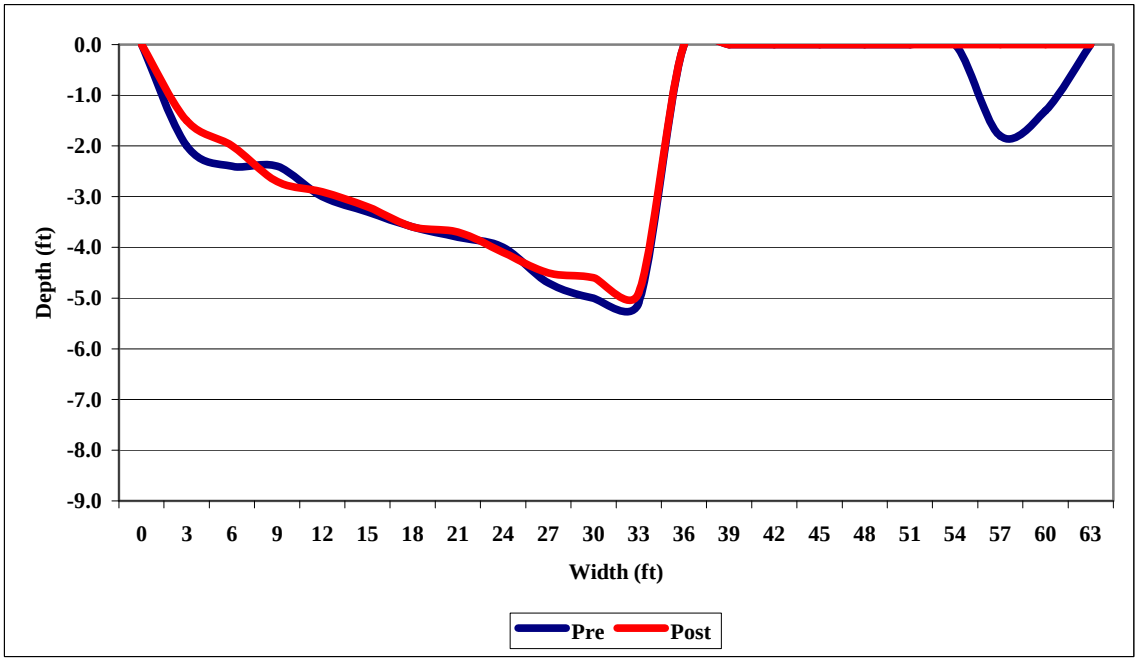
Appendix B-3. Pre and Post cross sections at Pool 1 Transect 3 – Comminsky Station Reach



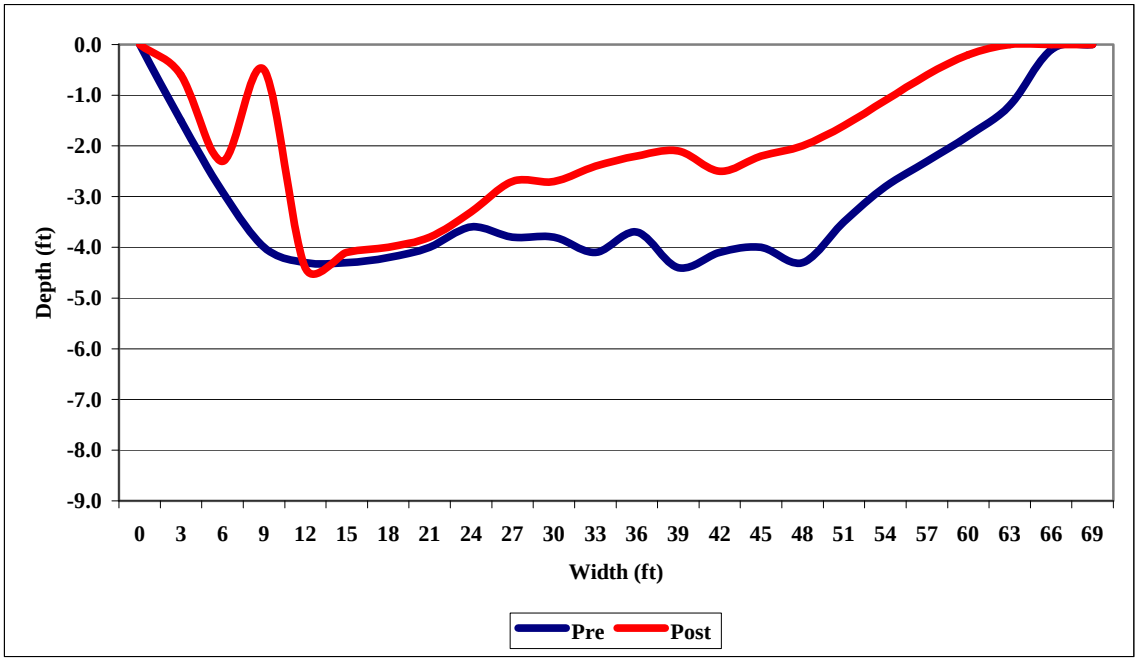
Appendix B4. Pre and Post cross sections at Pool 1 Transect 4 – Comminsky Station Reach



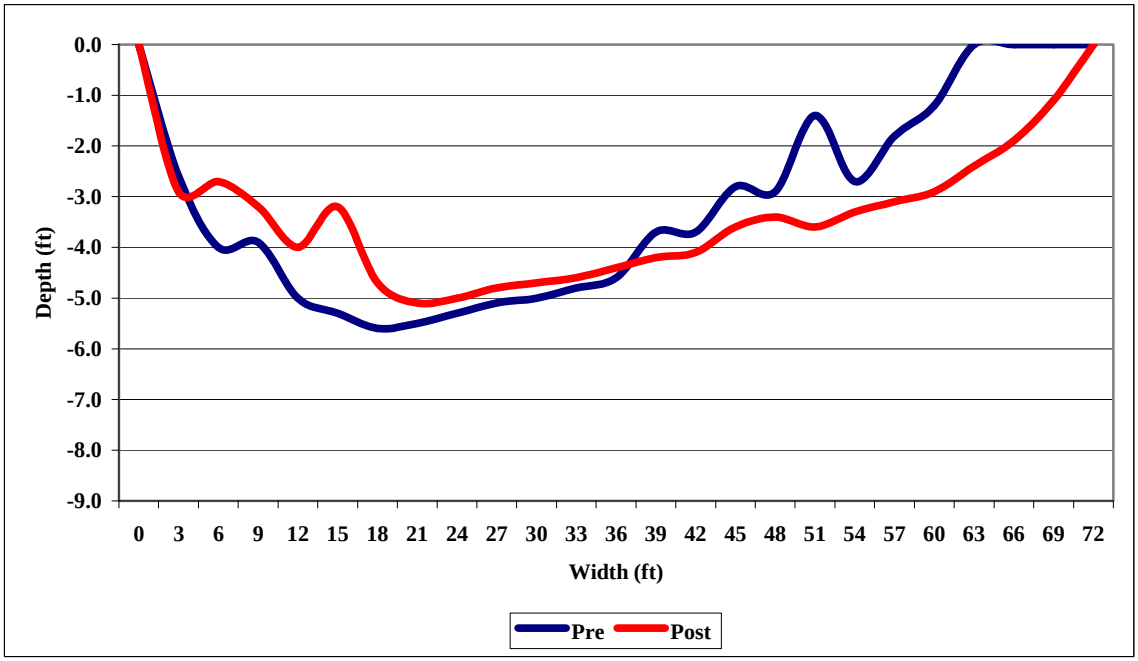
Appendix B-5. Pre and Post cross sections at Pool 2 Transect 1 – Comminsky Station Reach



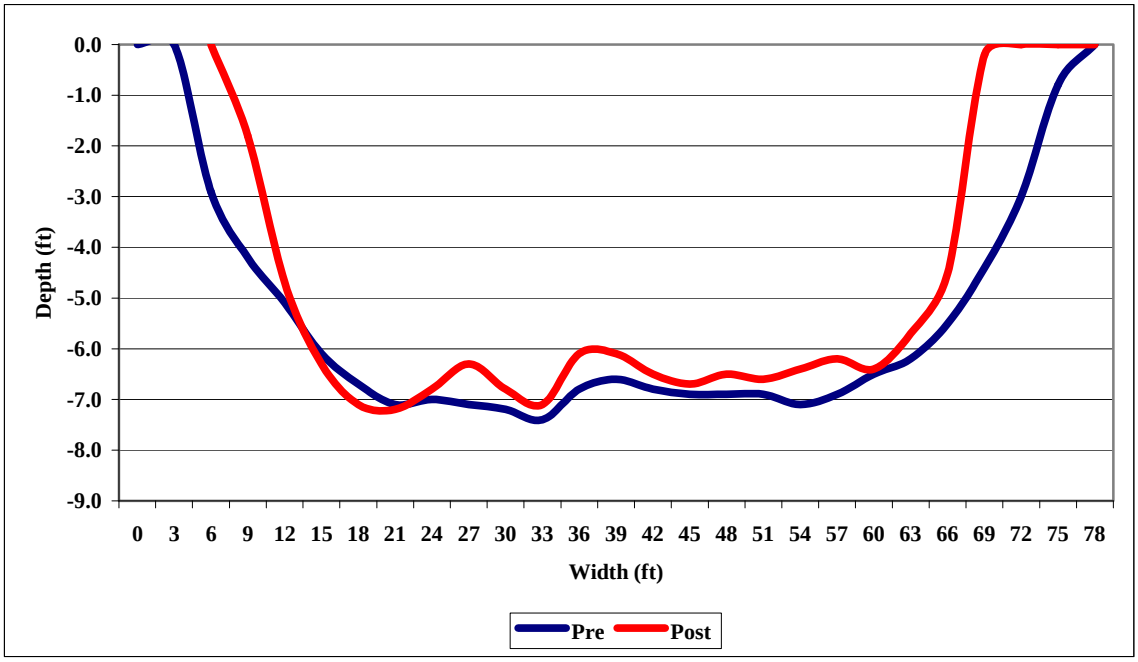
Appendix B6. Pre and Post cross sections at Pool 2 Transect 2 – Comminsky Station Reach



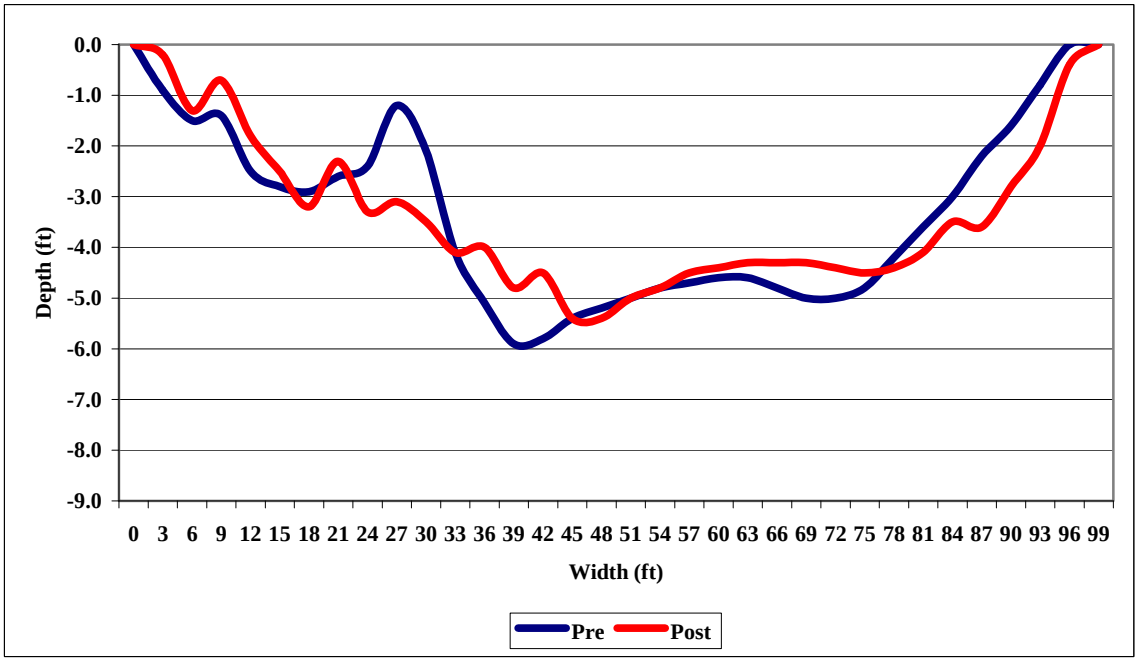
Appendix B-7. Pre and Post cross sections at Pool 2 Transect 3 – Comminsky Station Reach



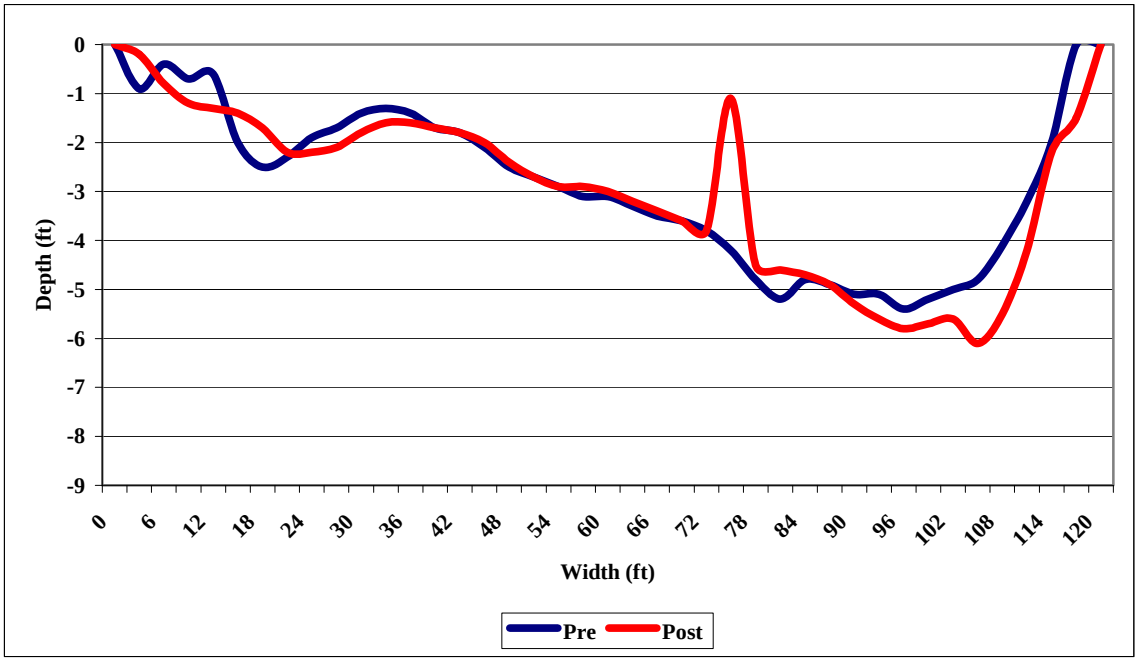
Appendix B-8. Pre and Post cross sections at Pool 3 Transect 1 – Comminsky Station Reach



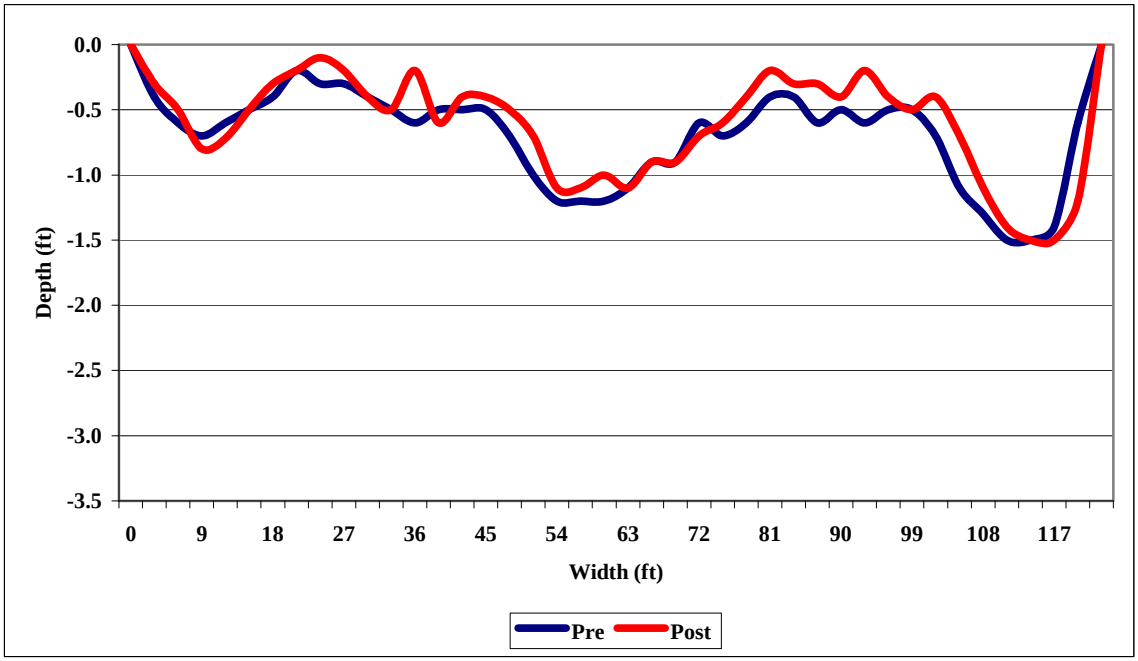
Appendix B-9. Pre and Post cross sections at Pool 3 Transect 2 – Comminsky Station Reach



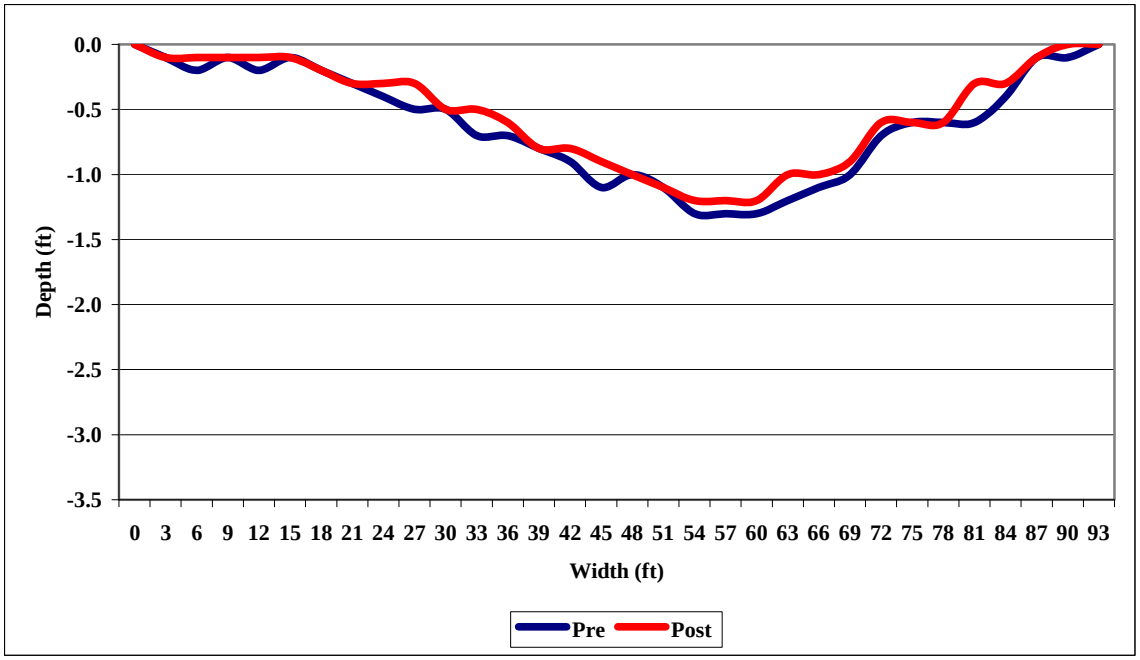
Appendix B-10. Pre and Post cross sections at Pool 3 Transect 3 – Comminsky Station Reach



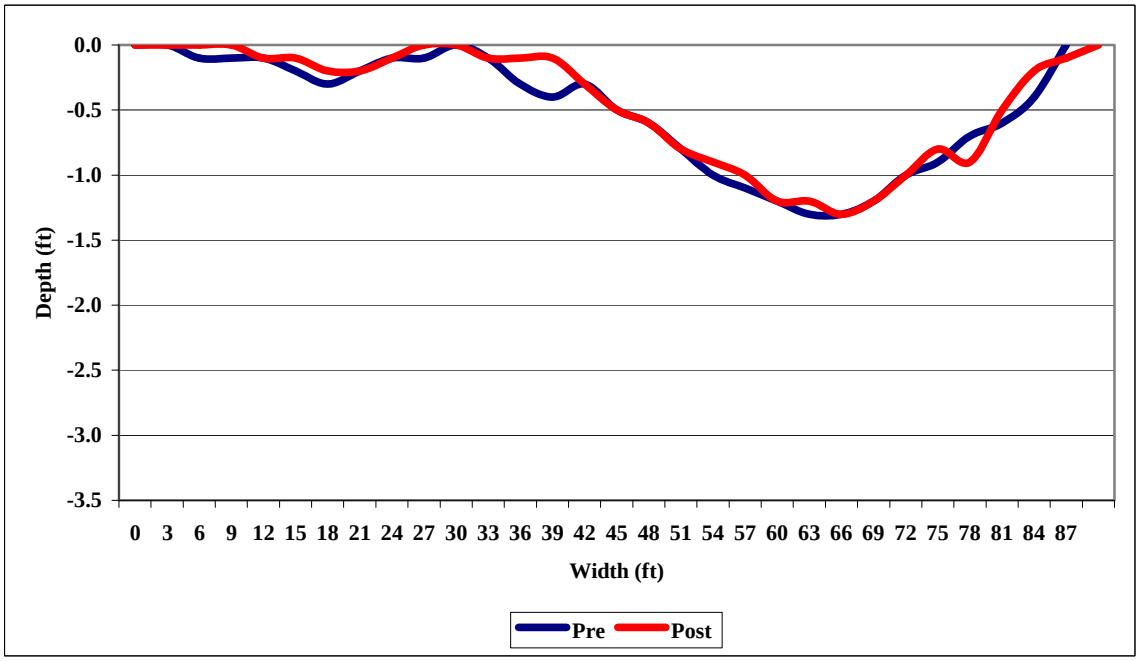
Appendix B-11. Pre and Post cross sections at Pool 3 Transect 4 – Comminsky Station Reach



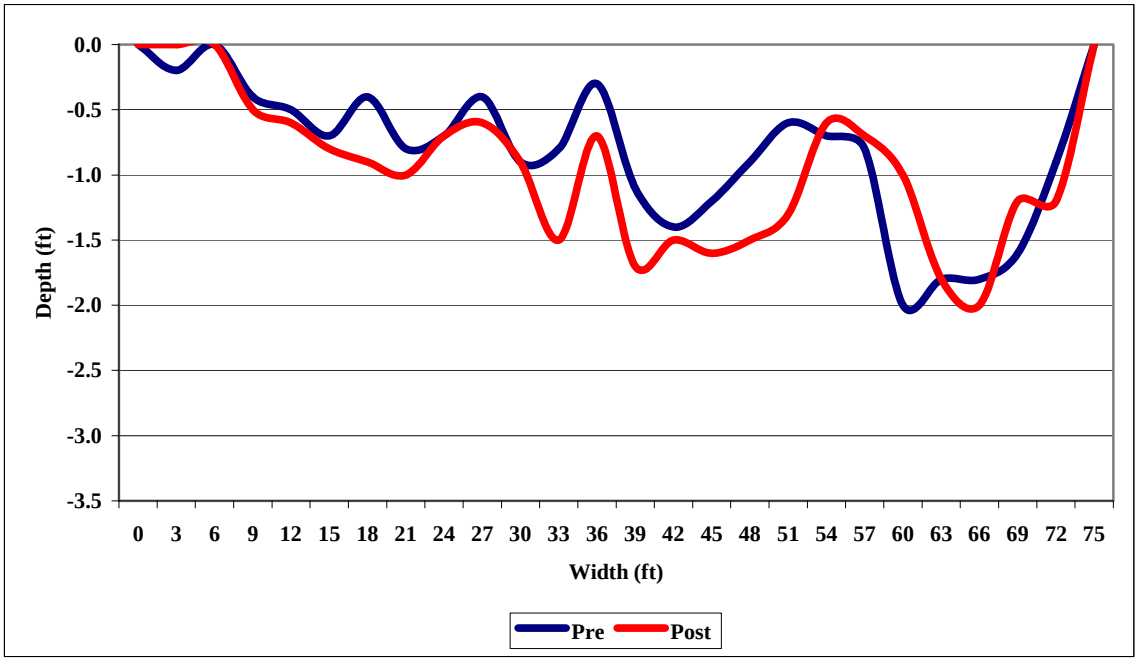
Appendix B-12. Pre and Post cross sections at Riffle 1 Transect 1 – Comminsky Station Reach



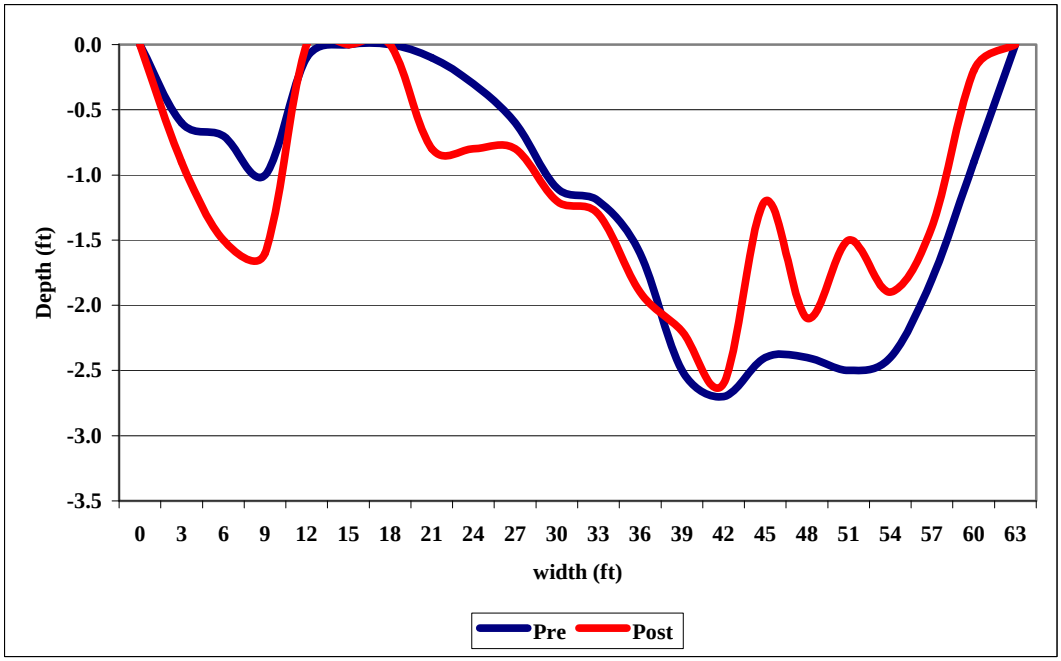
Appendix B-13. Pre and Post cross sections at Riffle 1 Transect 2 – Comminsky Station Reach



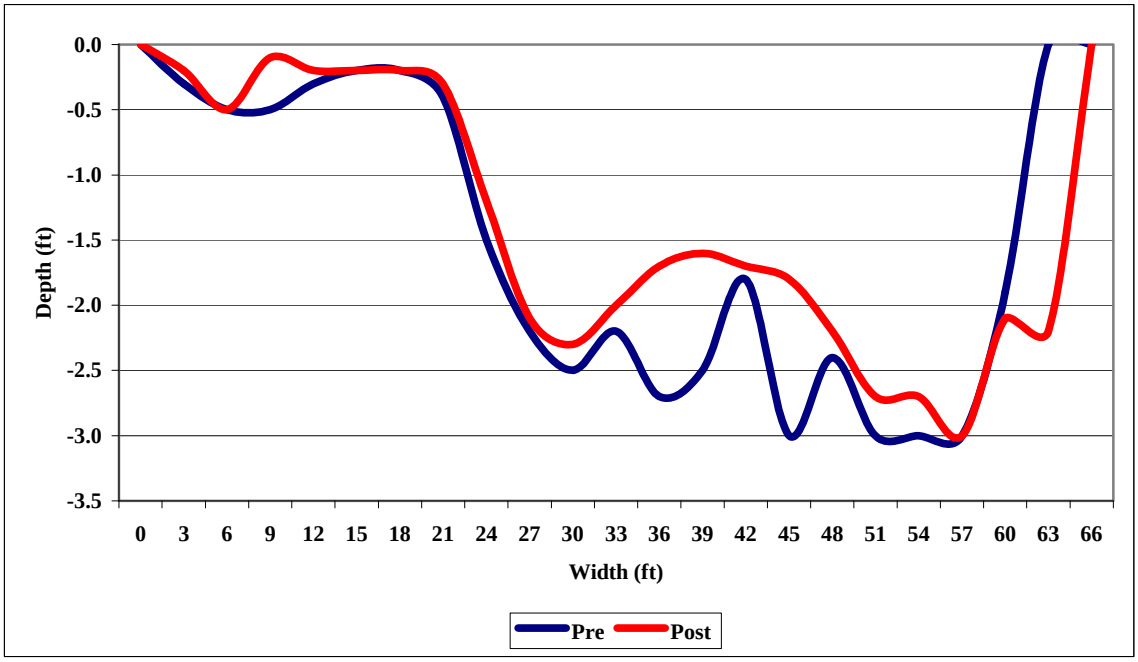
Appendix B-14. Pre and Post cross sections at Riffle 1 Transect 3 – Comminsky Station Reach



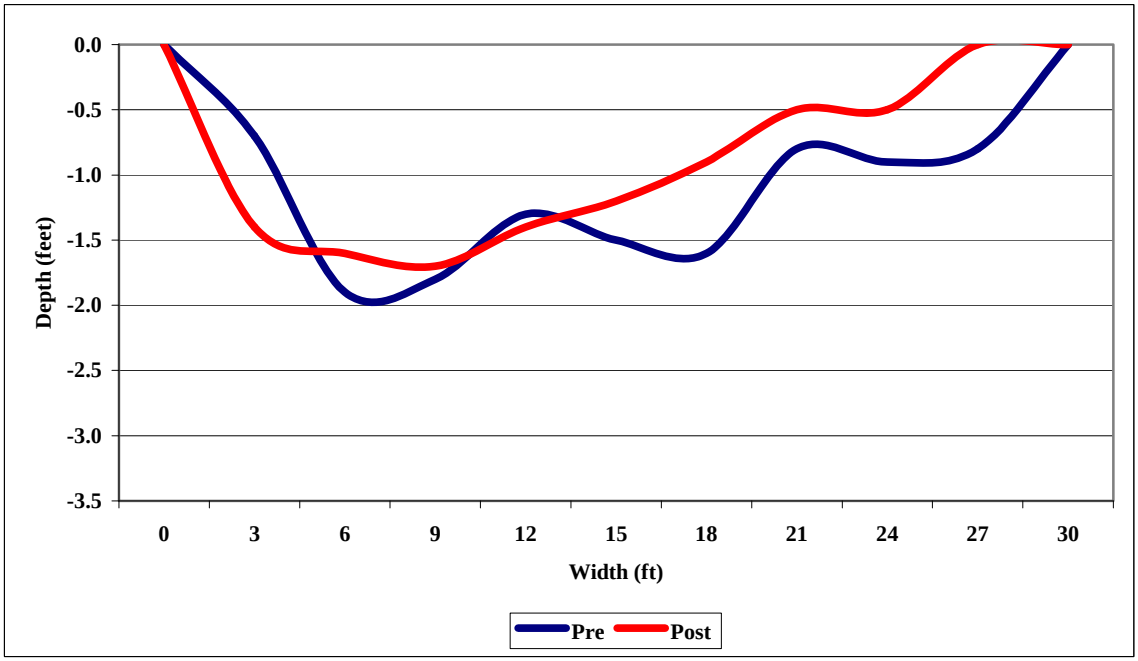
Appendix B-15. Pre and Post cross sections at Riffle 2 Transect 1 – Comminsky Station Reach



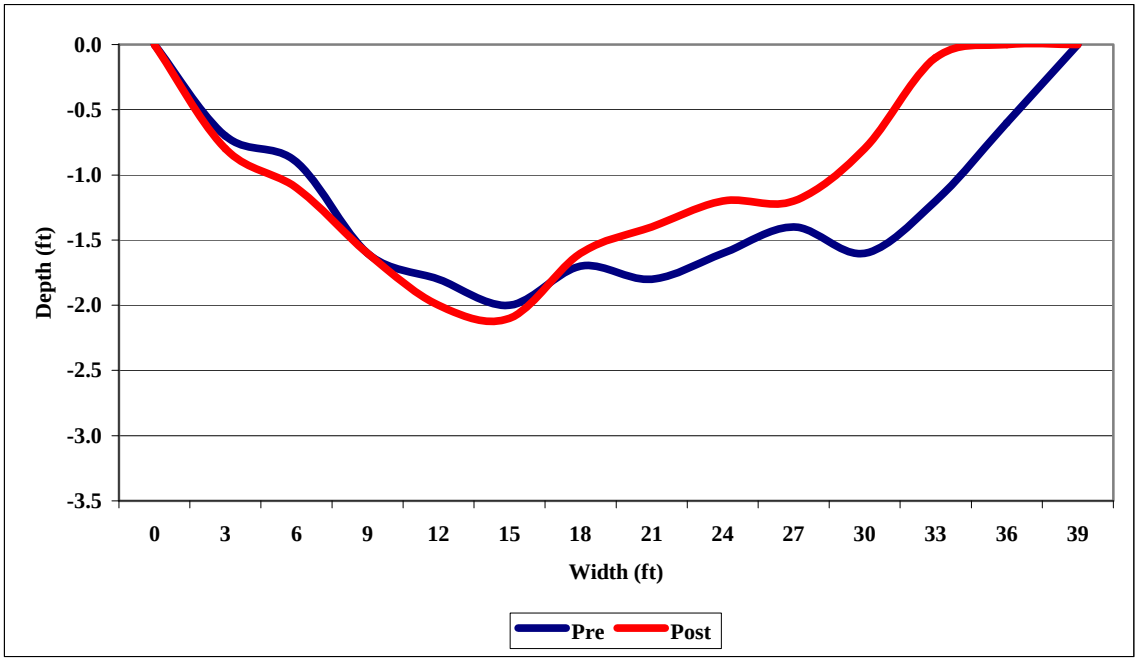
Appendix B-16. Pre and Post cross sections at Riffle 2 Transect 2 – Comminsky Station Reach



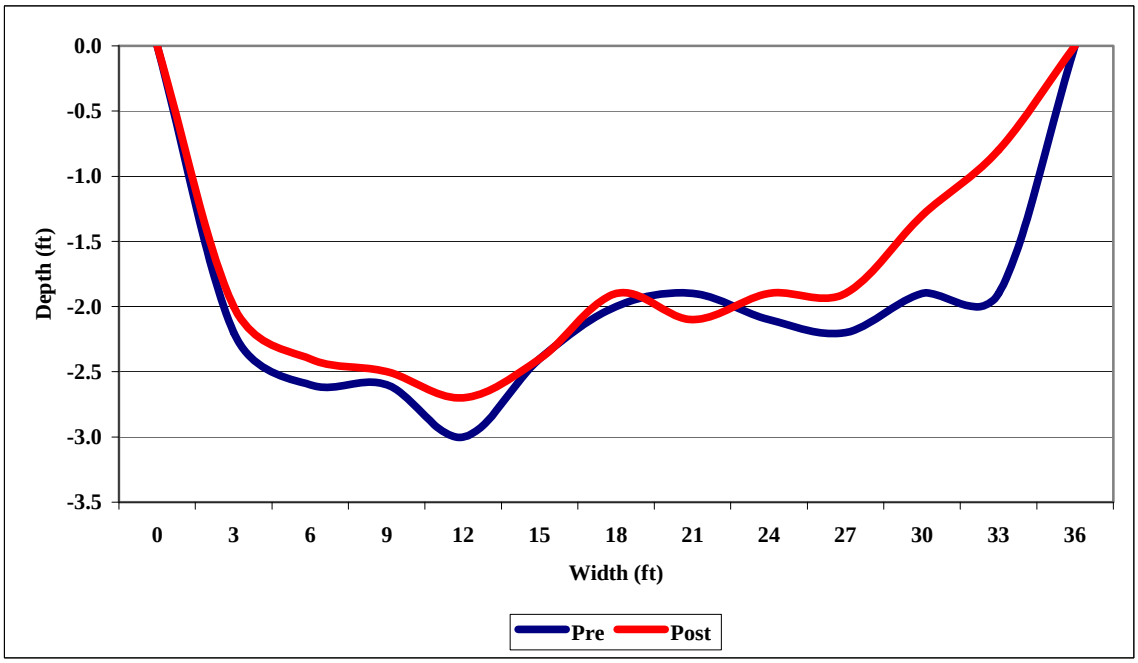
Appendix B-17. Pre and Post cross sections at Riffle 2 Transect 3 – Comminsky Station Reach



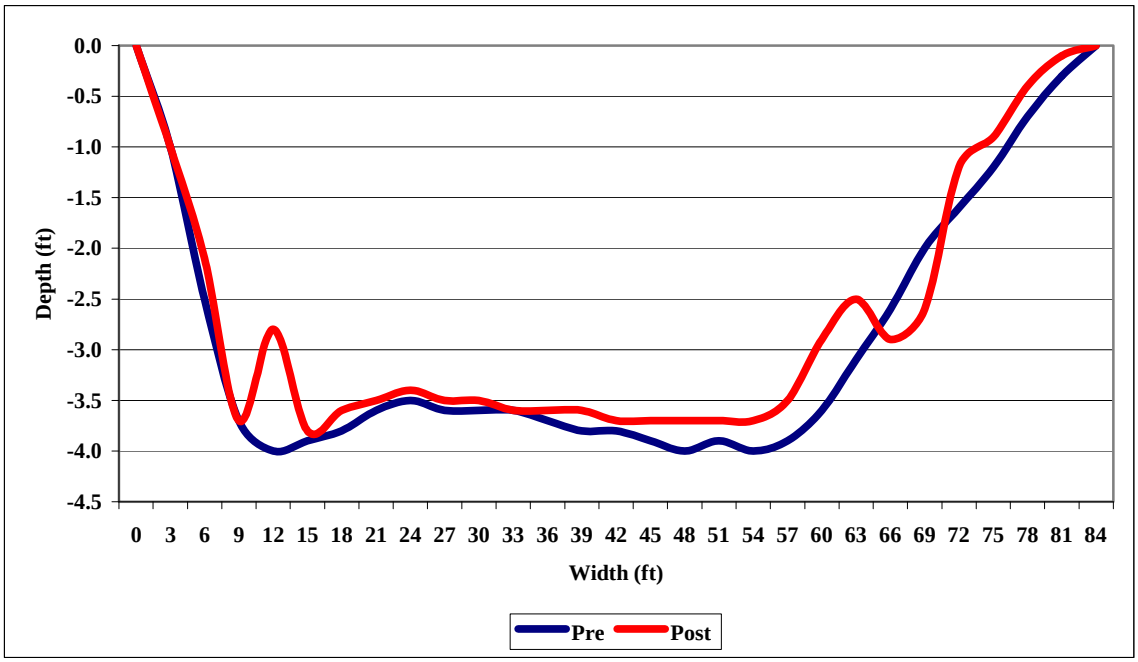
Appendix B-18. Pre and Post cross sections at Riffle 3 Transect 1 – Comminsky Station Reach



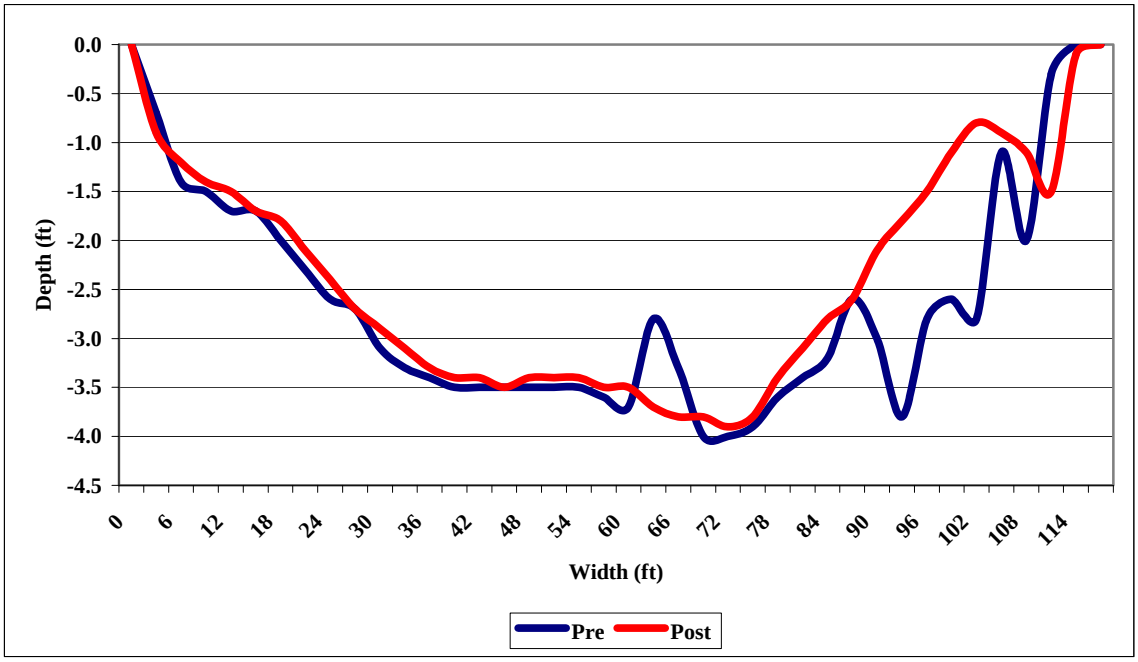
Appendix B-19. Pre and Post cross sections at Riffle 3 Transect 2 – Comminsky Station Reach



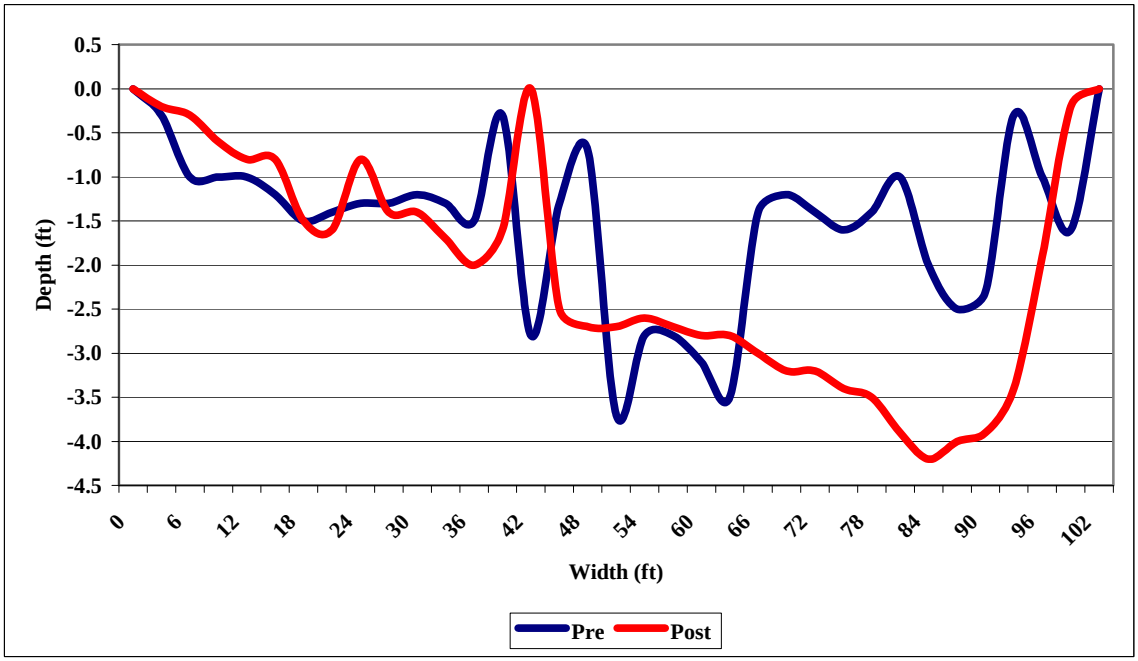
Appendix B-20. Pre and Post cross sections at Riffle 3 Transect 3 – Comminsky Station Reach



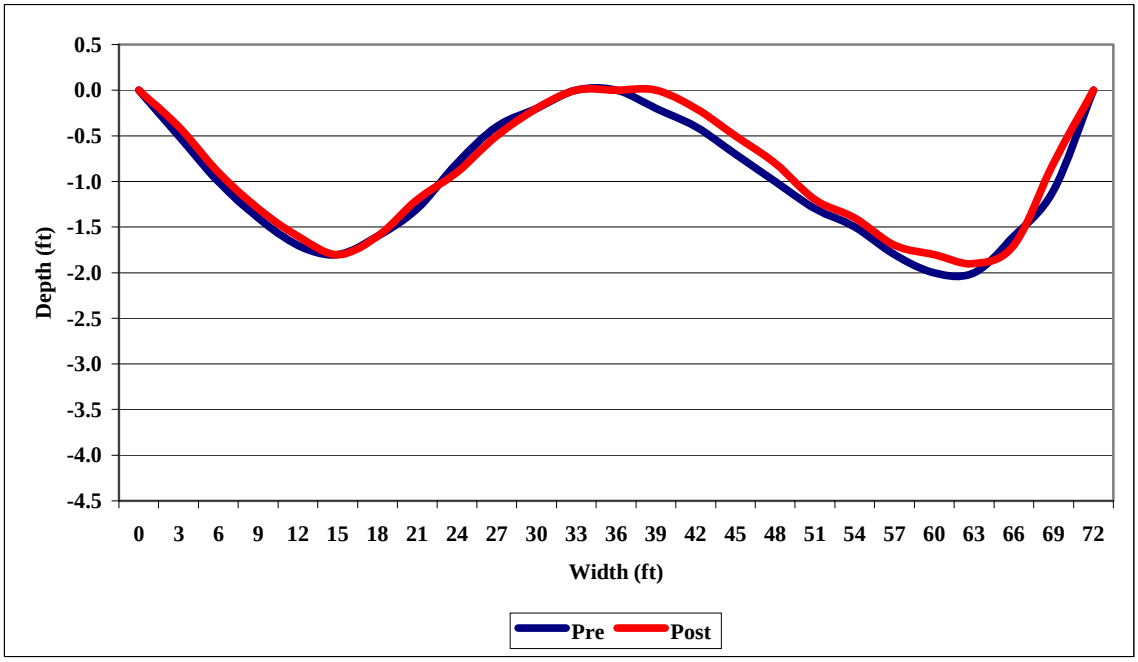
Appendix B-21. Pre and Post cross sections at Flatwater 1 Transect 1 – Comminsky Station Reach



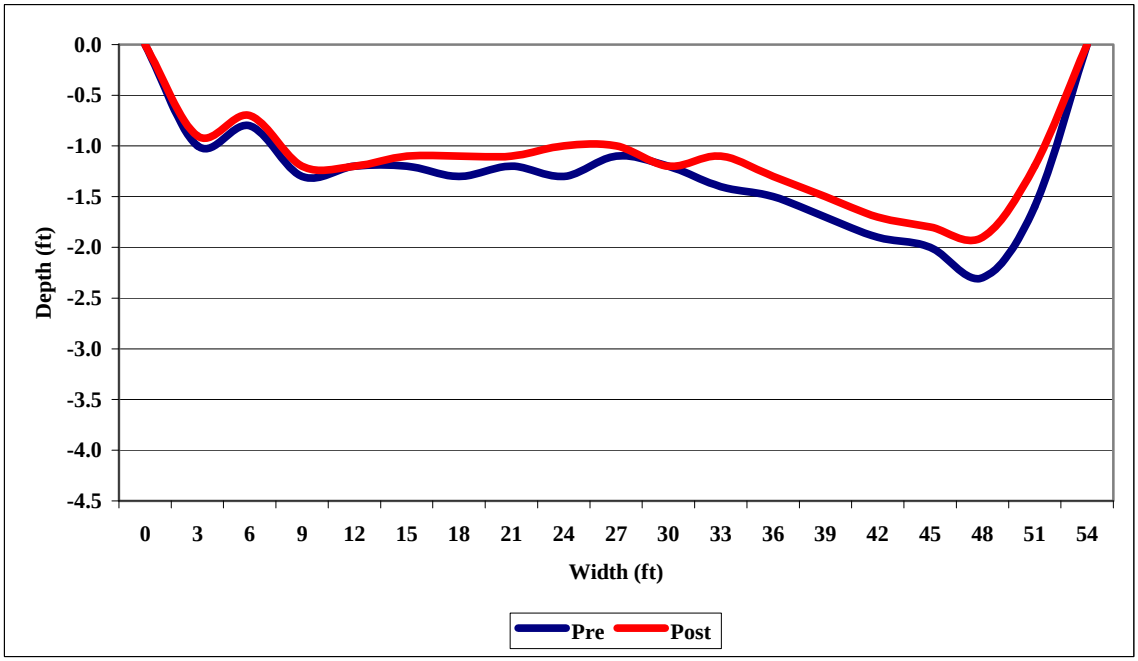
Appendix B-22. Pre and Post cross sections at Flatwater 1 Transect 2 – Comminsky Station Reach



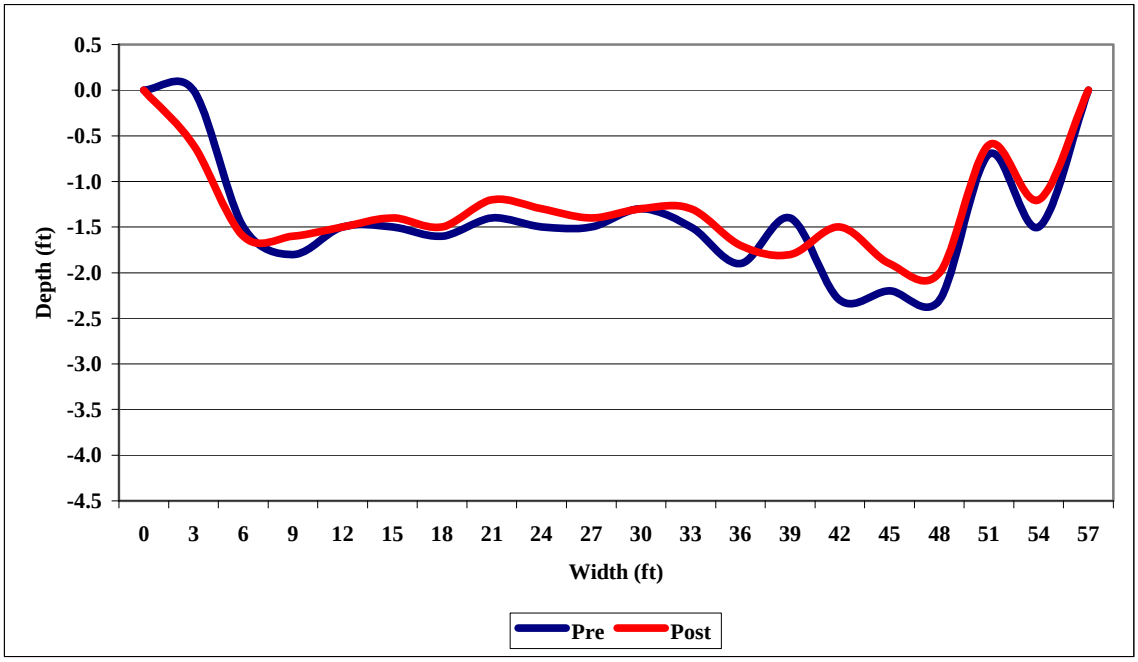
Appendix B-23. Pre and Post cross sections at Flatwater 1 Transect 3 – Comminsky Station Reach



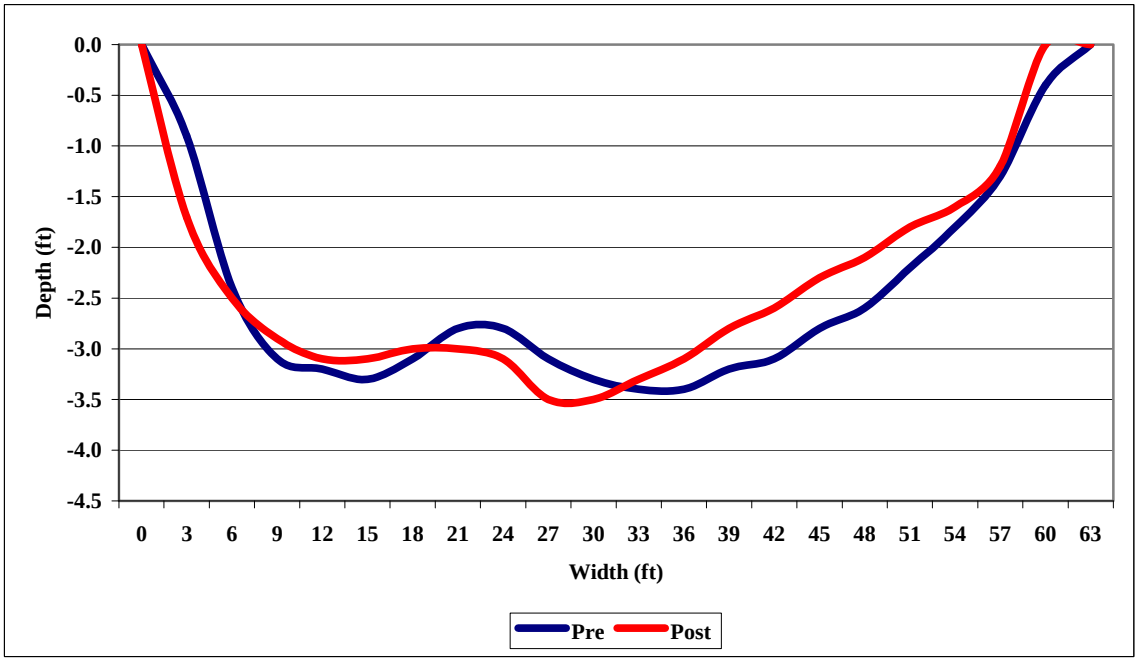
Appendix B-24. Pre and Post cross sections at Flatwater 2 Transect 1 – Comminsky Station Reach



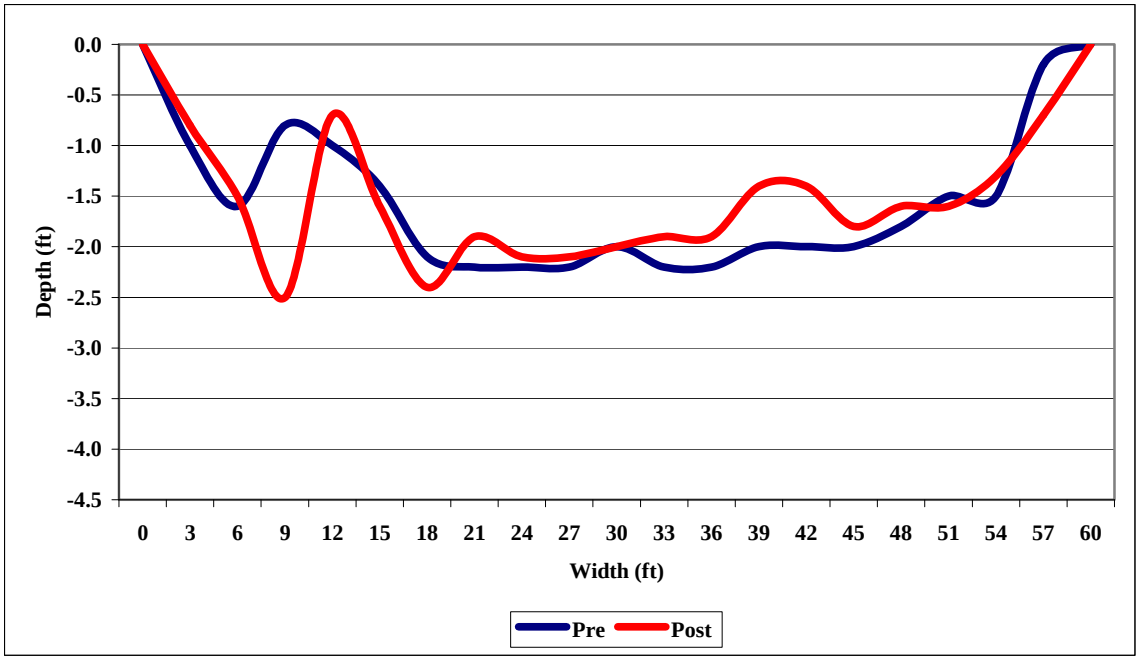
Appendix B-25. Pre and Post cross sections at Flatwater 2 Transect 2 – Comminsky Station Reach



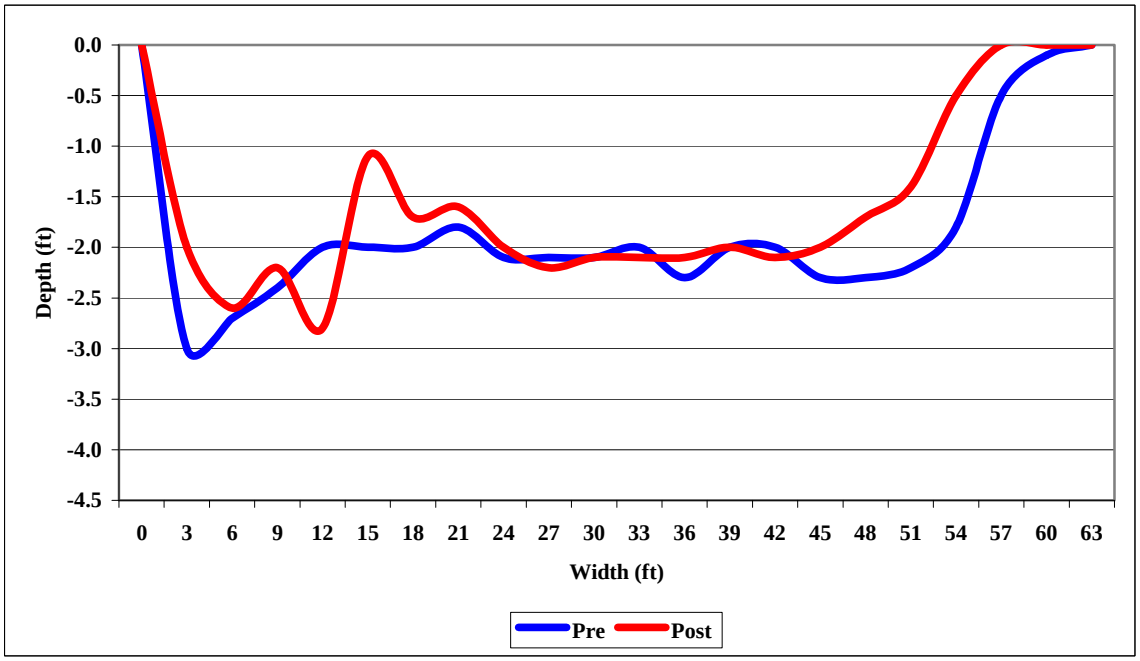
Appendix B-24. Pre and Post cross sections at Flatwater 2 Transect 3 – Comminsky Station Reach



Appendix B-25. Pre and Post cross sections at Flatwater 3 Transect 1 – Comminsky Station Reach



Appendix B-26. Pre and Post cross sections at Flatwater 3 Transect 2 – Comminsky Station Reach

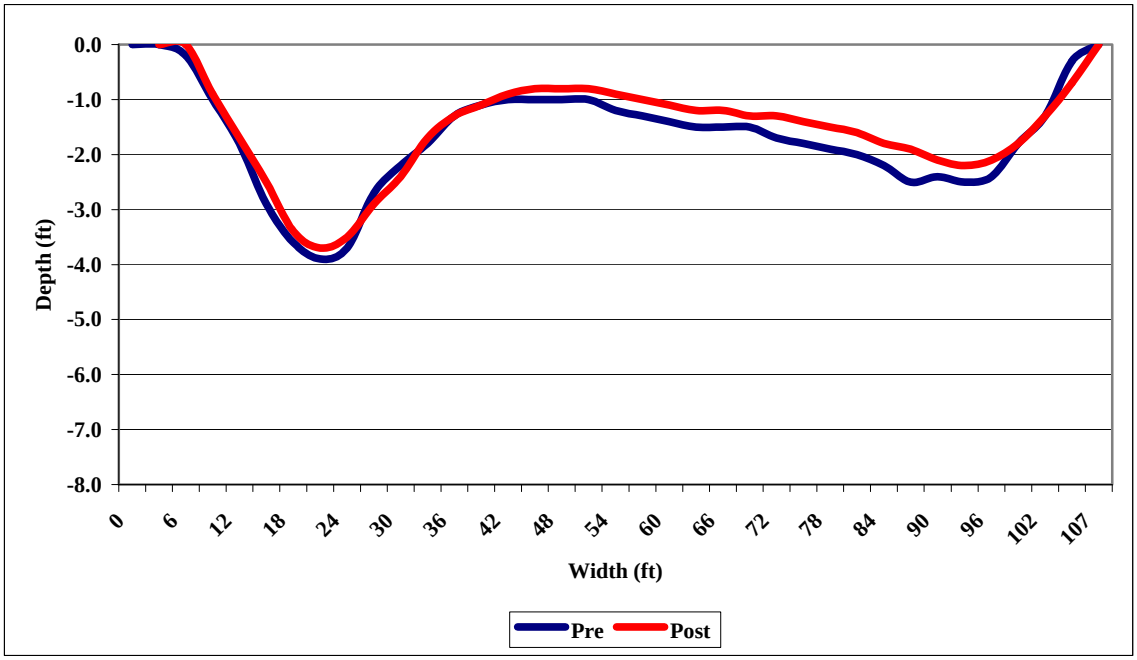


Appendix B-27. Pre and Post cross sections at Flatwater 3 Transect 3 – Comminsky Station Reach

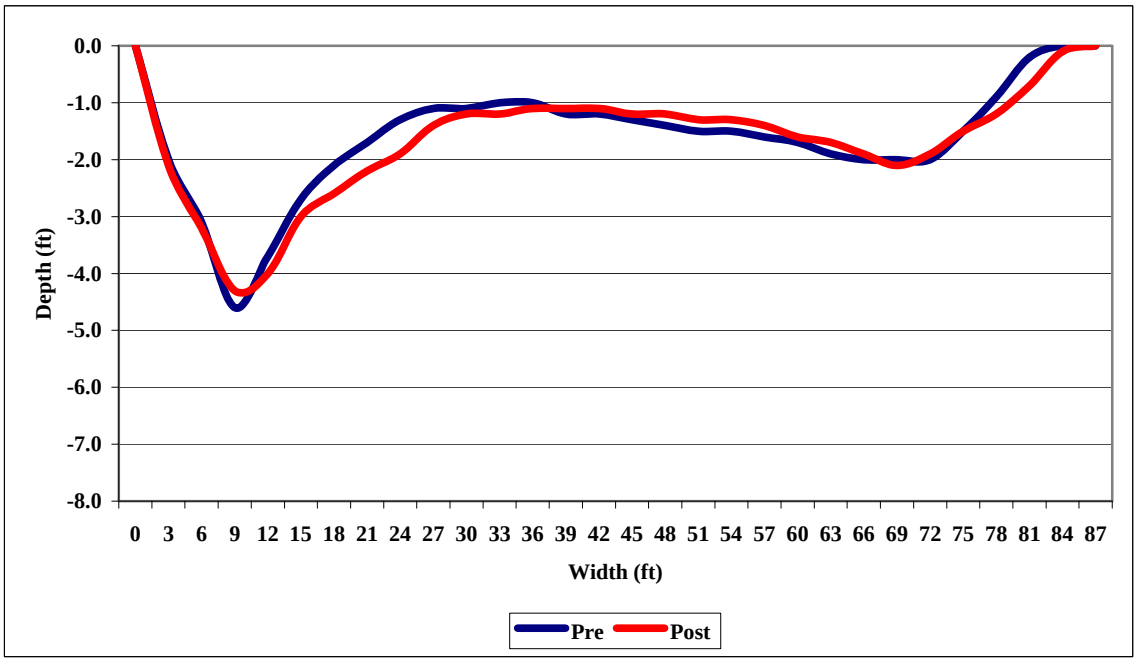
APPENDIX C

CLOVERDALE REACH CROSS SECTIONS

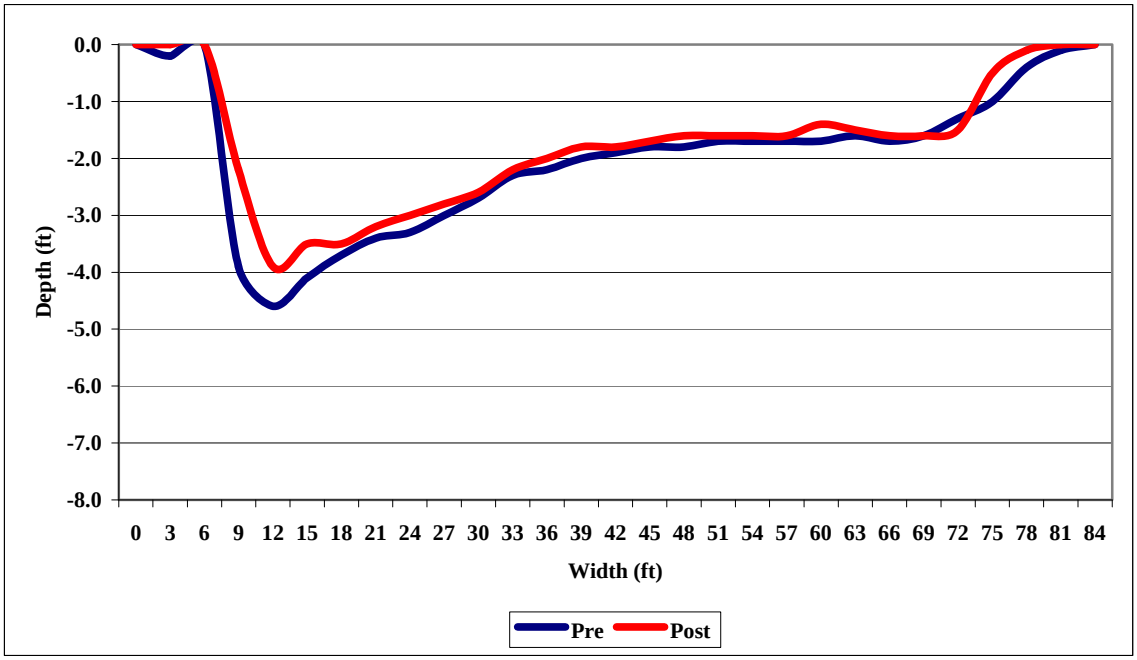
PRE AND POST FLOW REDUCTION SURVEYS



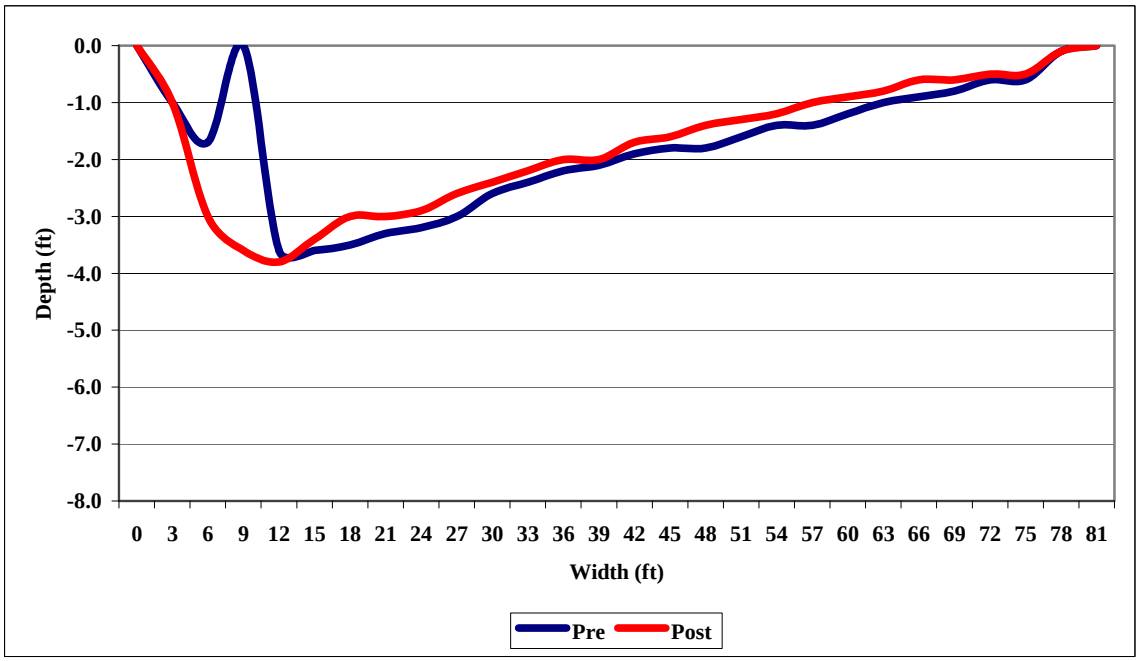
Appendix C-1. Pre- and Post cross sections at Pool 1 Transect 1 – Cloverdale Reach



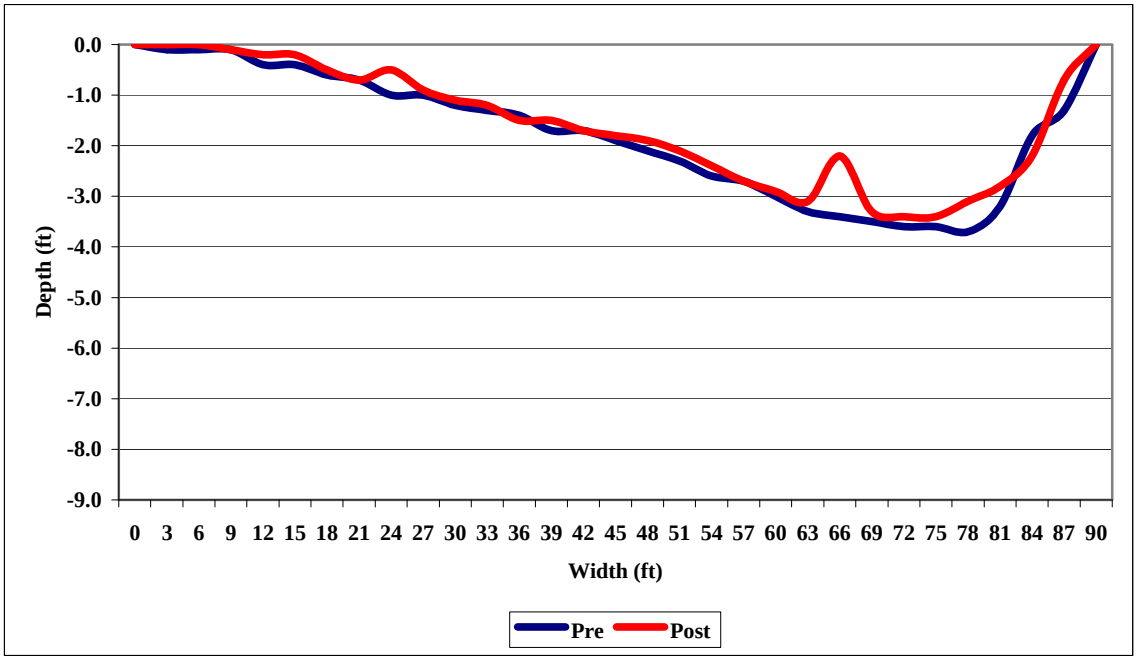
Appendix C-2. Pre- and Post cross sections at Pool 1 Transect 2 – Cloverdale Reach



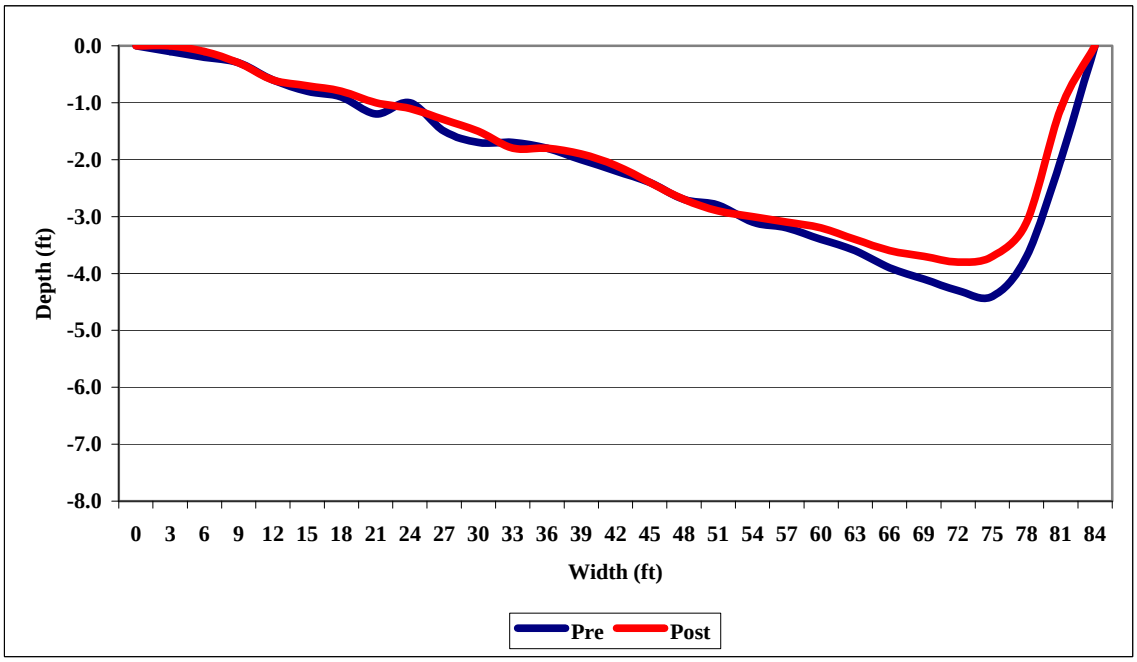
Appendix C-3. Pre- and Post cross sections at Pool 1 Transect 3 – Cloverdale Reach



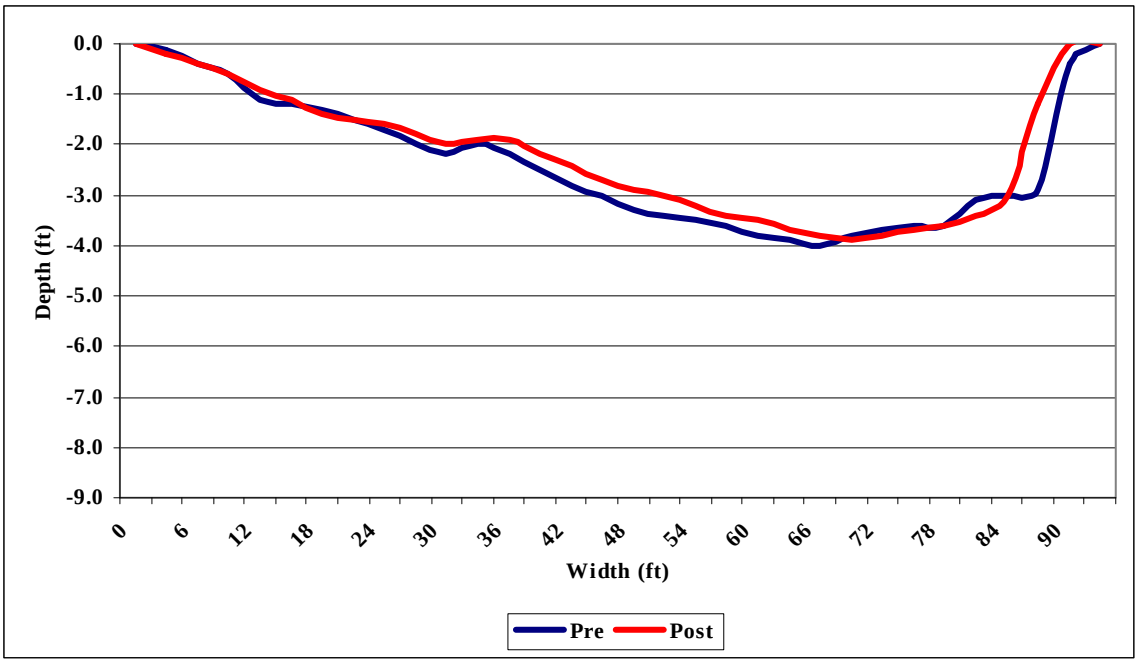
Appendix C-4. Pre- and Post cross sections at Pool 1 Transect 4 – Cloverdale Reach



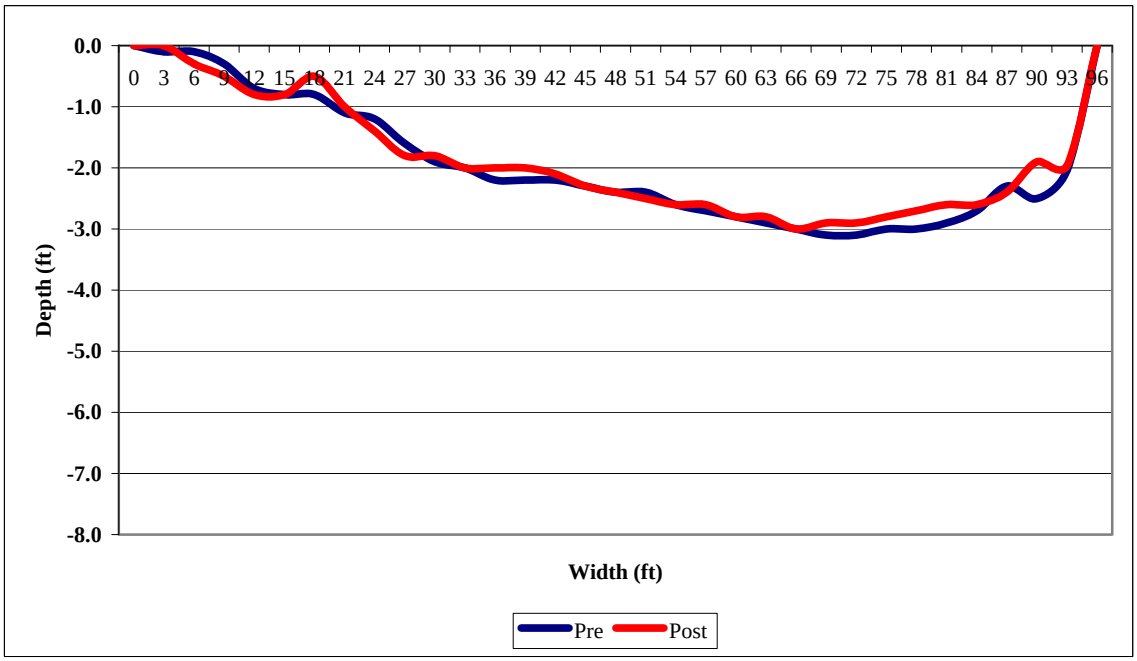
Appendix C-5. Pre- and Post cross sections at Pool 2 Transect 1 – Cloverdale Reach



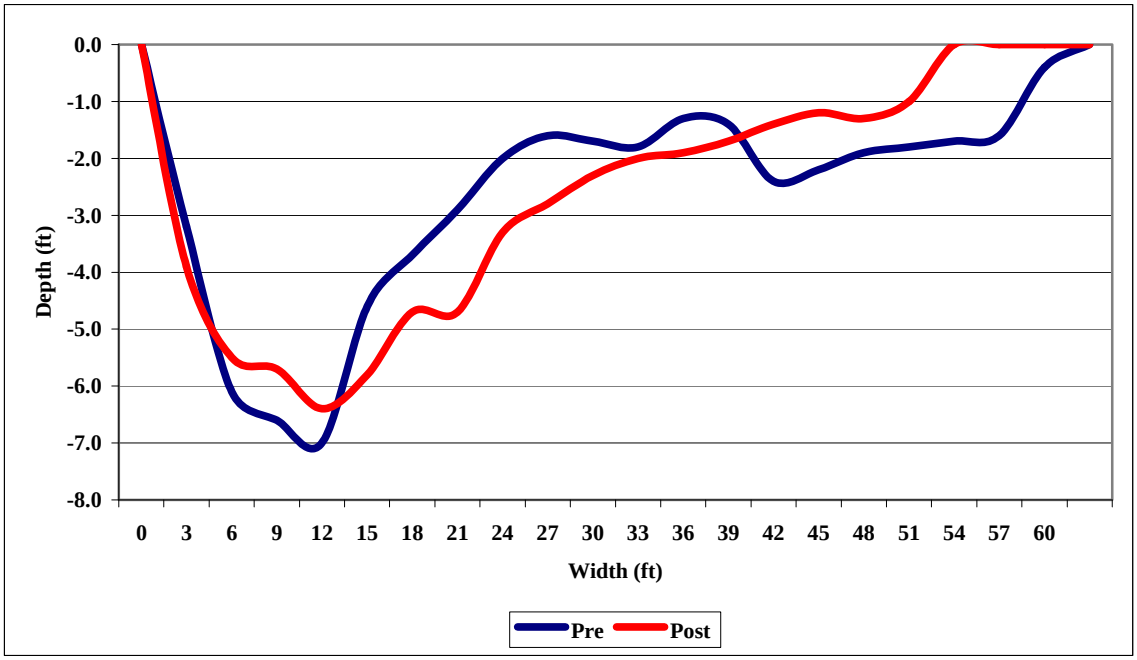
Appendix C-6. Pre- and Post cross sections at Pool 2 Transect 2 – Cloverdale Reach



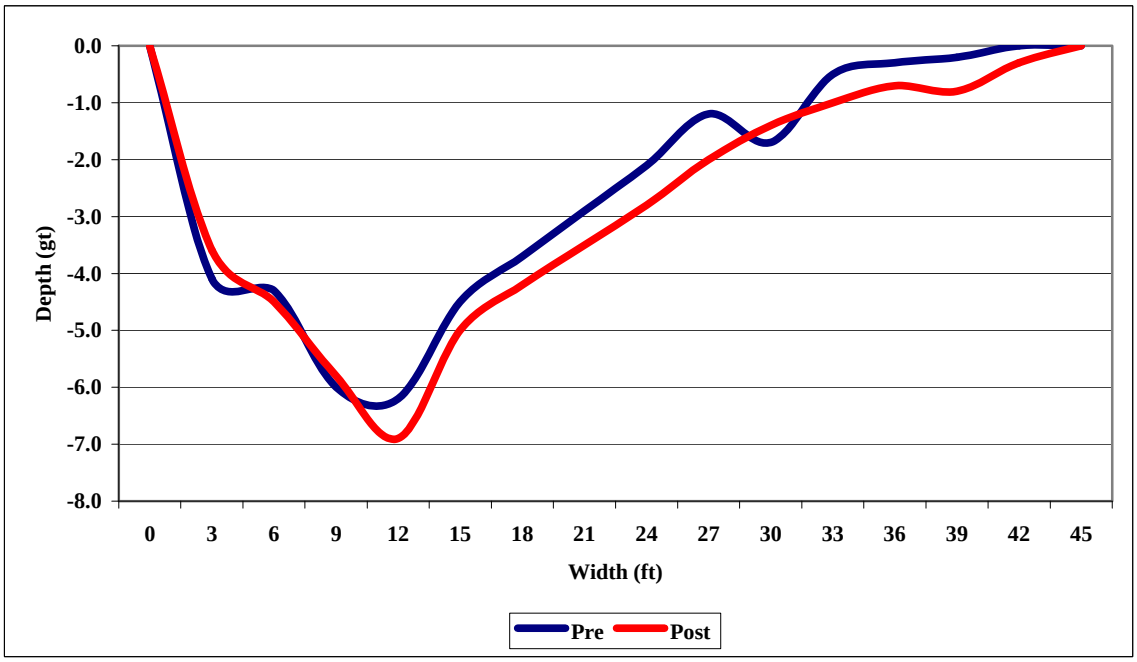
Appendix C-7. Pre- and Post cross sections at Pool 2 Transect 3 – Cloverdale Reach



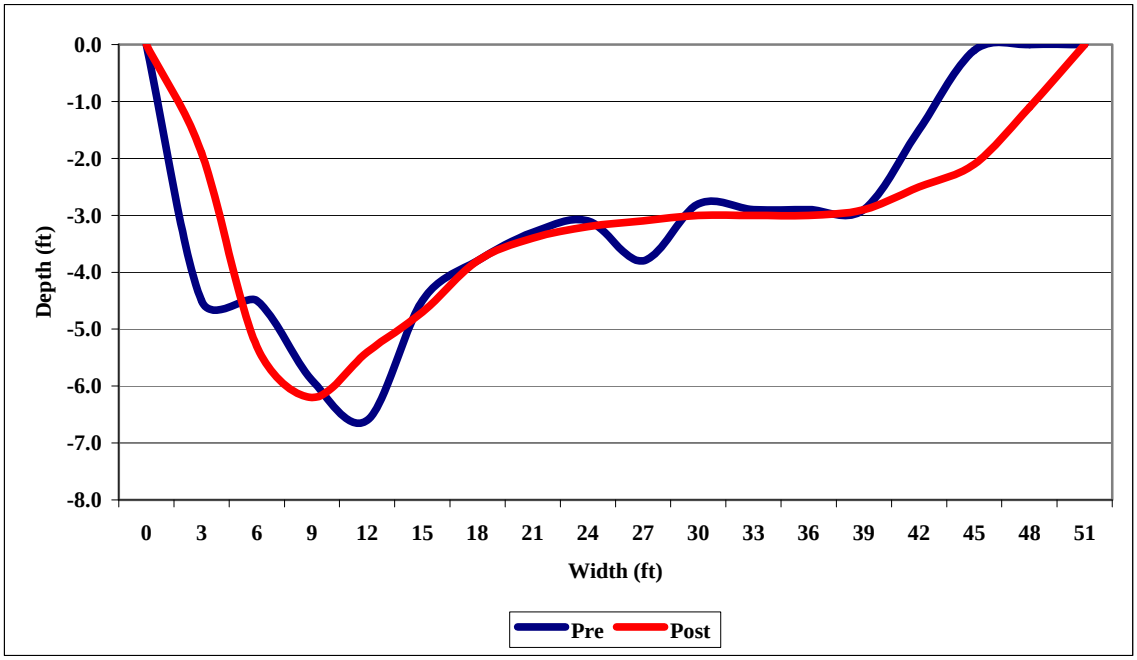
Appendix C-8. Pre- and Post cross sections at Pool 2 Transect 4 – Cloverdale Reach



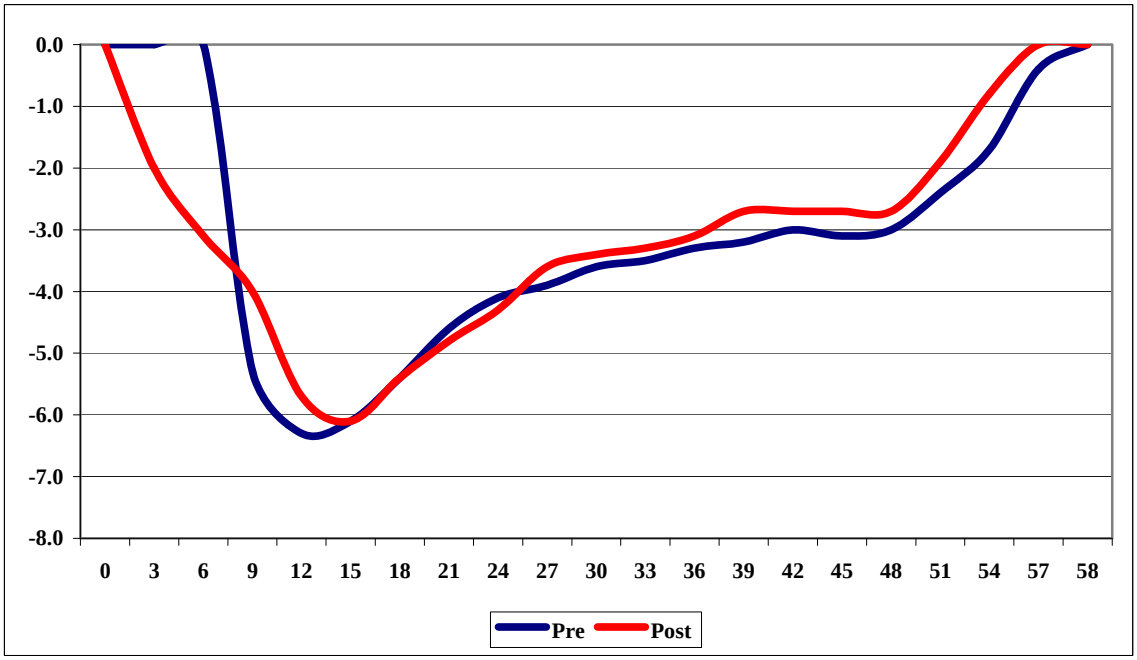
Appendix C-9. Pre- and Post cross sections at Pool 3 Transect 1 – Cloverdale Reach



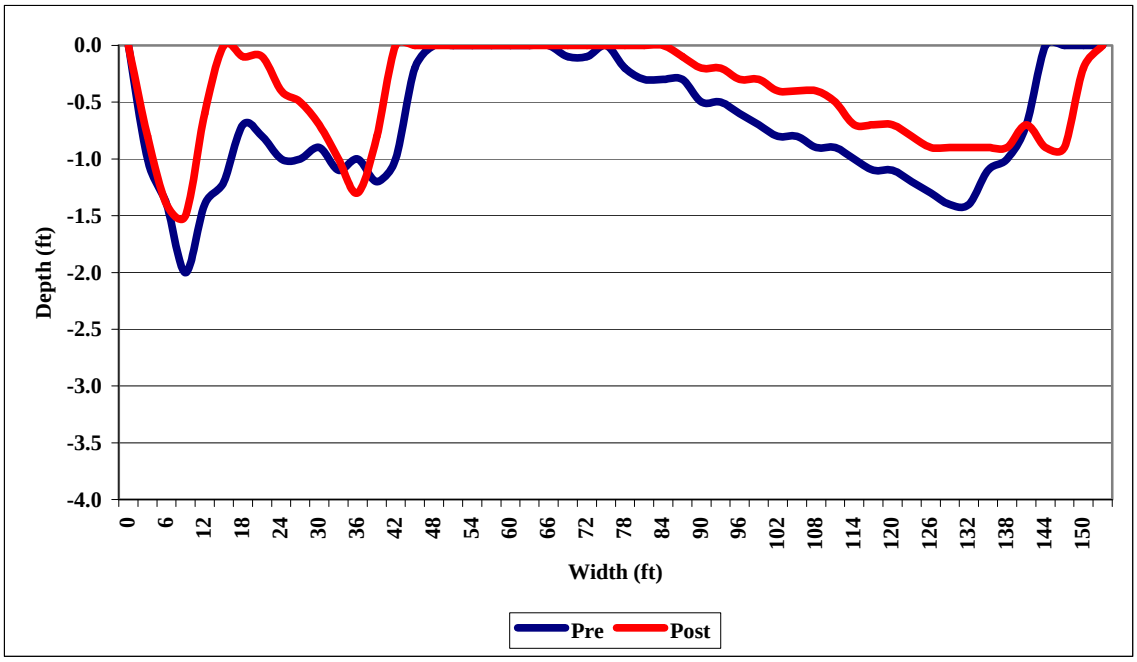
Appendix C-10. Pre- and Post cross sections at Pool 3 Transect 2 – Cloverdale Reach



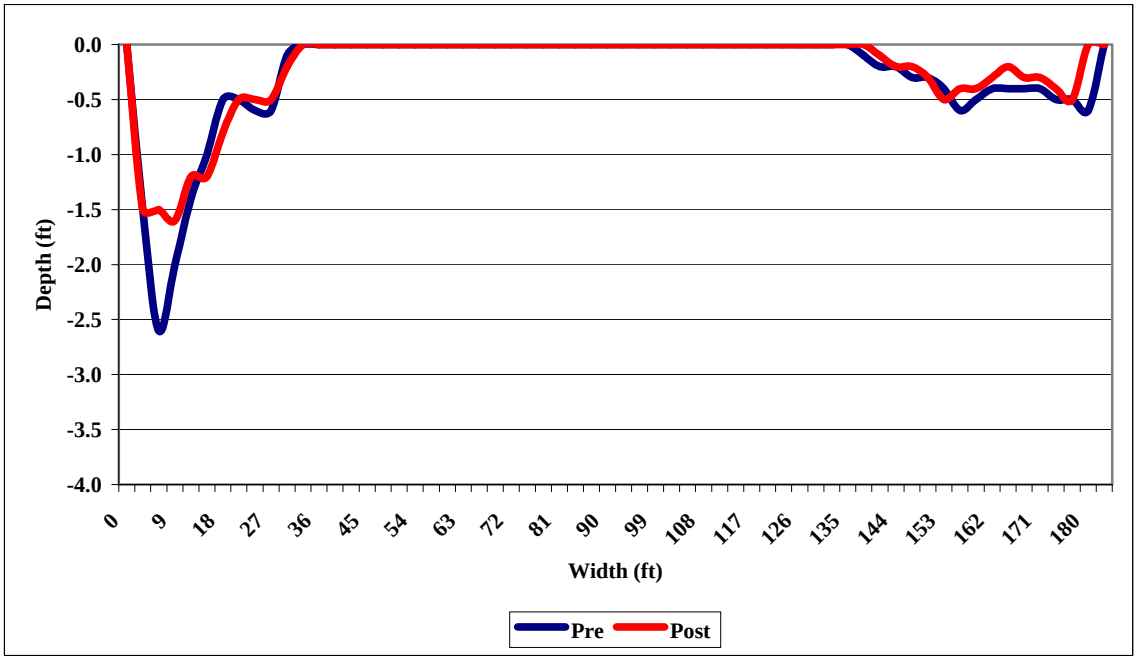
Appendix C-11. Pre- and Post cross sections at Pool 3 Transect 3 – Cloverdale Reach



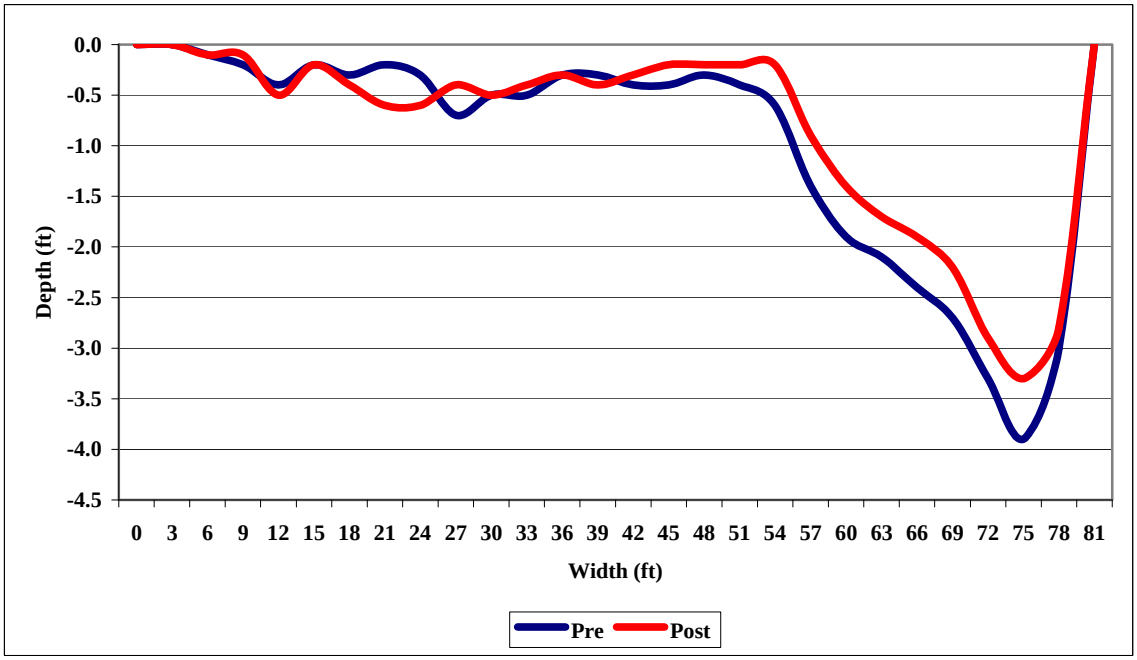
Appendix C-12. Pre- and Post cross sections at Pool 3 Transect 4 – Cloverdale Reach



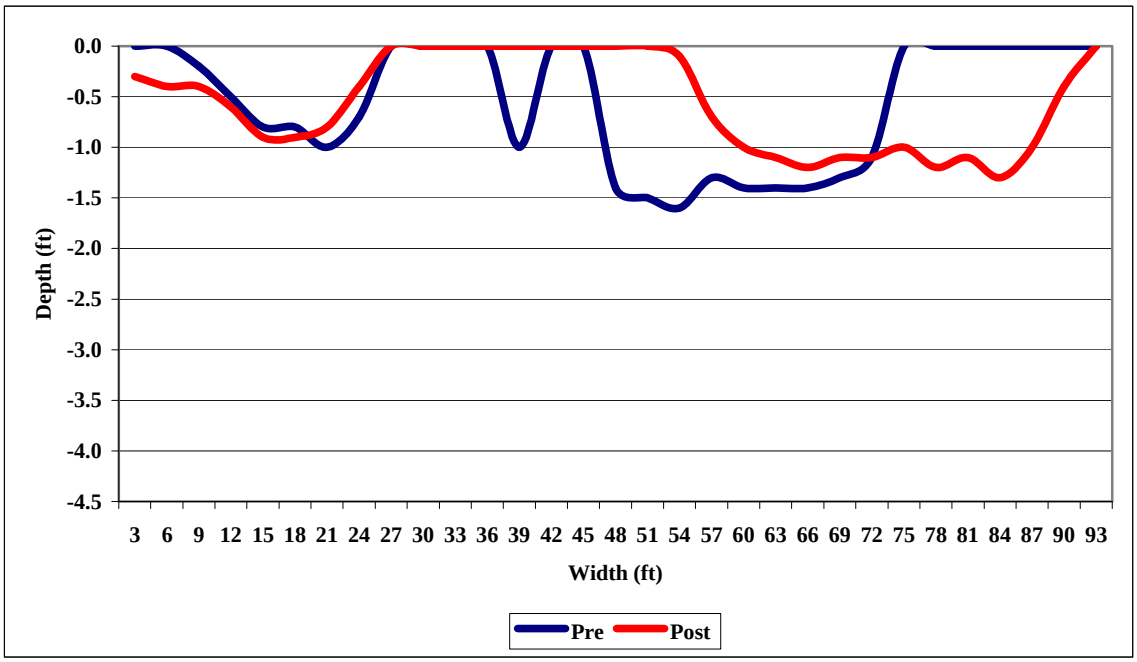
Appendix C-13. Pre- and Post cross sections at Riffle 1 Transect 1 – Cloverdale Reach



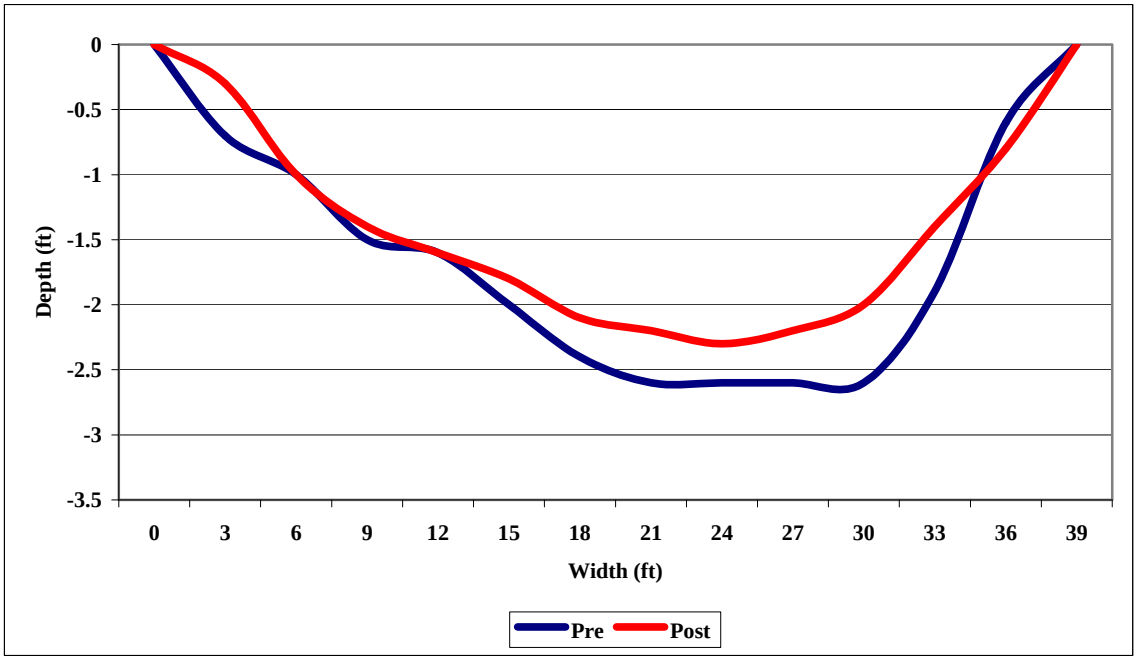
Appendix C-14. Pre- and Post cross sections at Riffle 1 Transect 2 – Cloverdale Reach



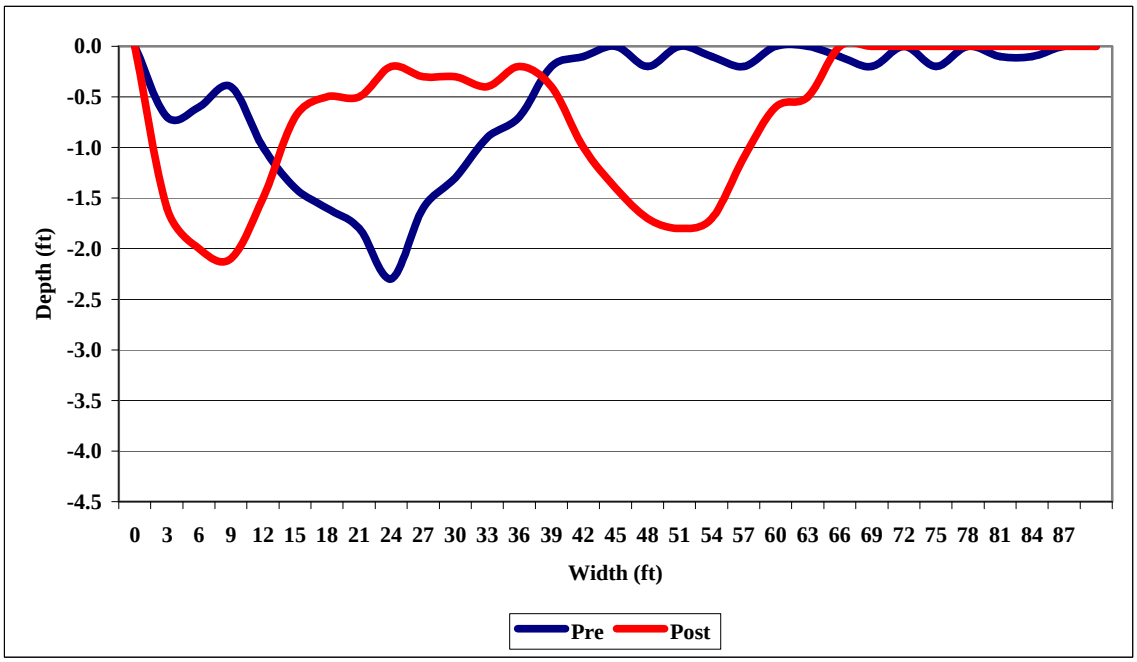
Appendix C-15. Pre- and Post cross sections at Riffle 2 Transect 1 – Cloverdale Reach



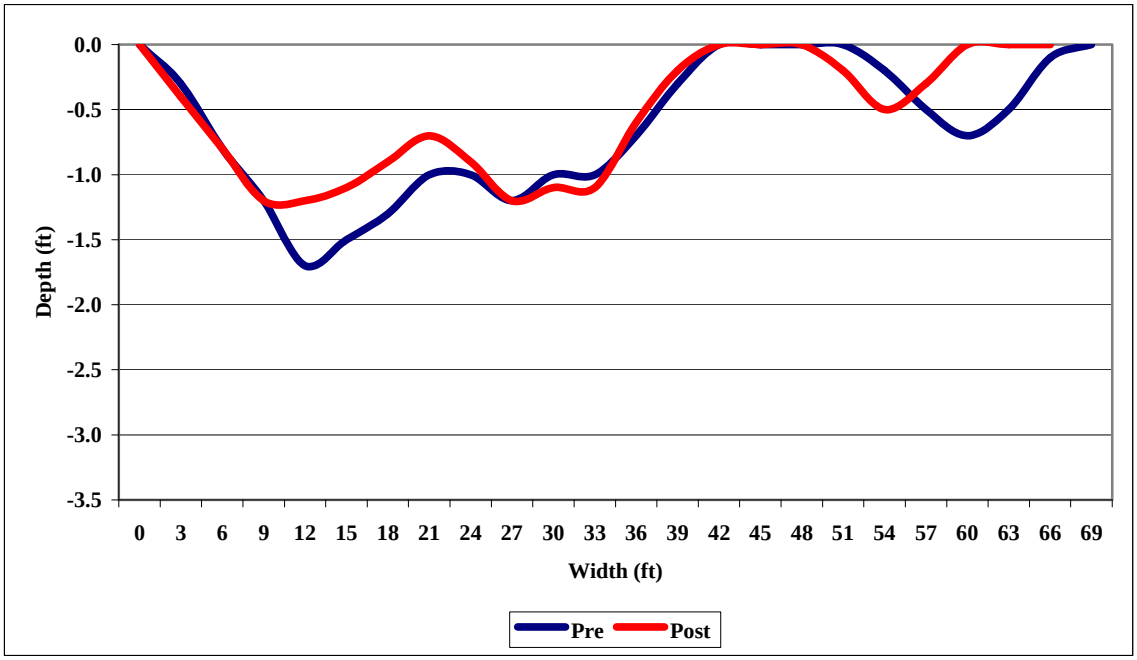
Appendix C-16. Pre- and Post cross sections at Riffle 2 Transect 2 – Cloverdale Reach



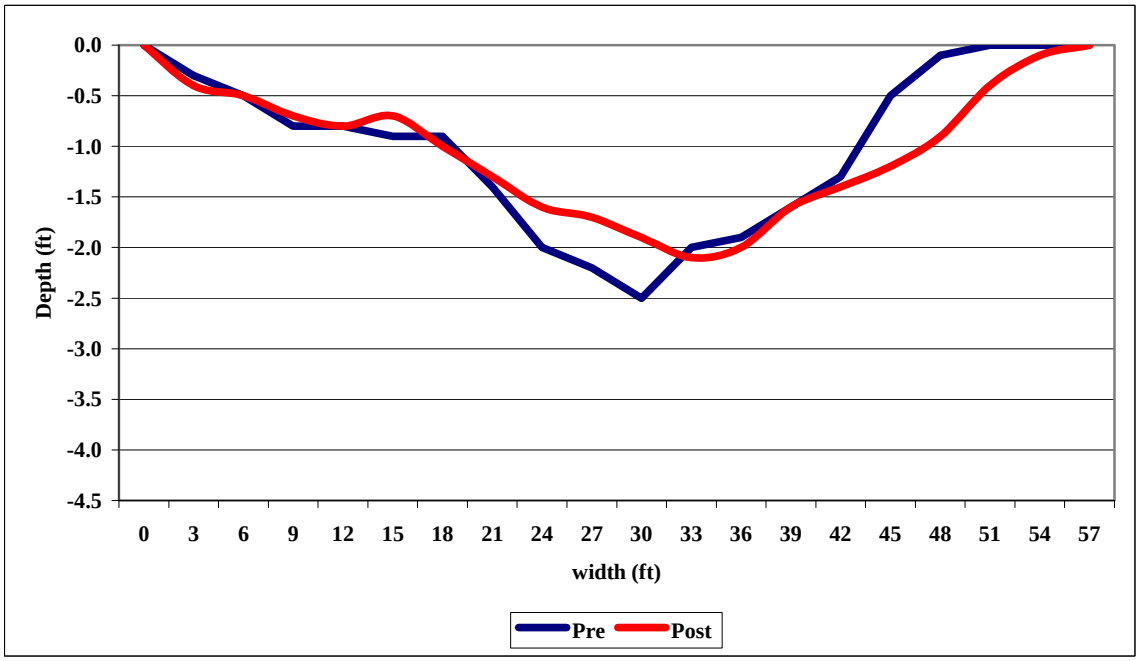
Appendix C-17. Pre- and Post cross sections at Riffle 2 Transect 3 – Cloverdale Reach



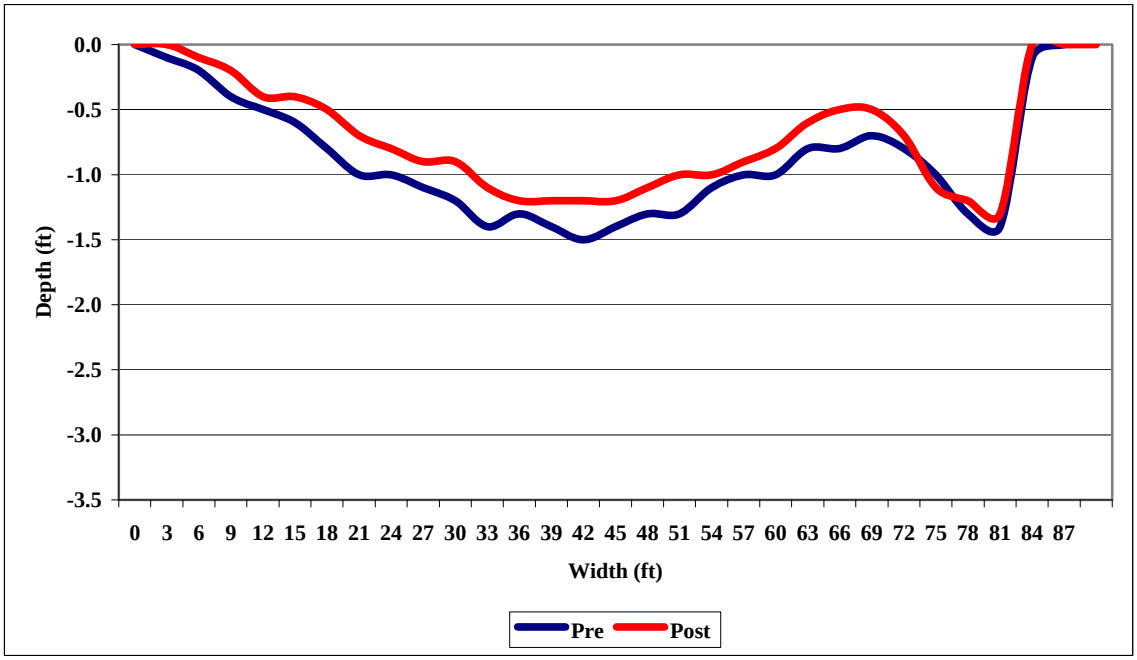
Appendix C-18. Pre- and Post cross sections at Riffle 3 Transect 1 – Cloverdale Reach



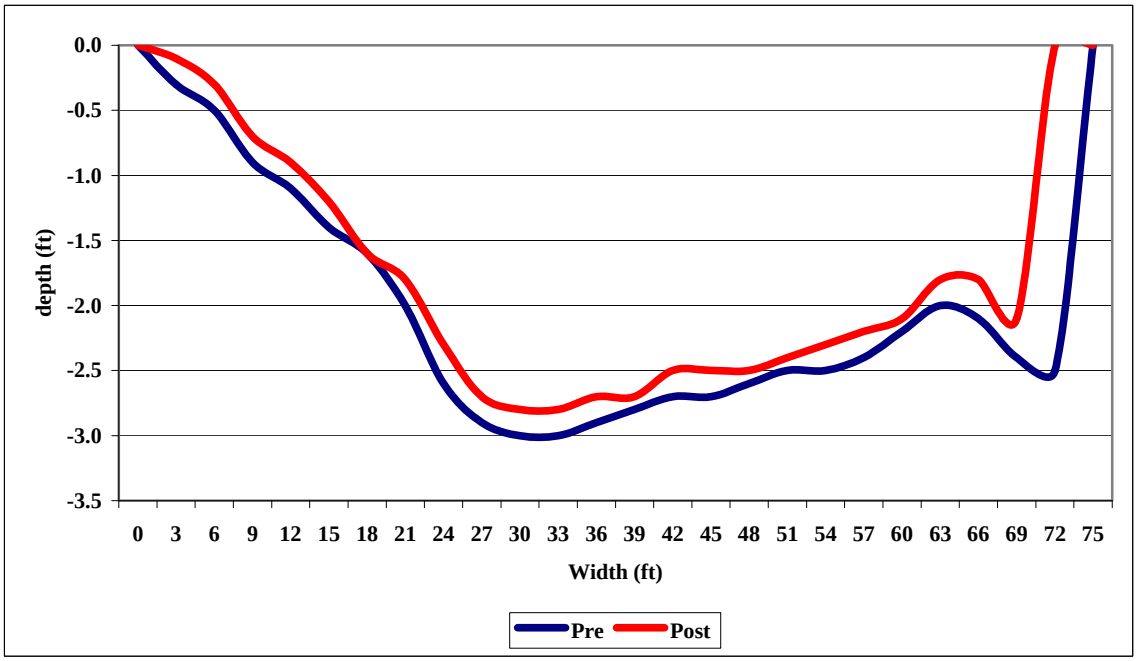
Appendix C-19. Pre- and Post cross sections at Riffle 3 Transect 2 – Cloverdale Reach



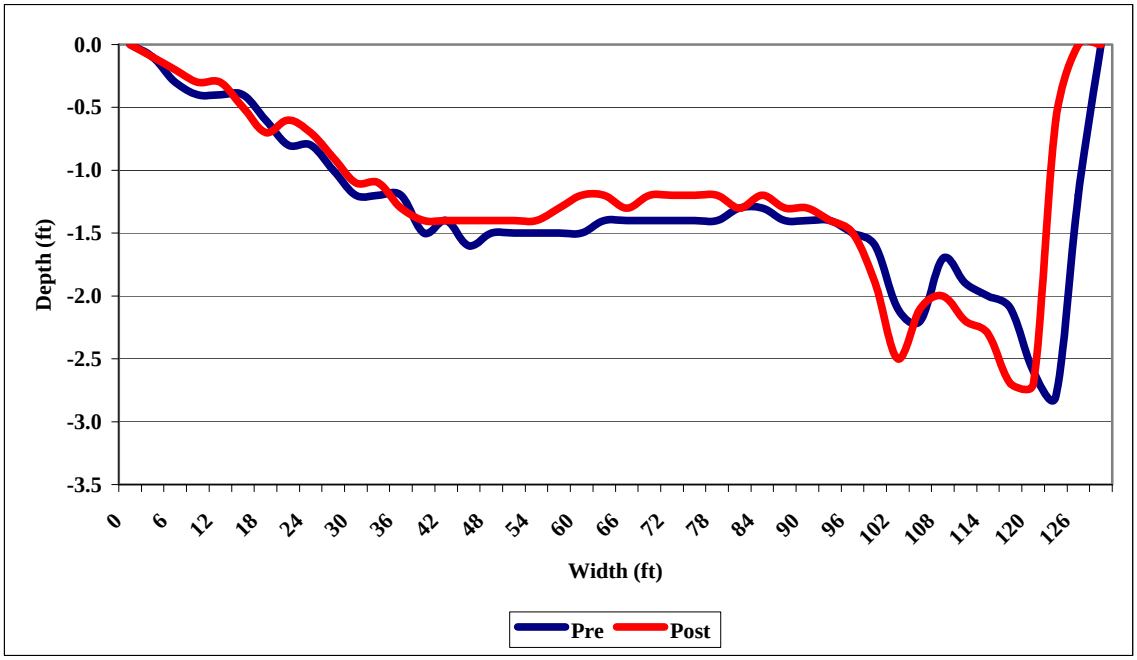
Appendix C-20. Pre- and Post cross sections at Riffle 3 Transect 3 – Cloverdale Reach



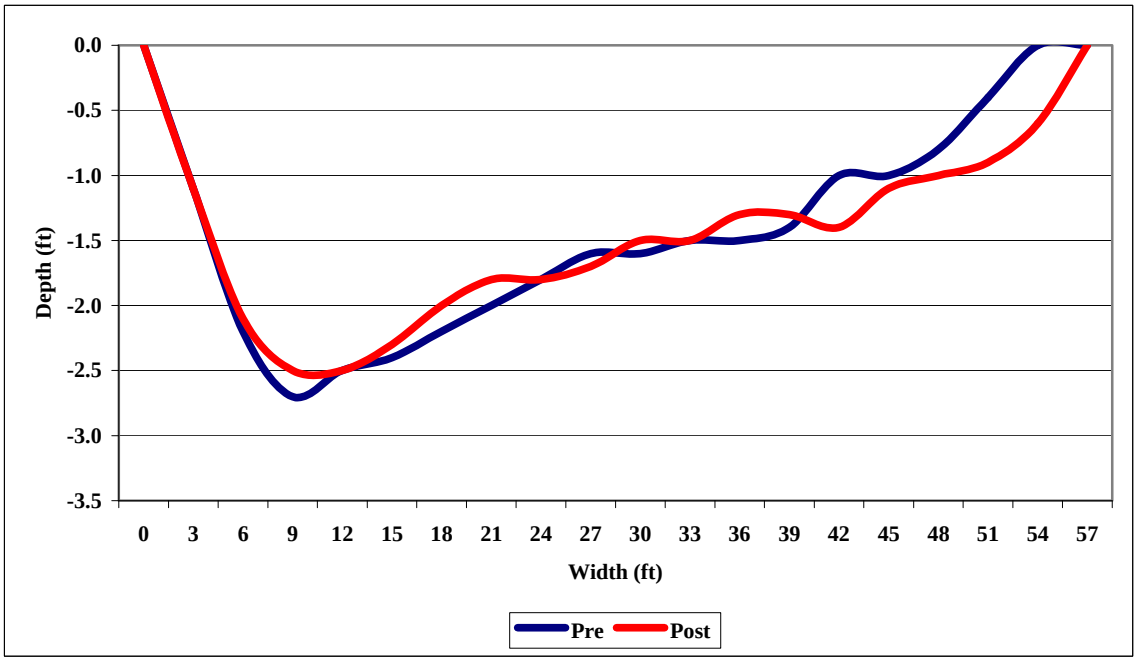
Appendix C-21. Pre- and Post cross sections at Flatwater 1 Transect 1 – Cloverdale Reach



Appendix C-22. Pre- and Post cross sections at Flatwater 1 Transect 2 – Cloverdale Reach



Appendix C-23. Pre- and Post cross sections at Flatwater 1 Transect 3 – Cloverdale Reach



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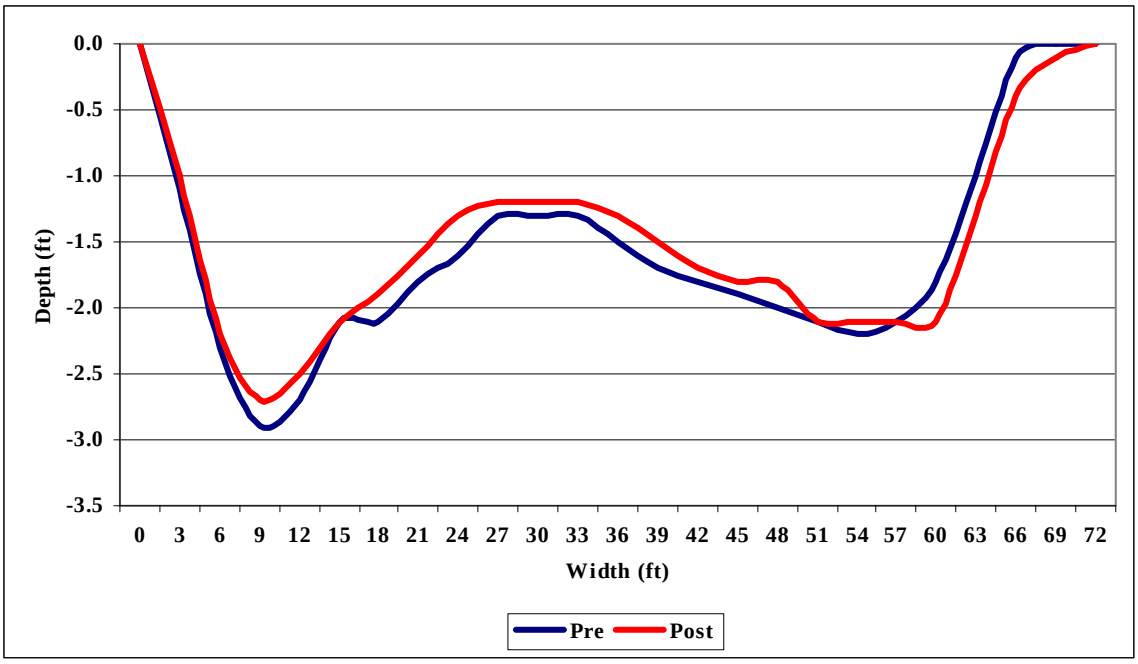

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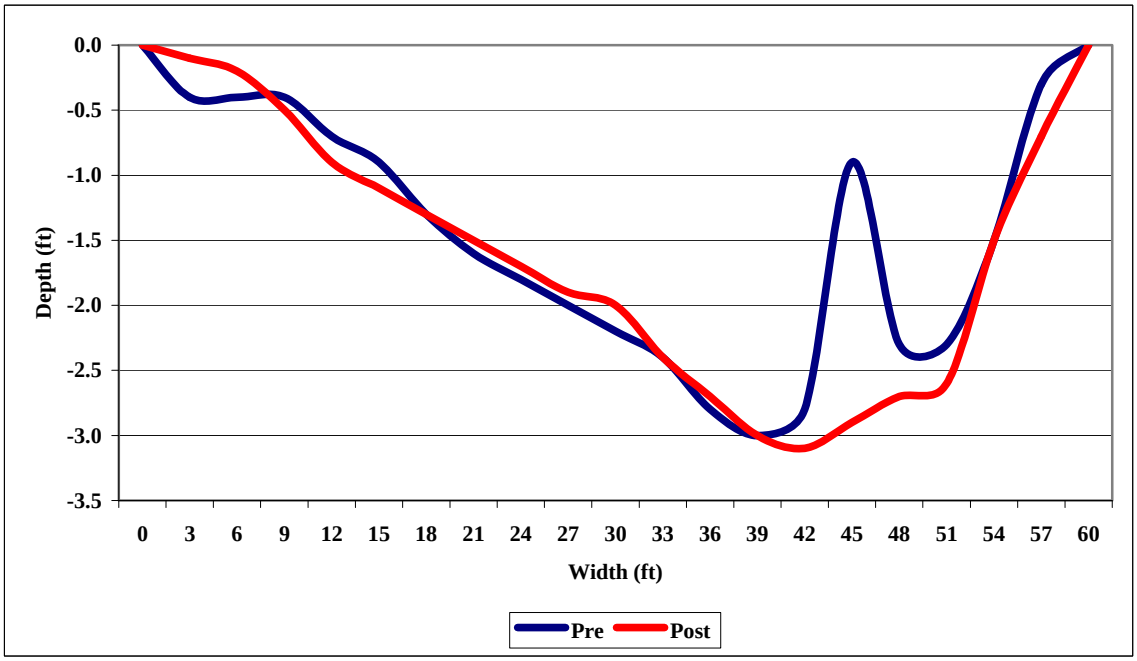
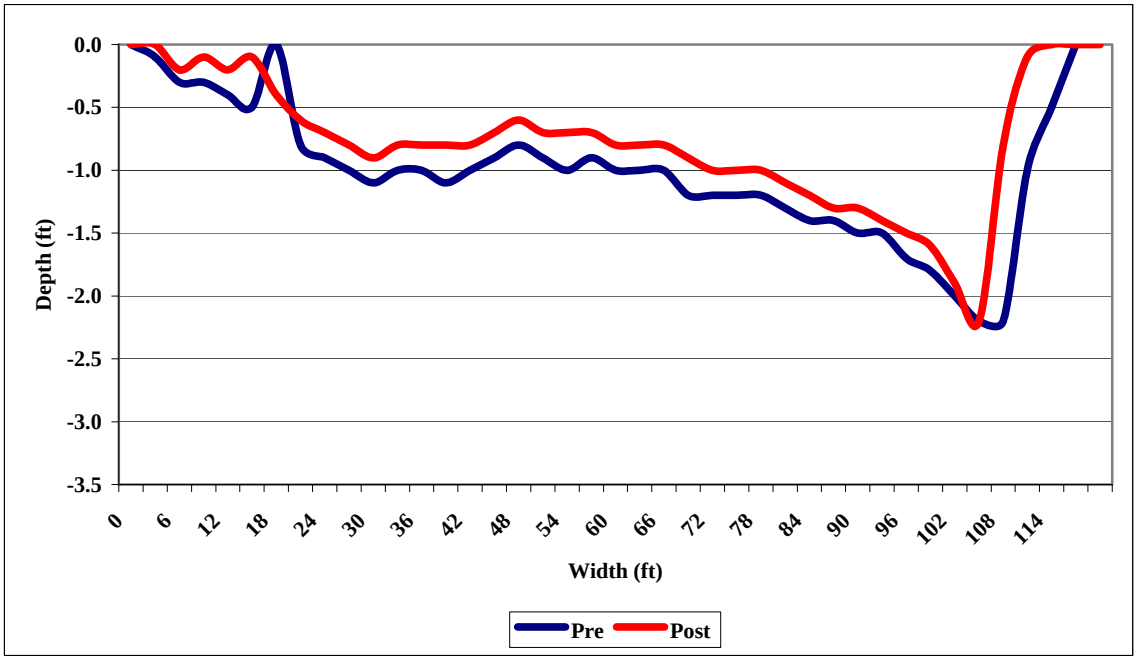
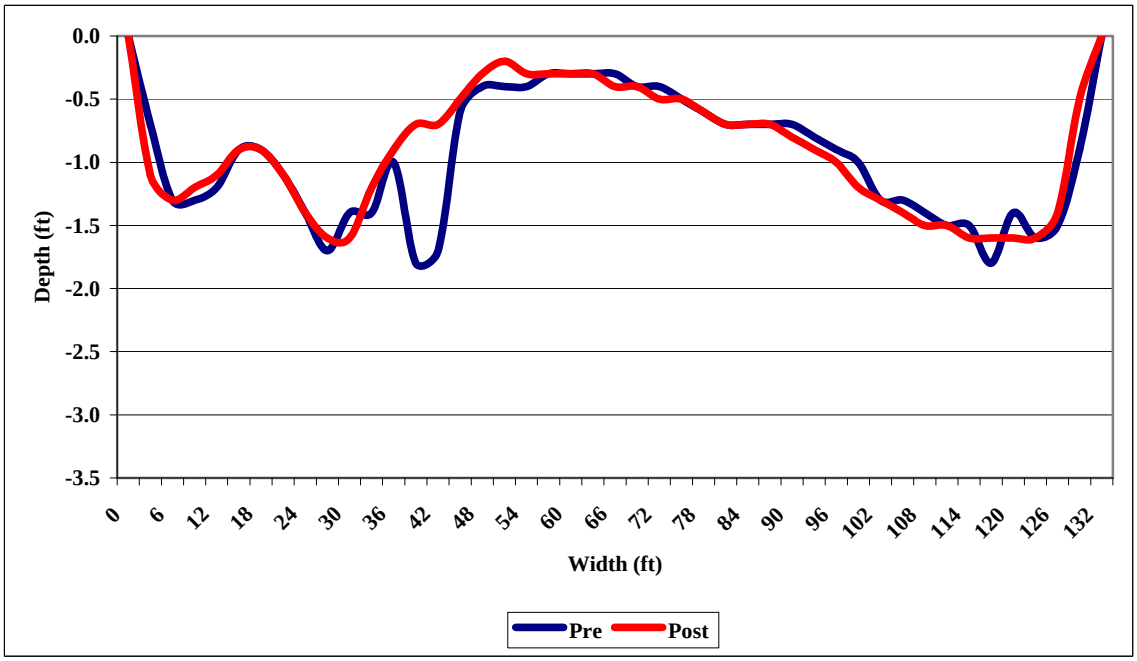


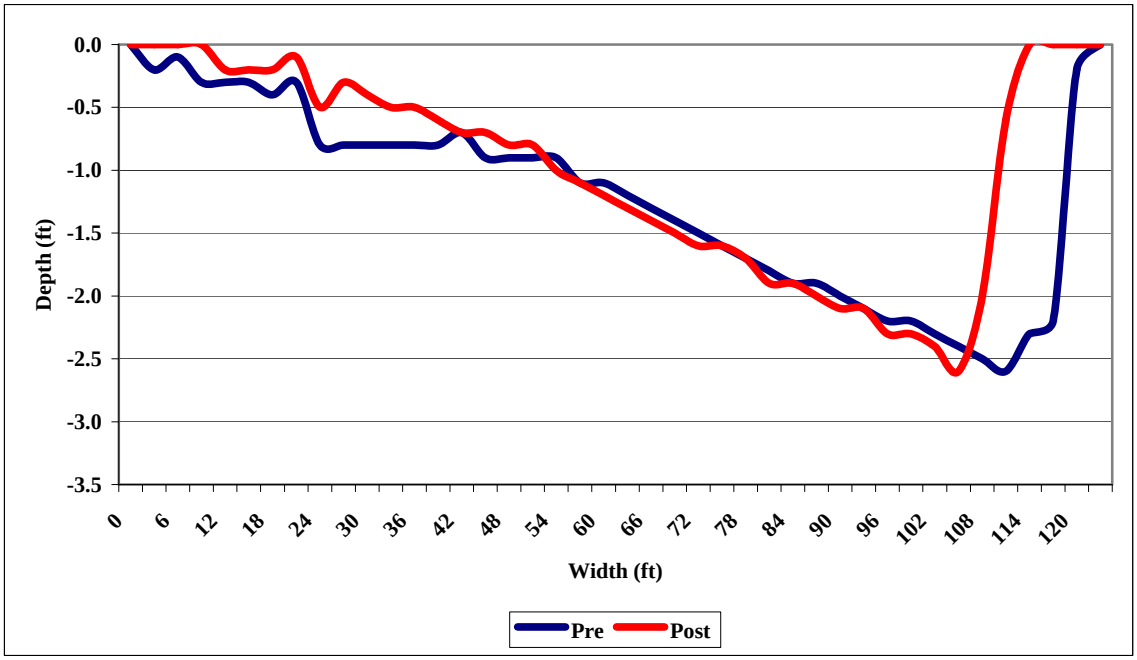
Appendix C-26. Pre- and Post cross sections at Flatwater 2 Transect 3 – Cloverdale Reach



Appendix C-27. Pre- and Post cross sections at Flatwater 3 Transect 1 – Cloverdale Reach



Appendix C-28. Pre- and Post cross sections at Flatwater 3 Transect 2 – Cloverdale Reach

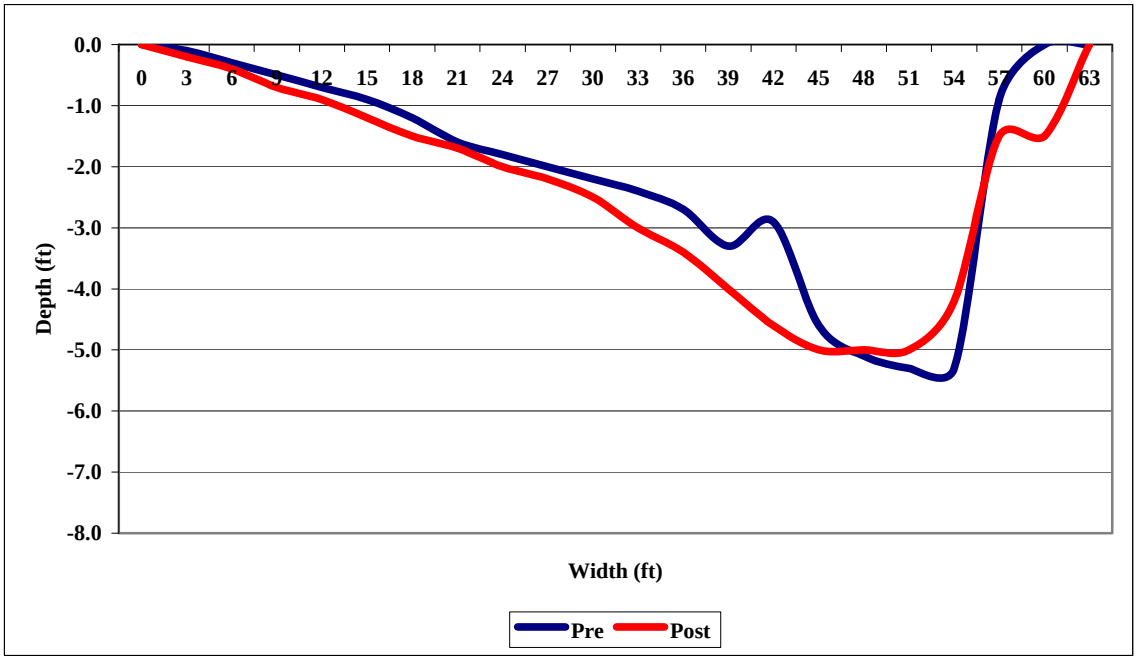


Appendix C-29. Pre- and Post cross sections at Flatwater 3 Transect 3 – Cloverdale Reach

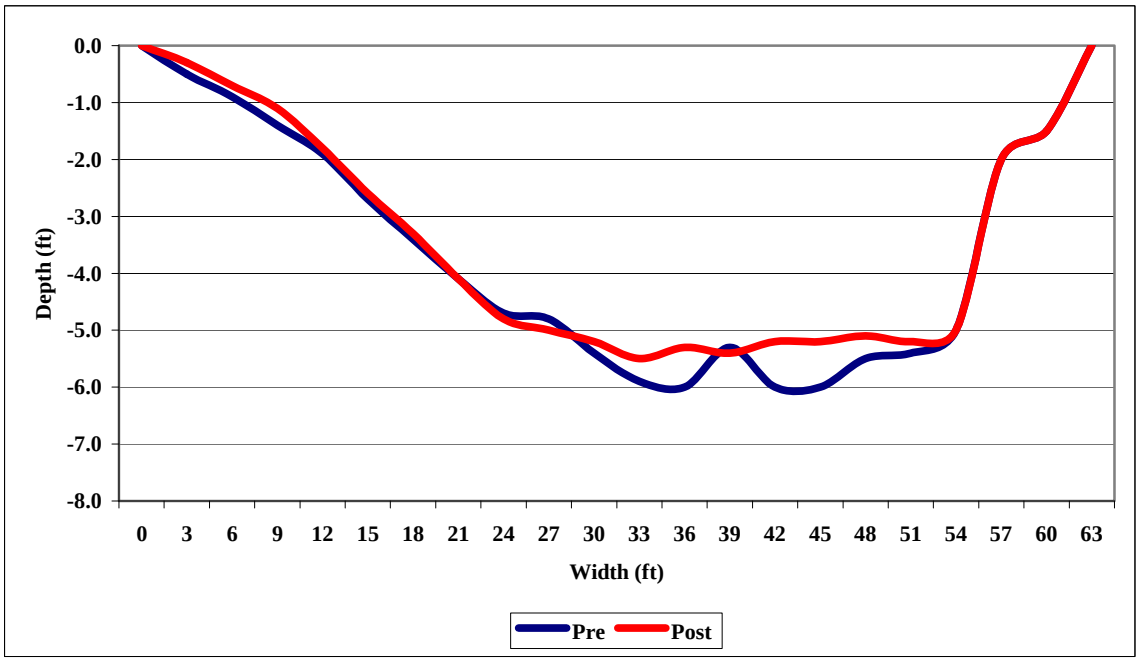
APPENDIX D

GEYSERVILLE REACH CROSS SECTIONS

PRE AND POST FLOW REDUCTION SURVEYS



Appendix D-1. Pre- and Post cross sections at Pool 1 Transect 1 – Geyserville Reach



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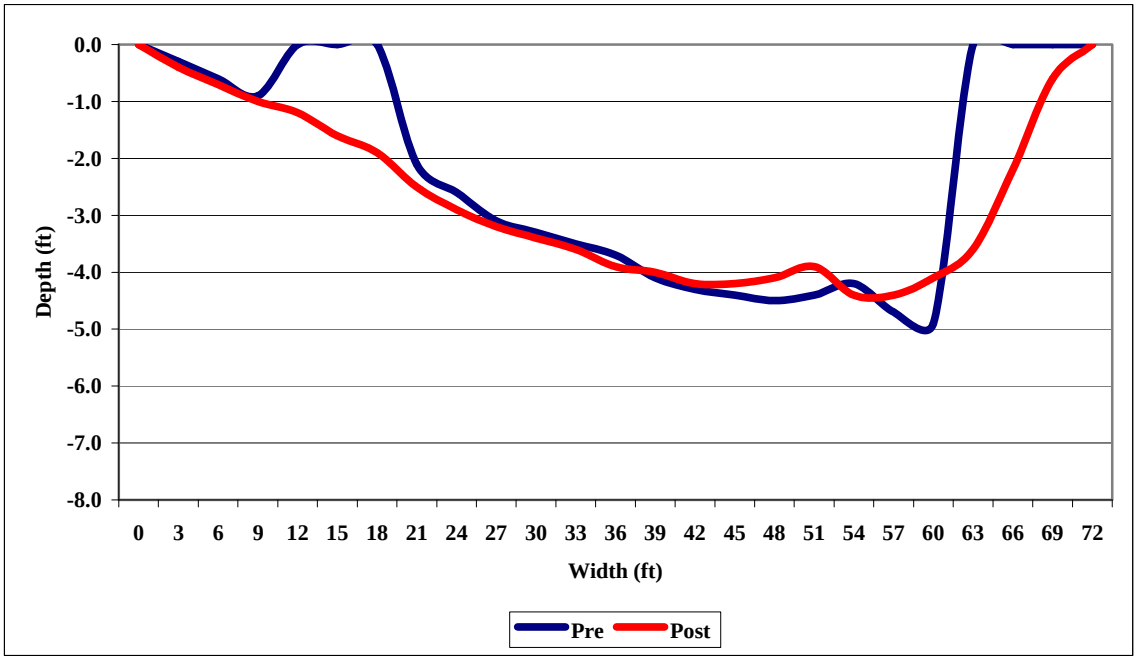
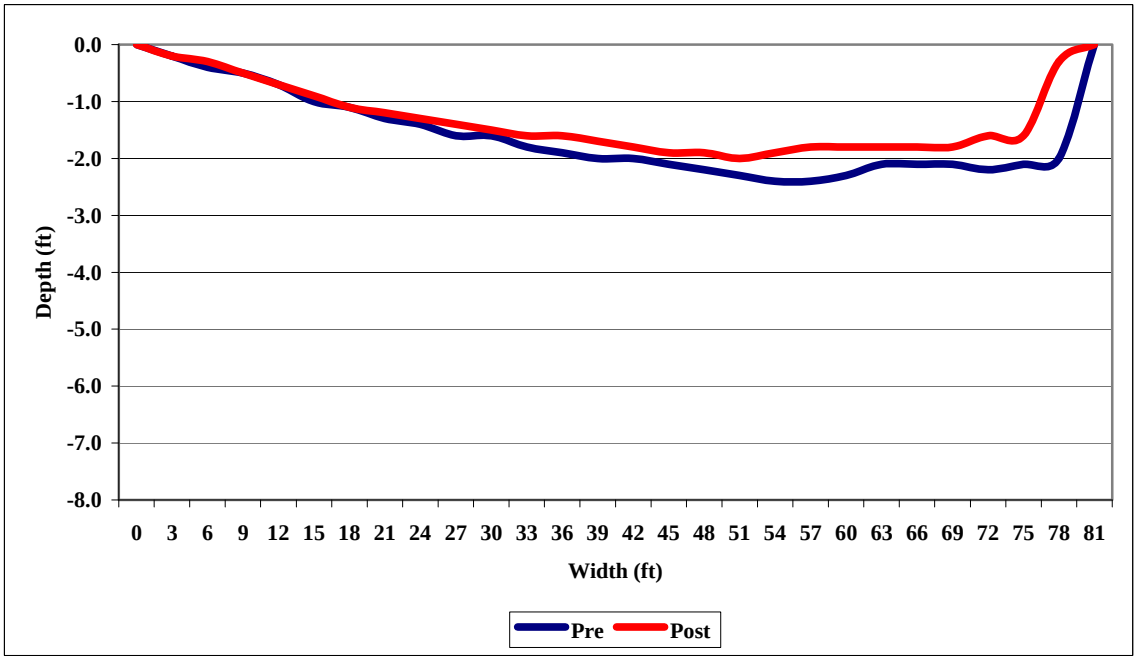
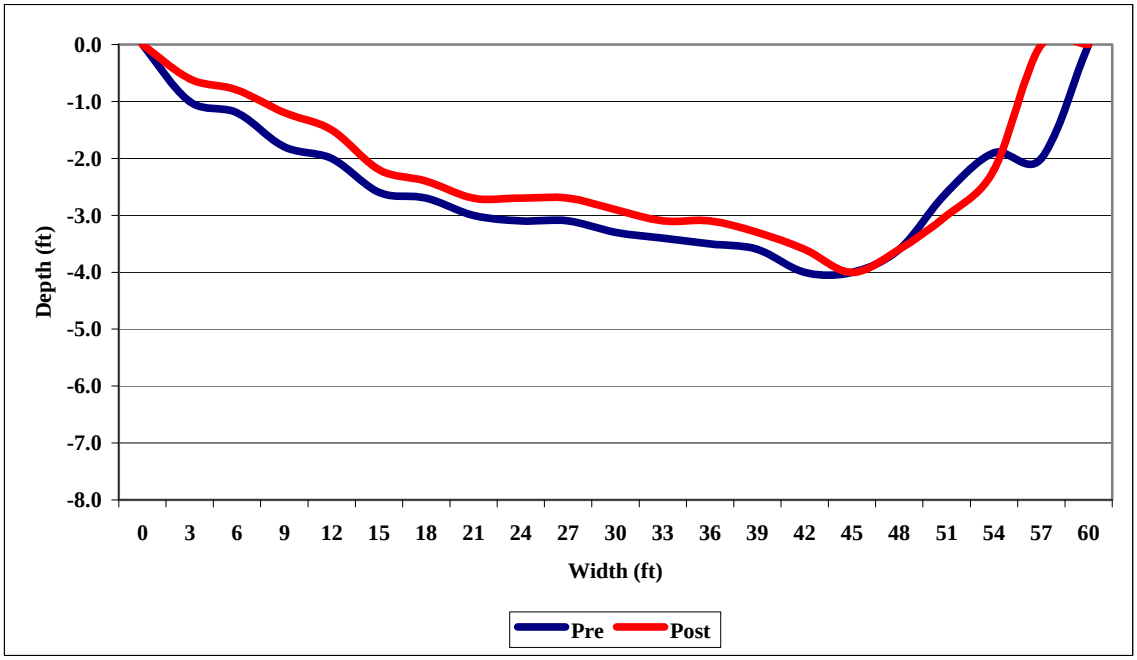


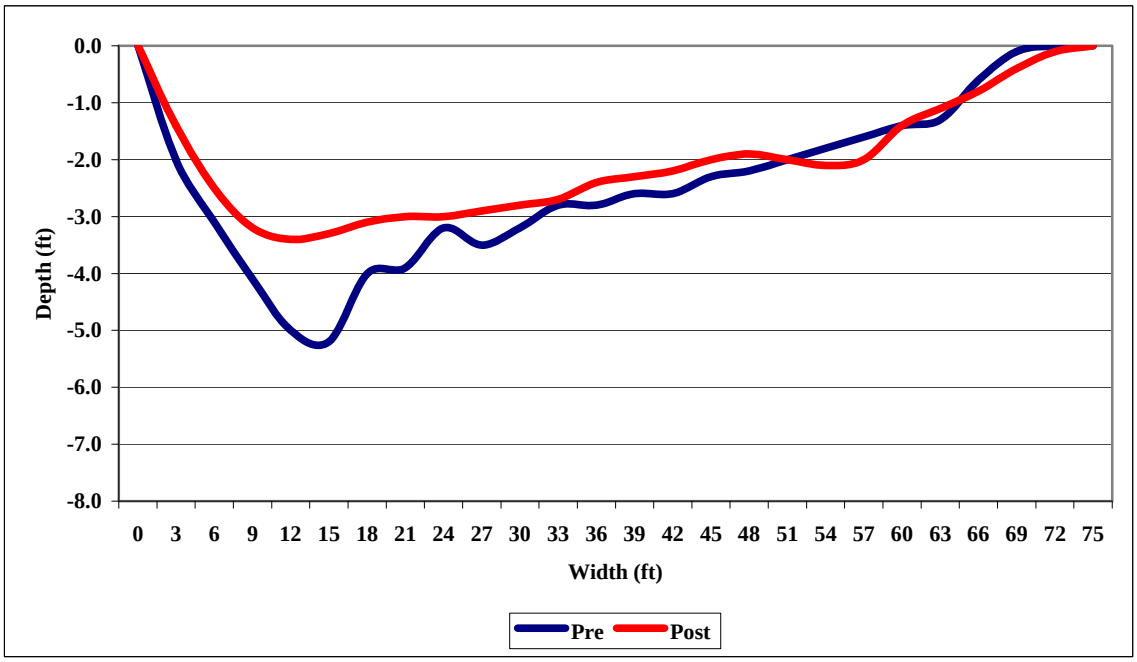
Appendix D-3. Pre- and Post cross sections at Pool 1 Transect 3 – Geyserville Reach



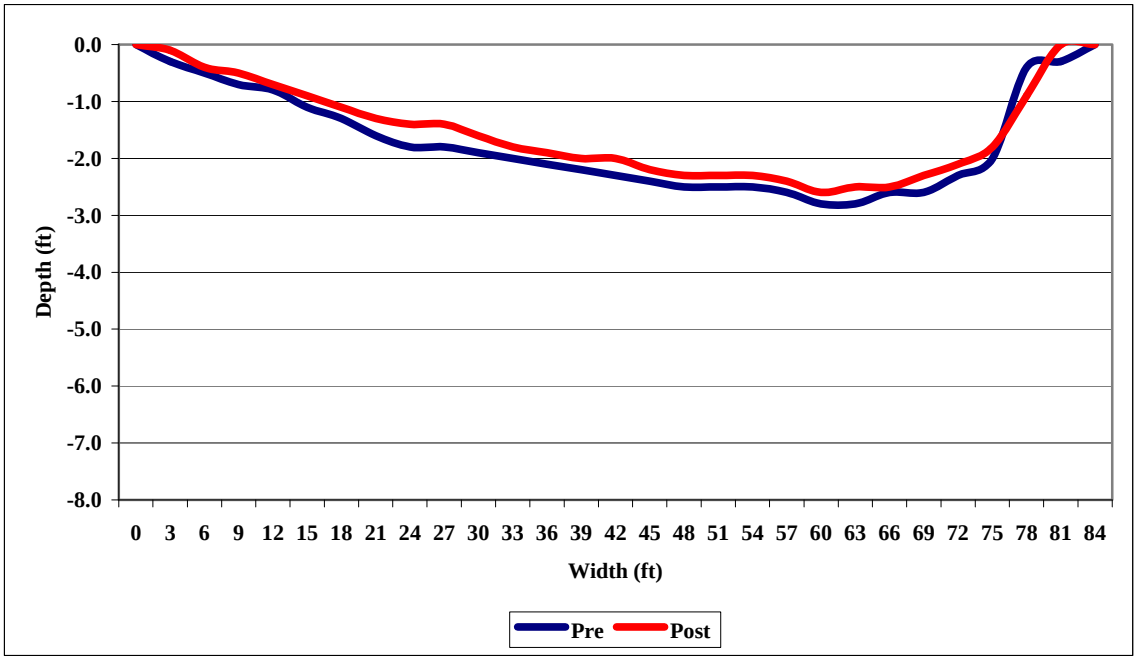
Appendix D-4. Pre- and Post cross sections at Pool 1 Transect 4 – Geyserville Reach



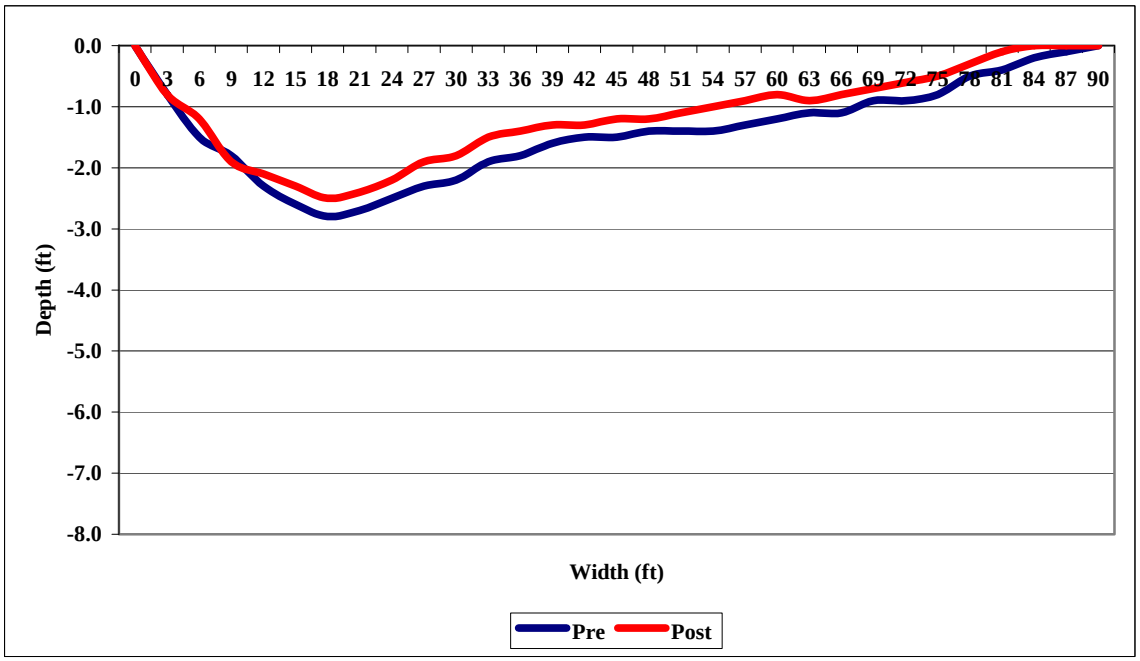
Appendix D-5. Pre- and Post cross sections at Pool 2 Transect 1 – Geyserville Reach



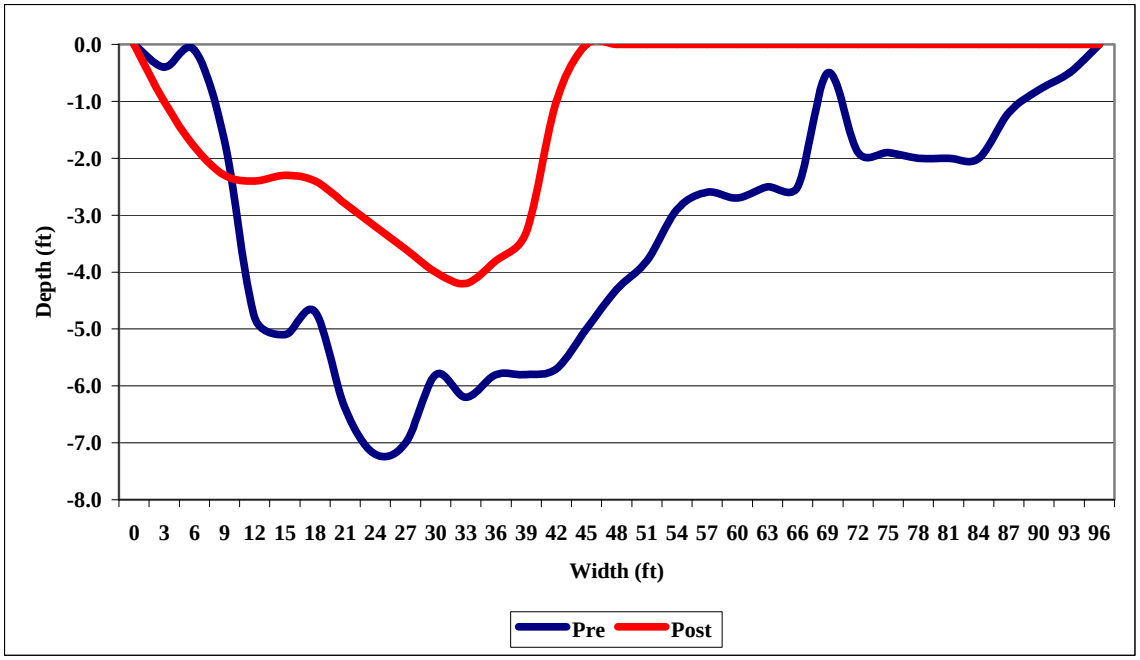
Appendix D-6. Pre- and Post cross sections at Pool 2 Transect 2 – Geyserville Reach



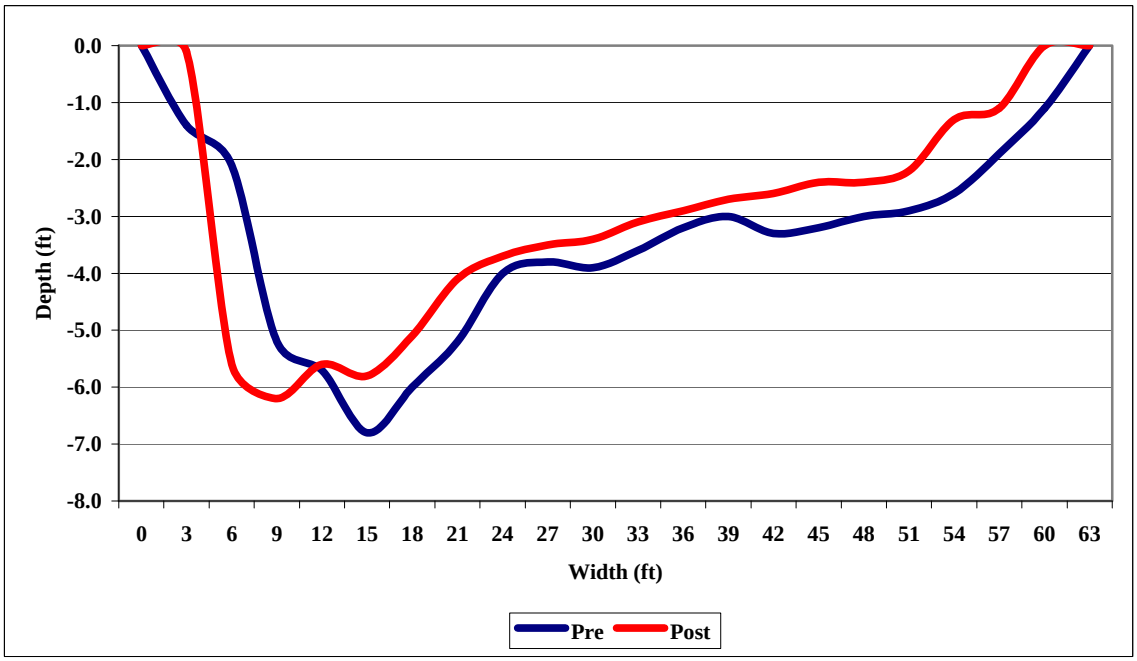
Appendix D-7. Pre- and Post cross sections at Pool 2 Transect 3 – Geyserville Reach



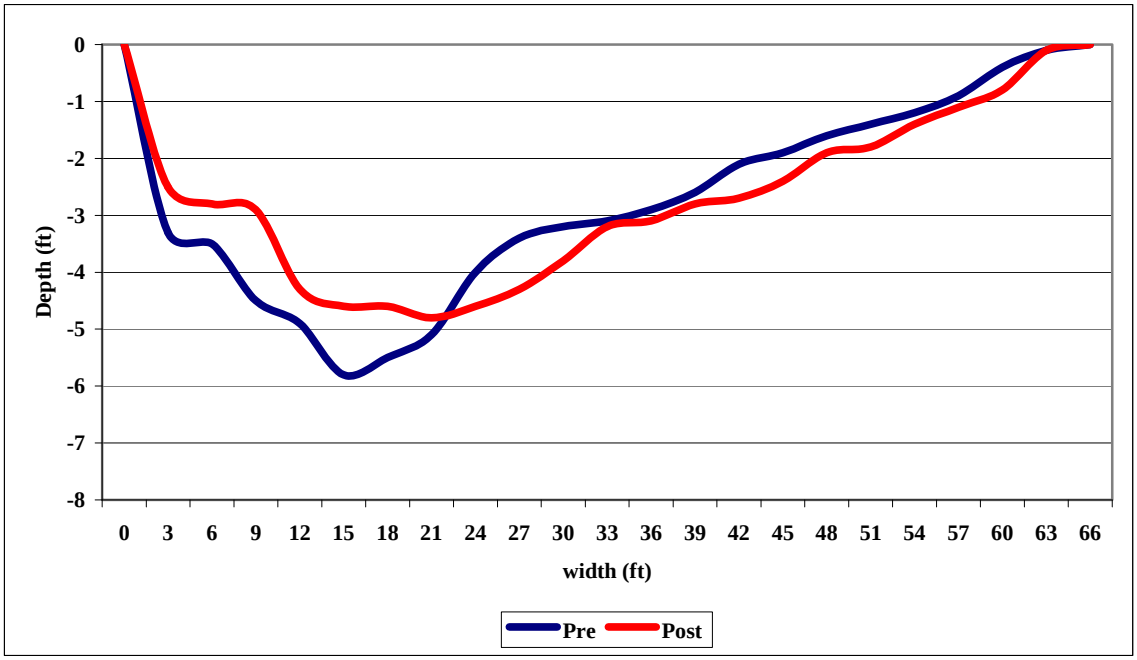
Appendix D-8. Pre- and Post cross sections at Pool 2 Transect 4 – Geyserville Reach



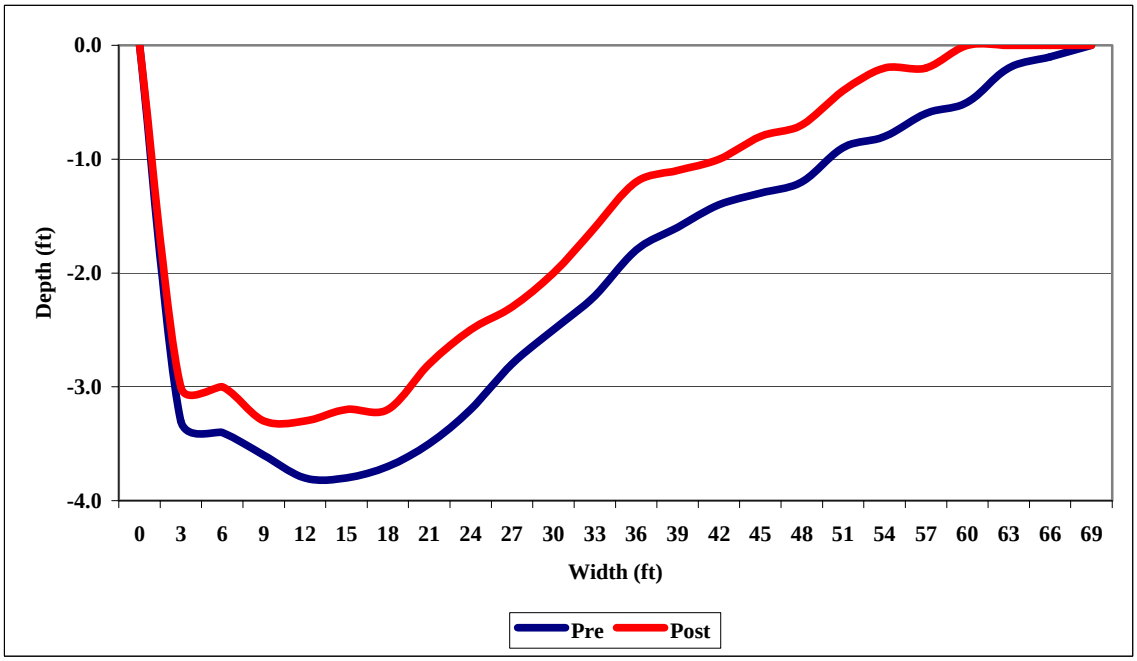
Appendix D-9. Pre- and Post cross sections at Pool 3 Transect 1 – Geyserville Reach



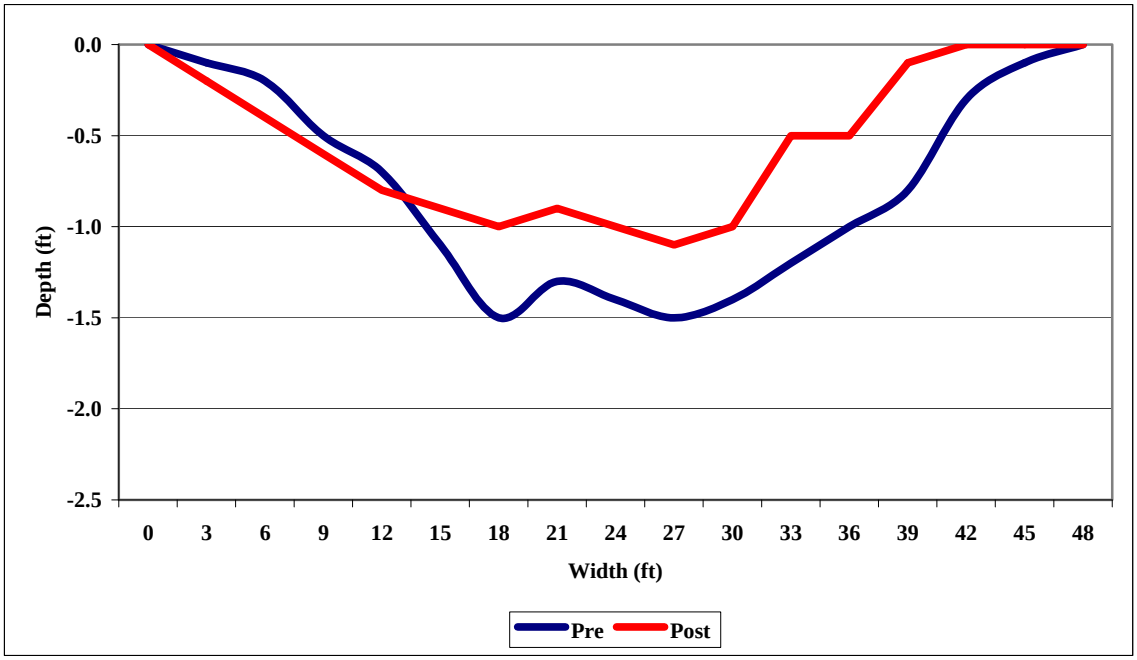
Appendix D-10. Pre- and Post cross sections at Pool 3 Transect 2 – Geyserville Reach



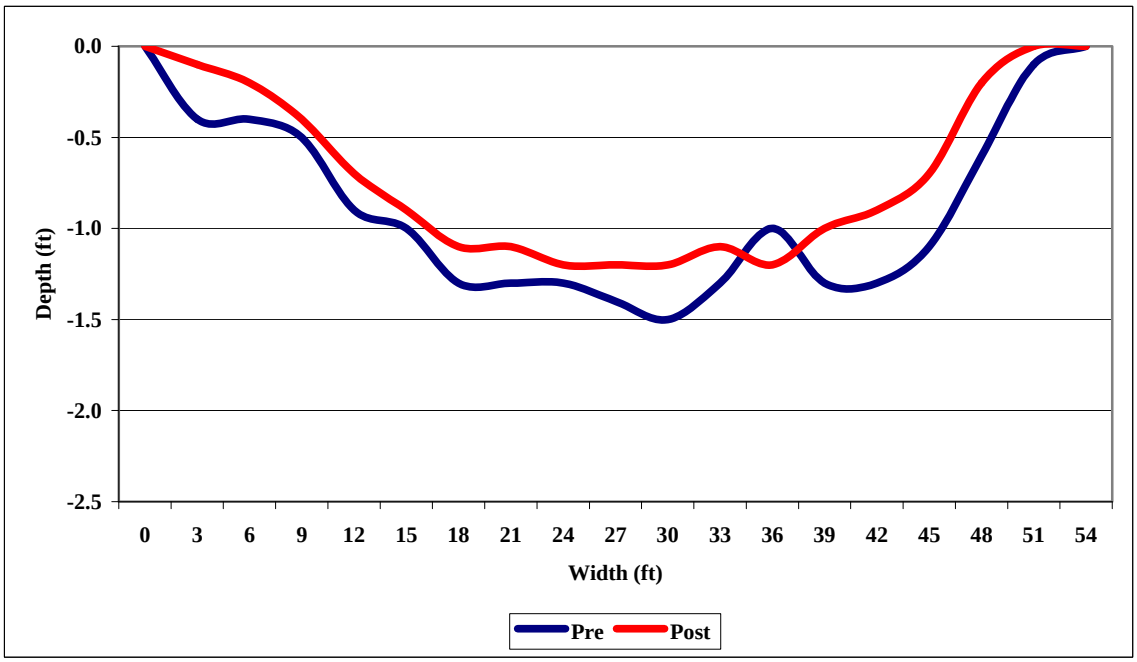
Appendix D-11. **Pre- and Post cross sections at Pool 3 Transect 3 – Geyserville Reach**



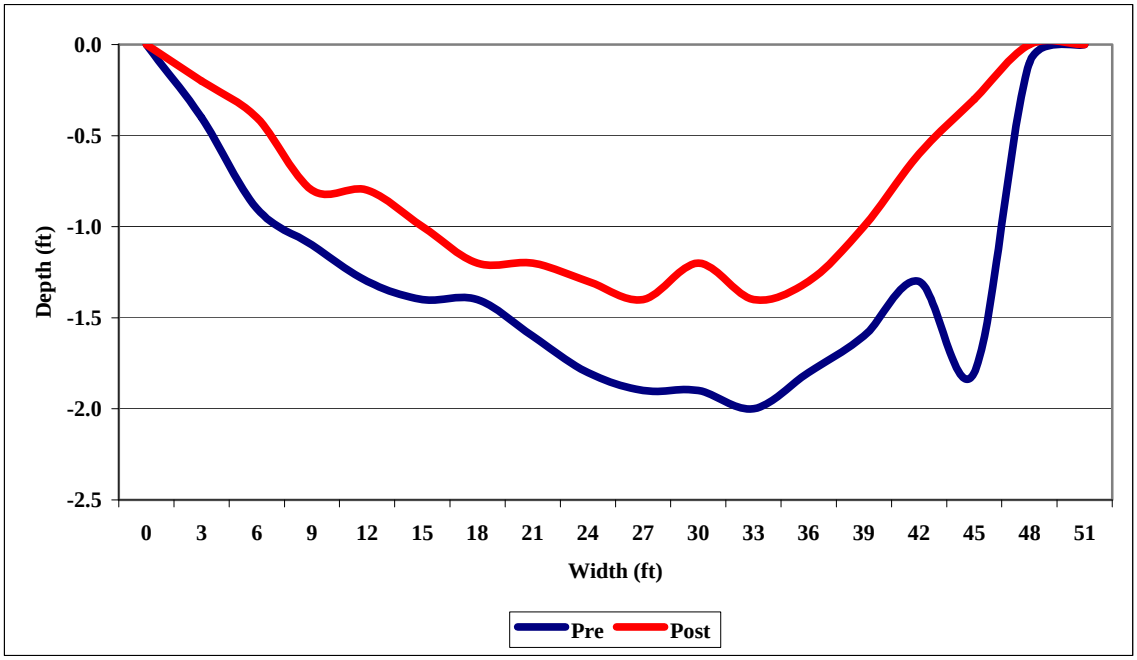
Appendix D-12. **Pre- and Post cross sections at Pool 3 Transect 4 – Geyserville Reach**



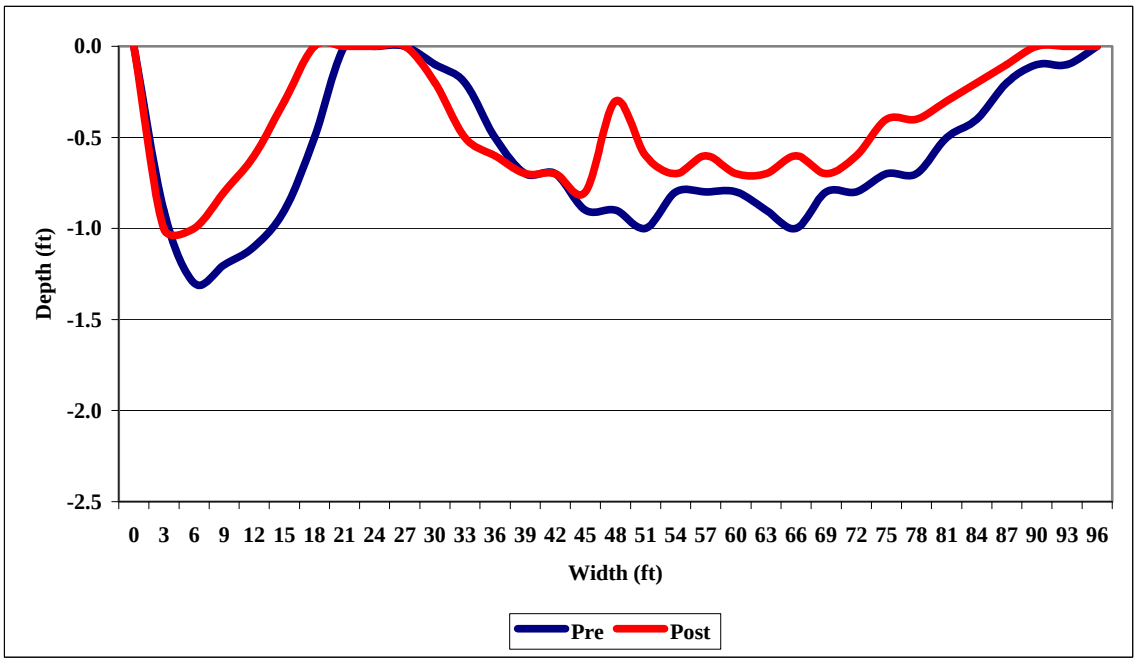
Appendix D-12. **Pre- and Post cross sections at Riffle 1 Transect 1 – Geyserville Reach**



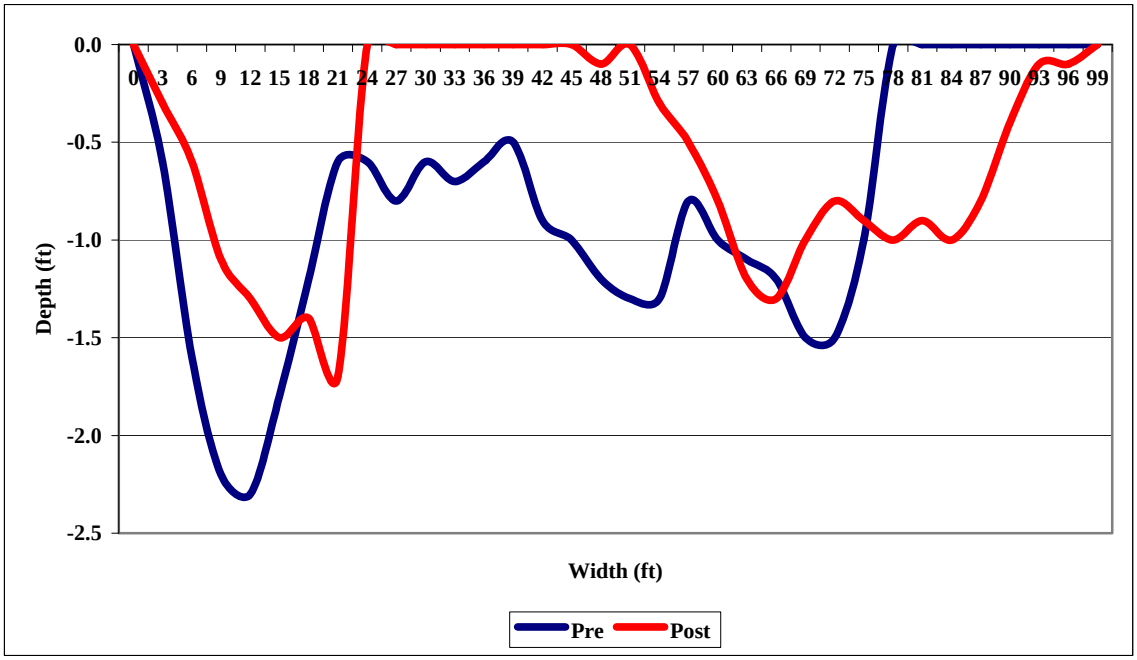
Appendix D-13. **Pre- and Post cross sections at Riffle 1 Transect 2 – Geyserville Reach**



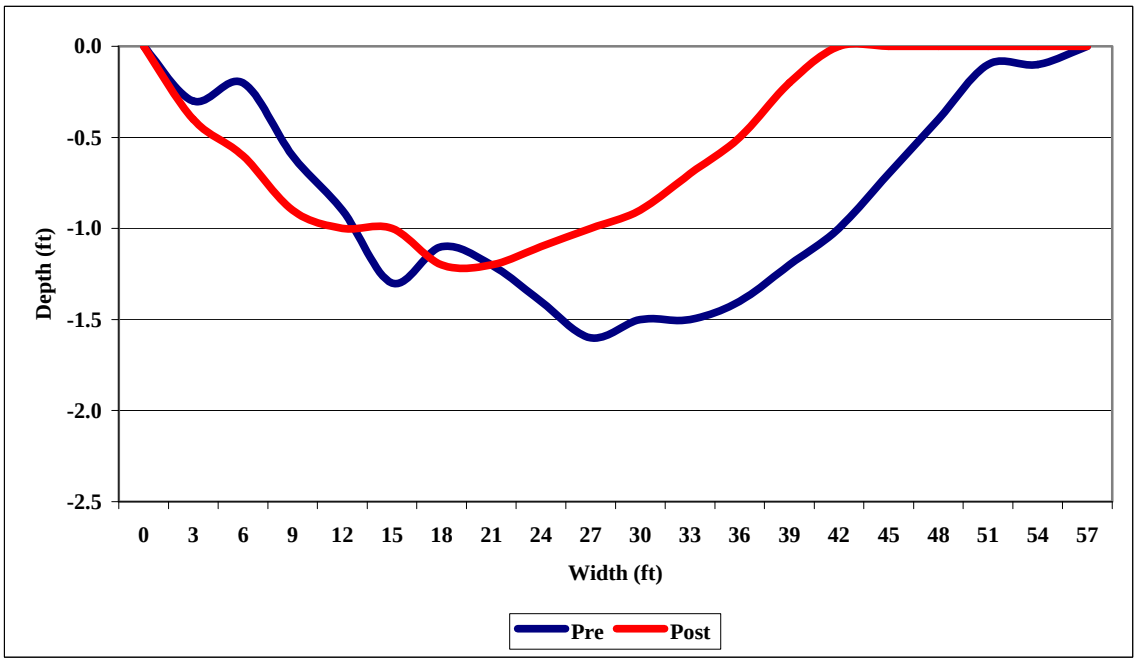
Appendix D-14. **Pre- and Post cross sections at Riffle 1 Transect 3 – Geyserville Reach**



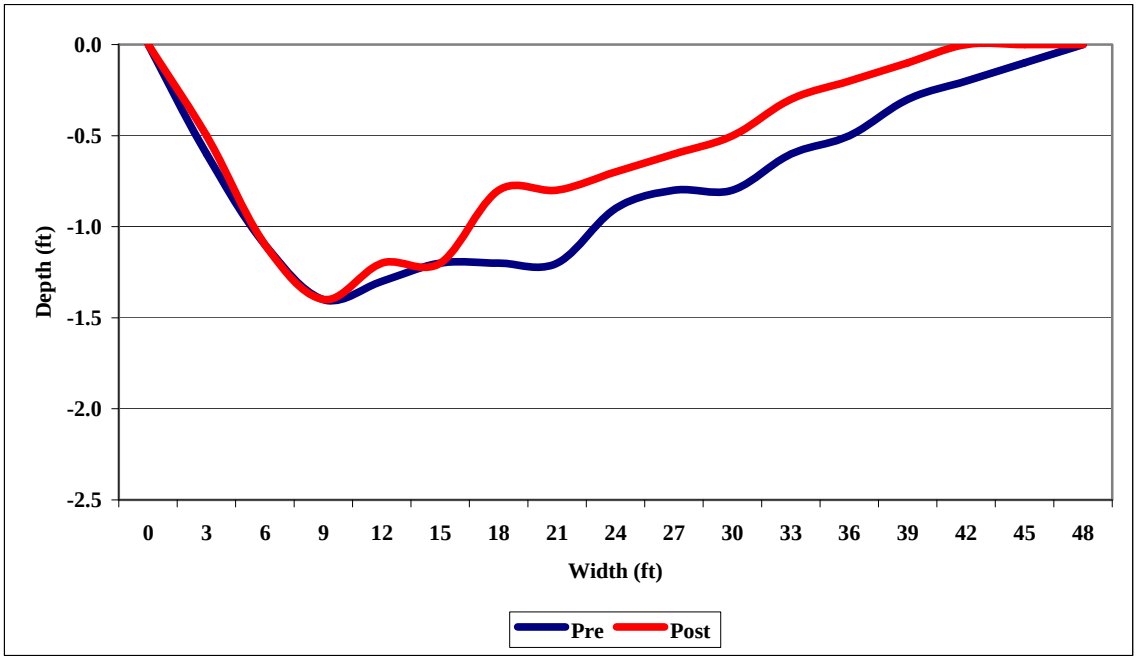
Appendix D-15. **Pre- and Post cross sections at Riffle 2 Transect 1 – Geyserville Reach**



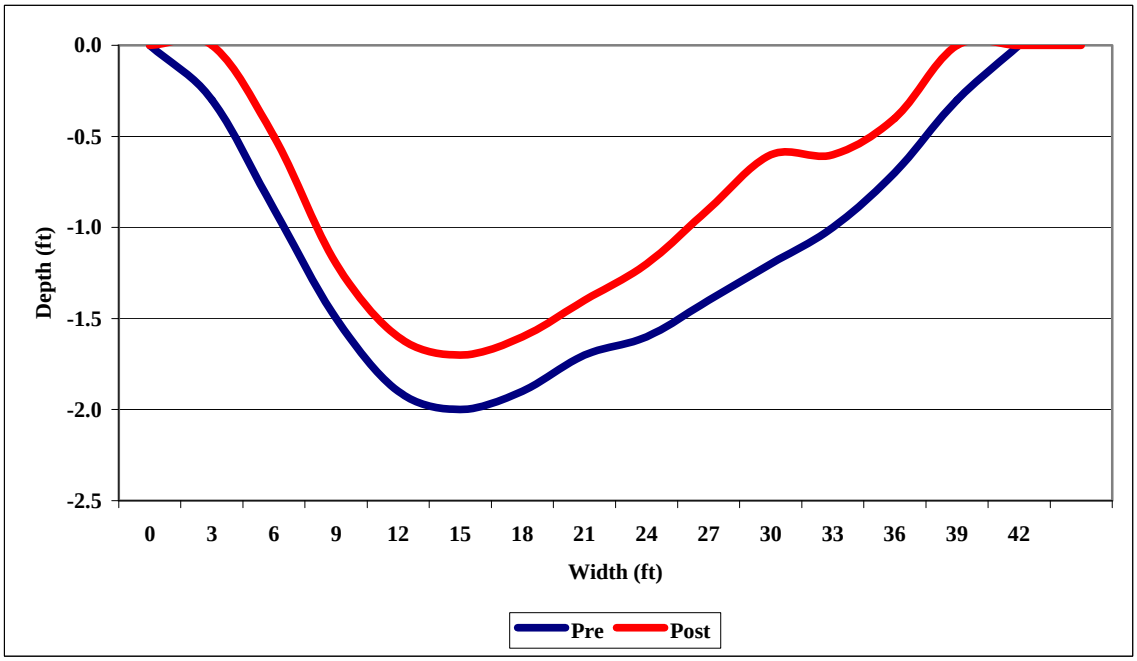
Appendix D-16. **Pre- and Post cross sections at Riffle 2 Transect 2 – Geyserville Reach**



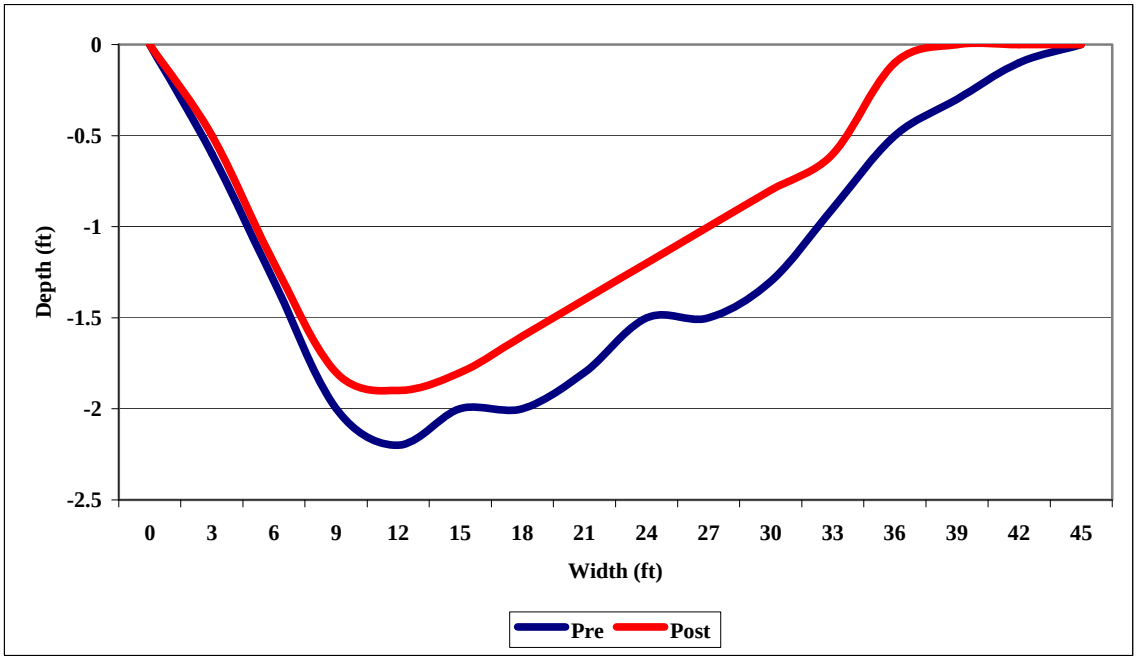
Appendix D-17. **Pre- and Post cross sections at Riffle 2 Transect 3 – Geyserville Reach**



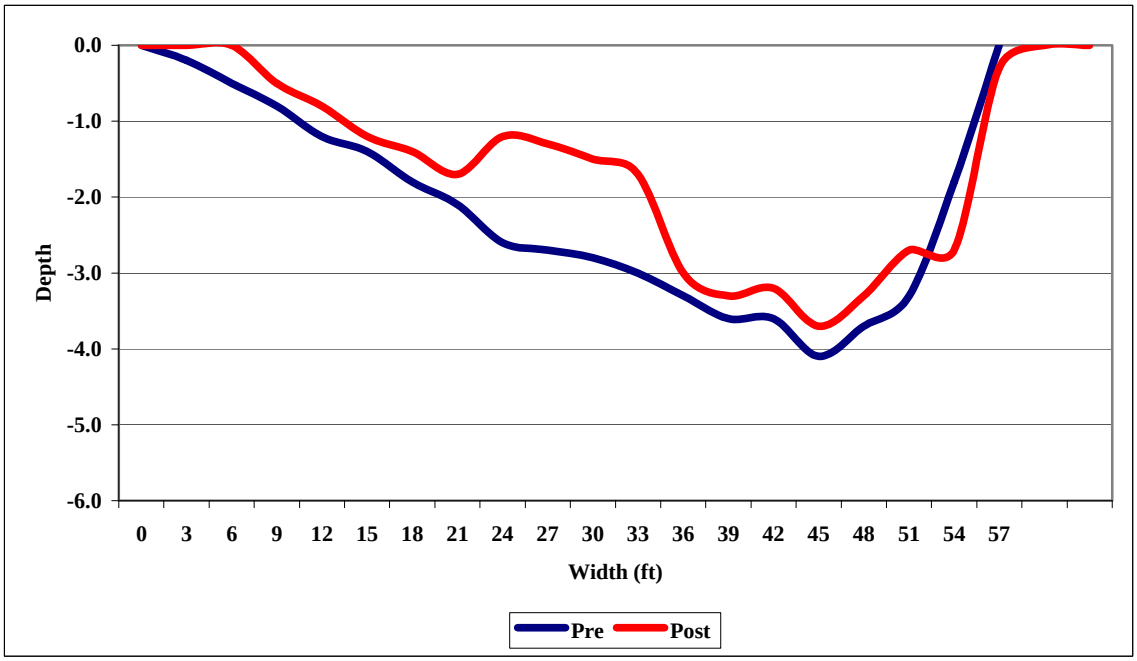
Appendix D-18. **Pre- and Post cross sections at Riffle 3 Transect 1 – Geyserville Reach**



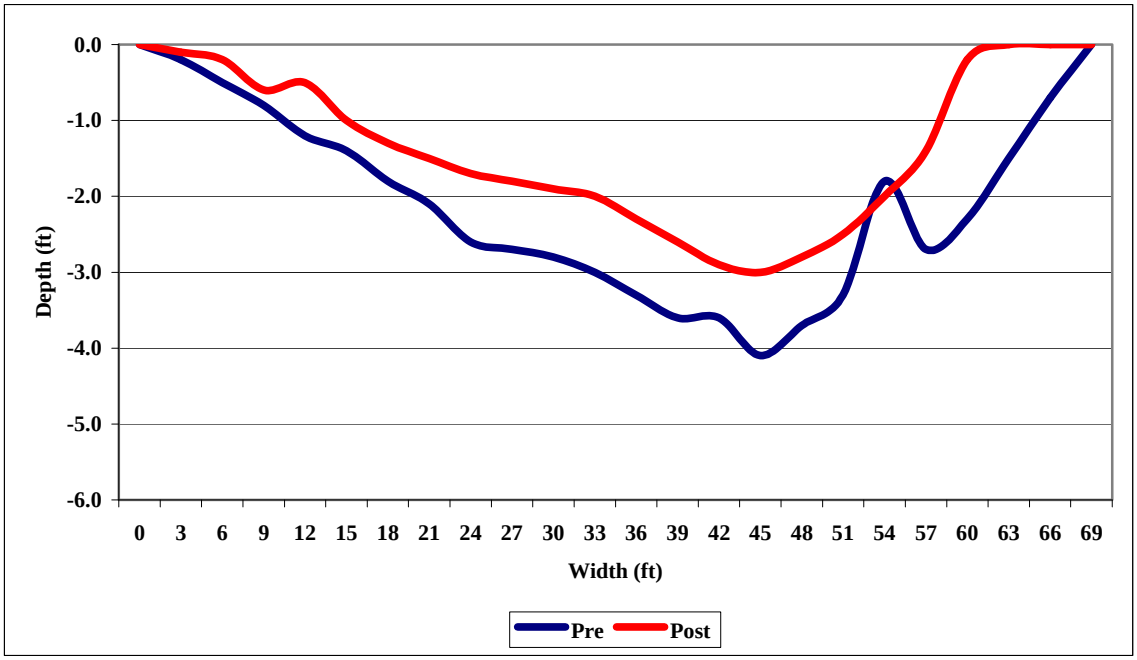
Appendix D-18. **Pre- and Post cross sections at Riffle 3 Transect 2 – Geyserville Reach**



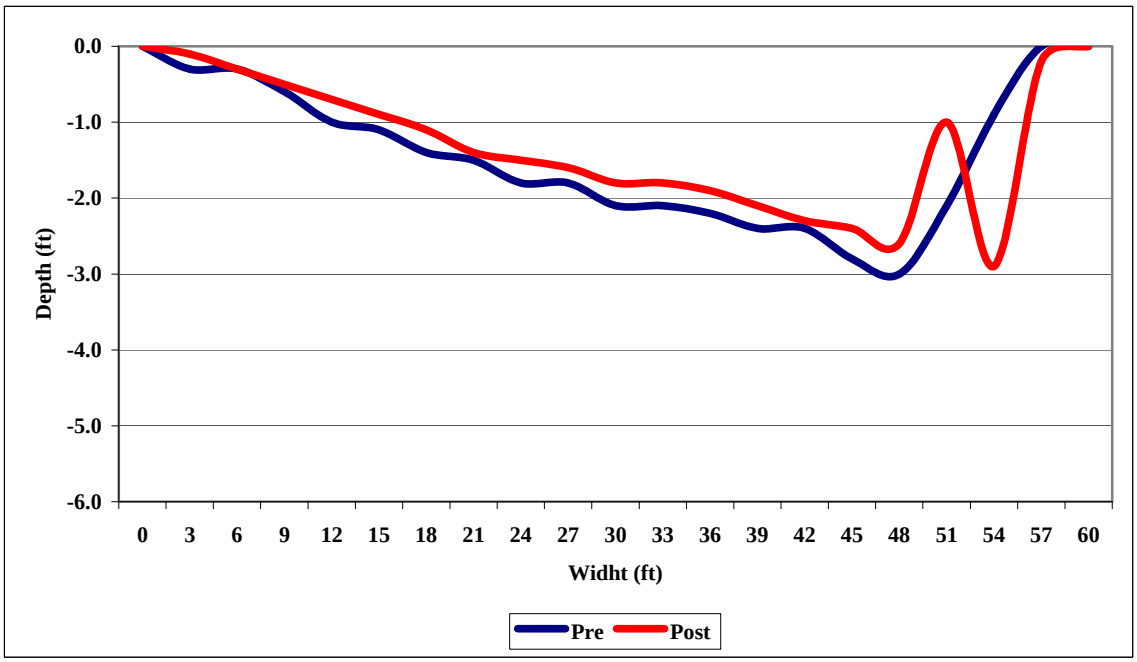
Appendix D-19. **Pre- and Post cross sections at Riffle 3 Transect 3 – Geyserville Reach**



Appendix D-20. **Pre- and Post cross sections at Flatwater 1 Transect 1 – Geyserville Reach**



Appendix D-21. **Pre- and Post cross sections at Flatwater 1 Transect 2 – Geyserville Reach**



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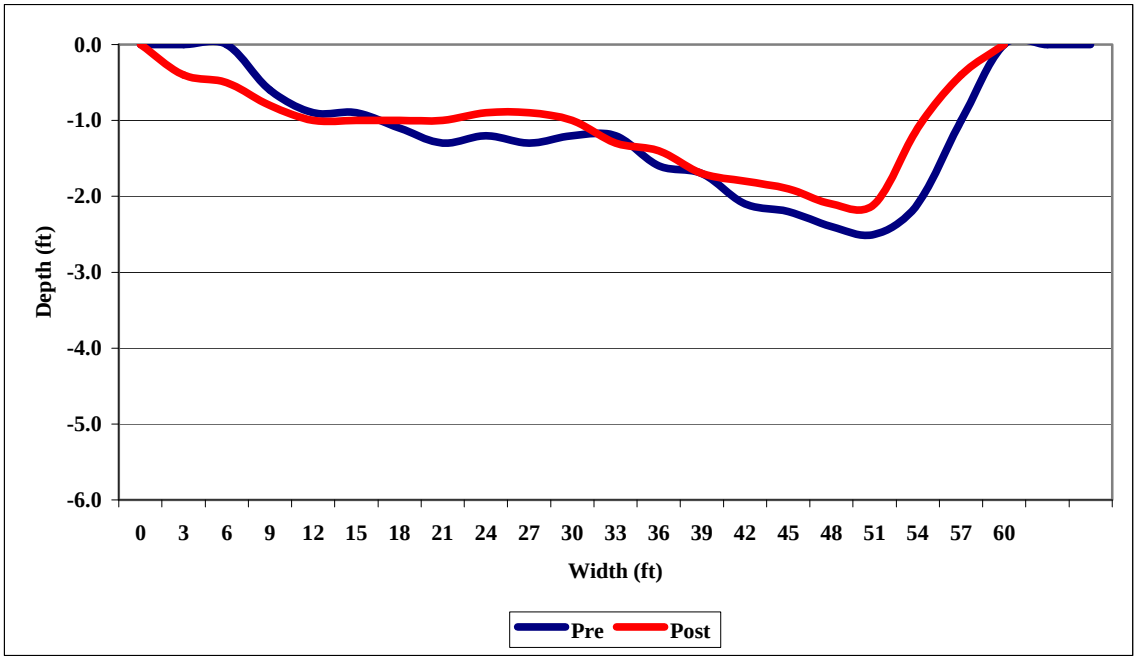
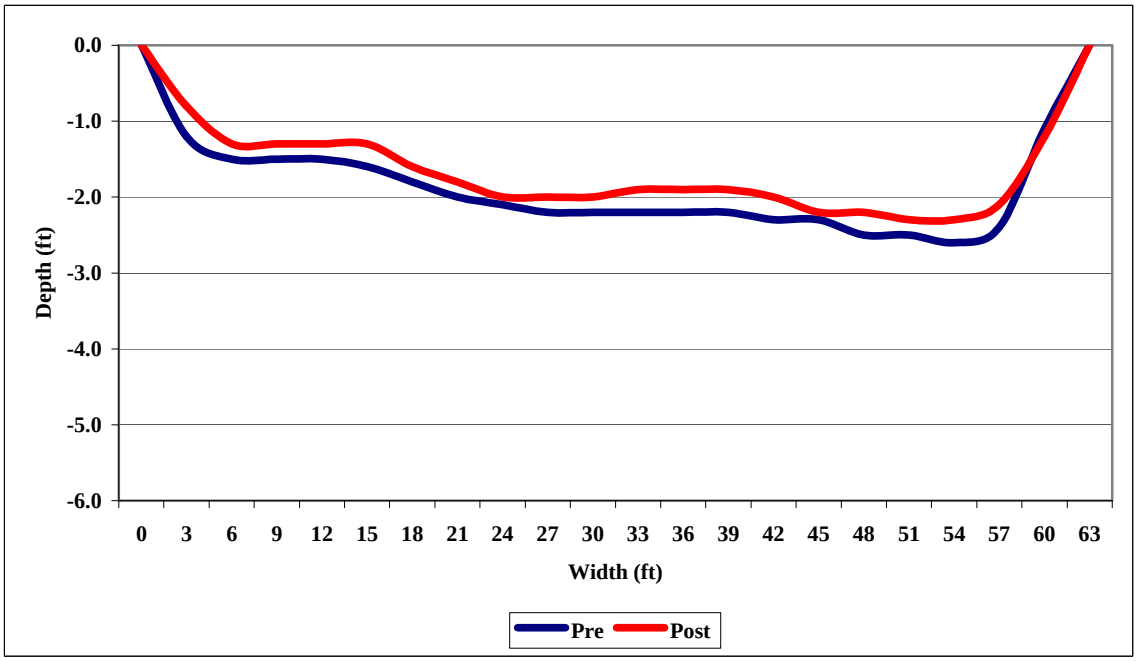
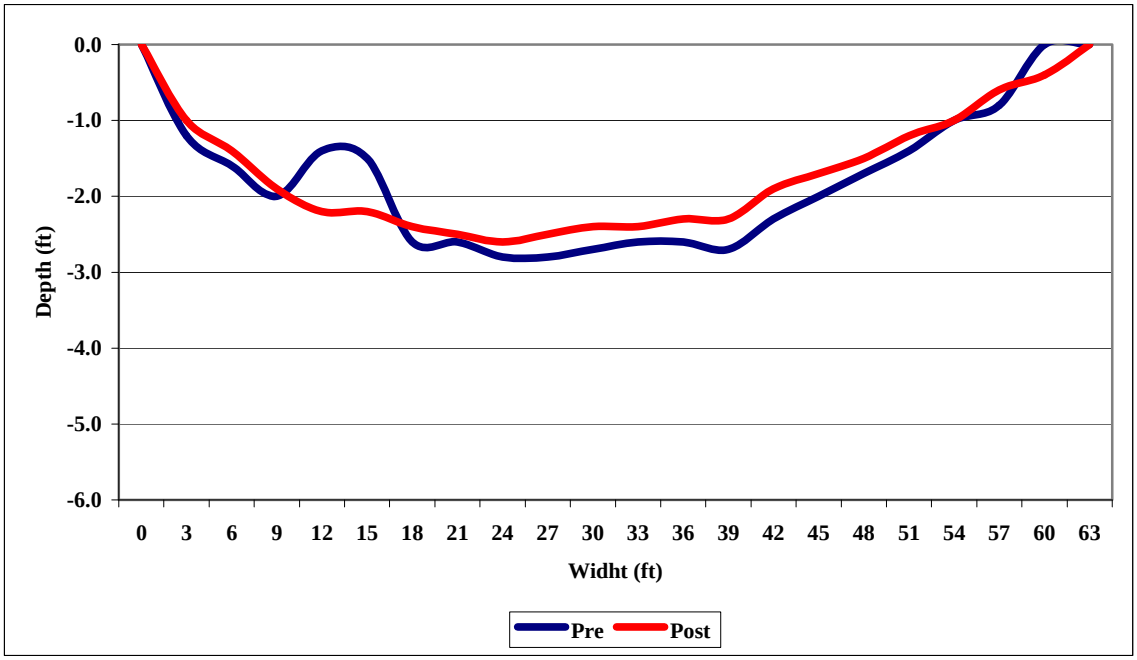


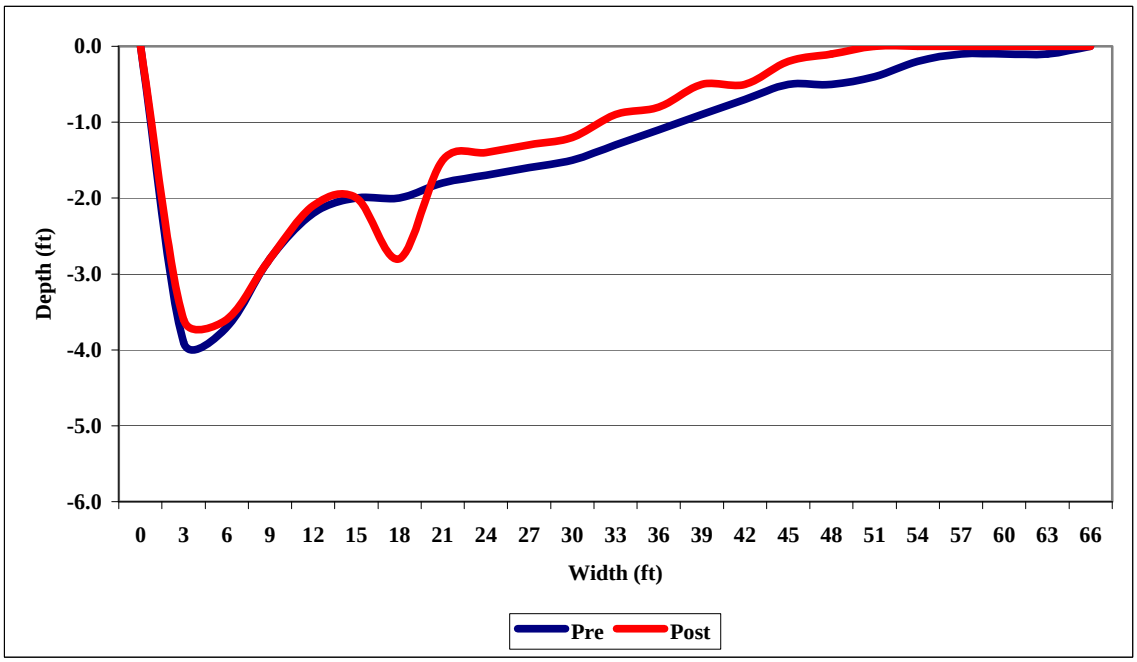
Appendix D-23. **Pre- and Post cross sections at Flatwater 2 Transect 1 – Geyserville Reach**



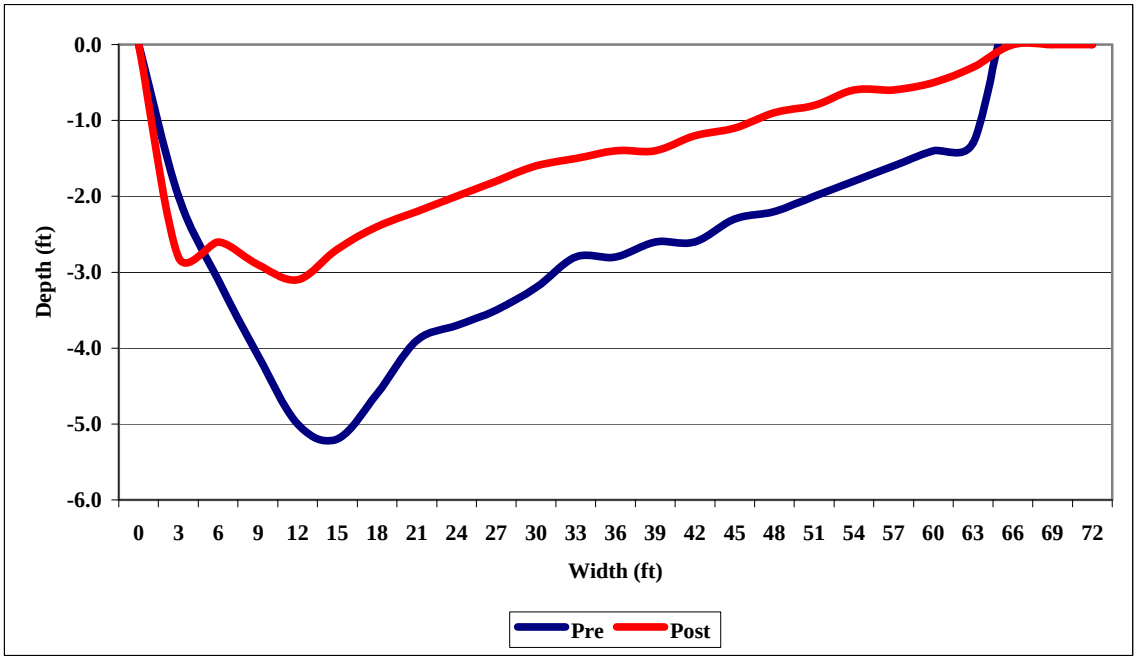
Appendix D-24. **Pre- and Post cross sections at Flatwater 2 Transect 2 – Geyserville Reach**



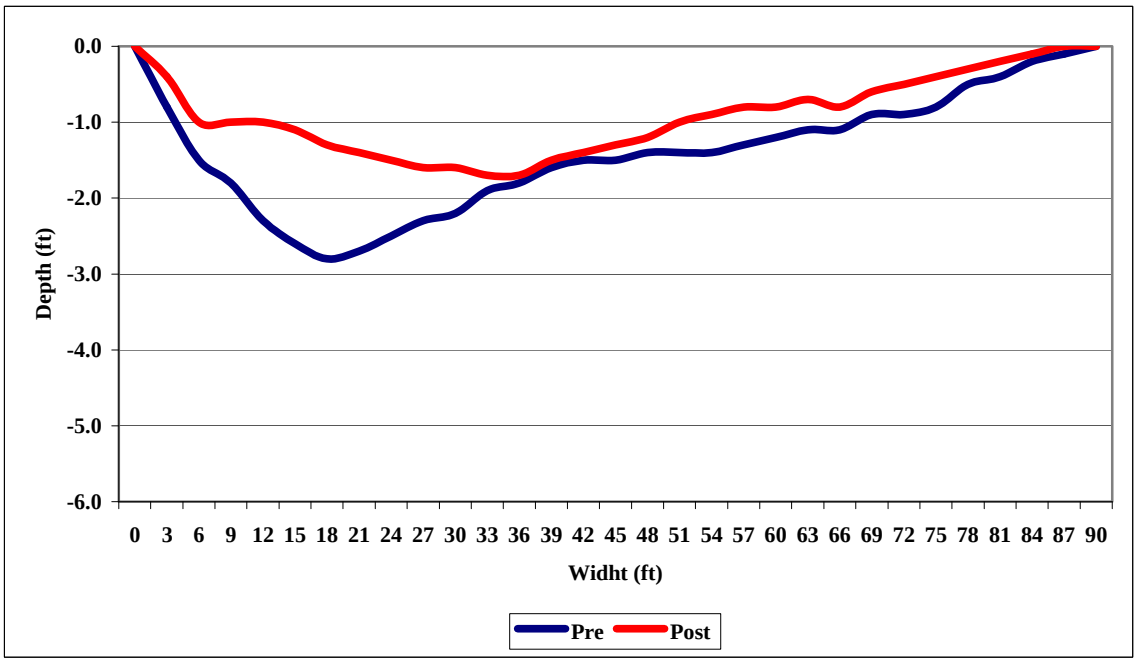
Appendix D-25. **Pre- and Post cross sections at Flatwater 2 Transect 3 – Geyserville Reach**



Appendix D-26. **Pre- and Post cross sections at Flatwater 3 Transect 1 – Geyserville Reach**



Appendix D-27. **Pre- and Post cross sections at Flatwater 3 Transect 2 – Geyserville Reach**

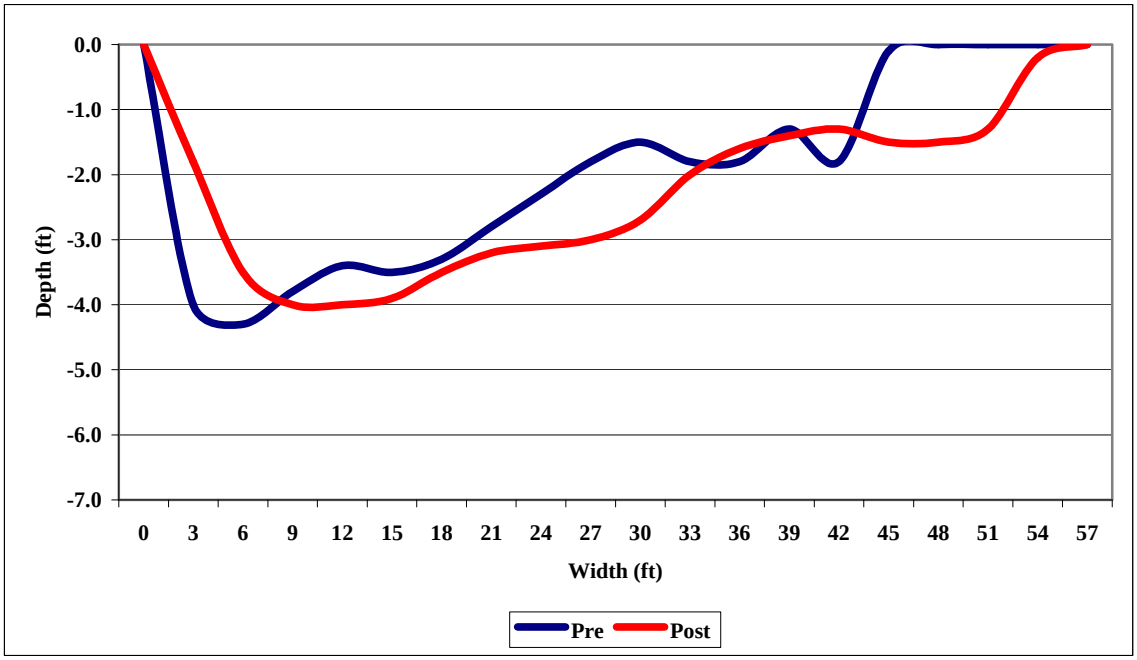


Appendix D-28. **Pre- and Post cross sections at Flatwater 3 Transect 3 – Geyserville Reach**

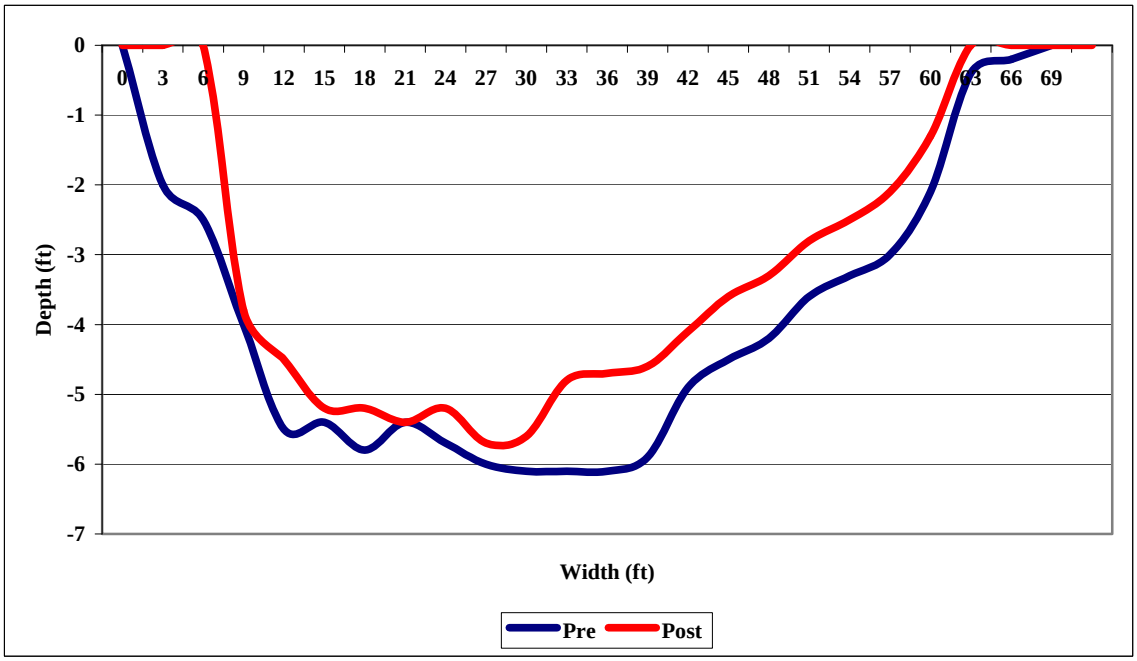
APPENDIX E

DIGGERS BEND REACH CROSS SECTIONS

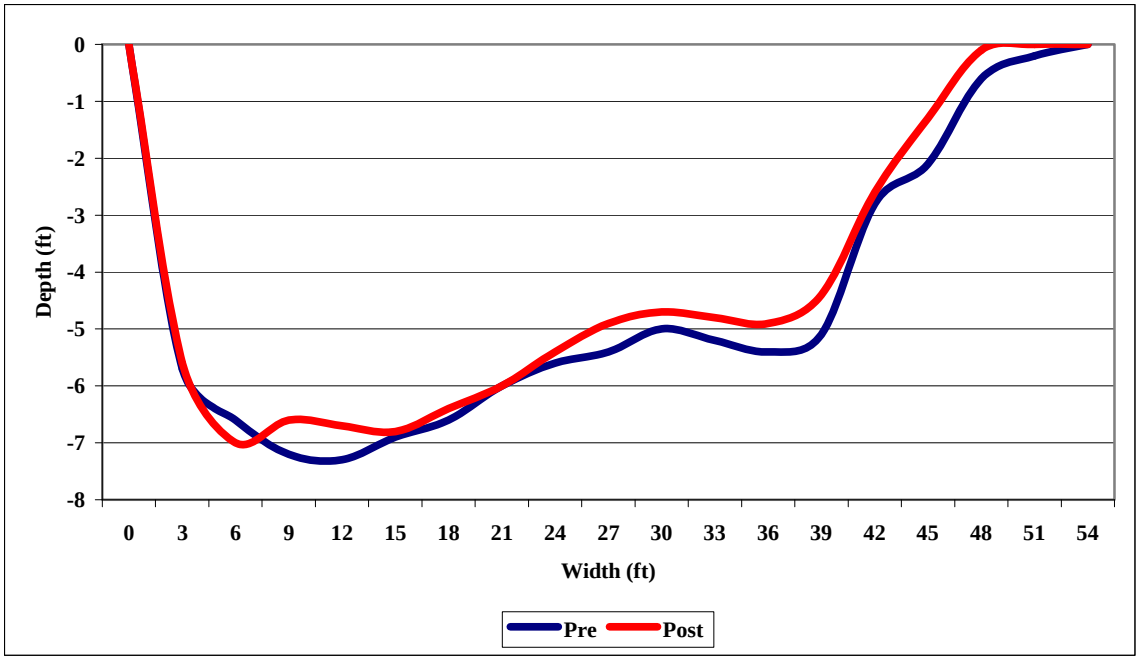
PRE AND POST FLOW REDUCTION SURVEYS



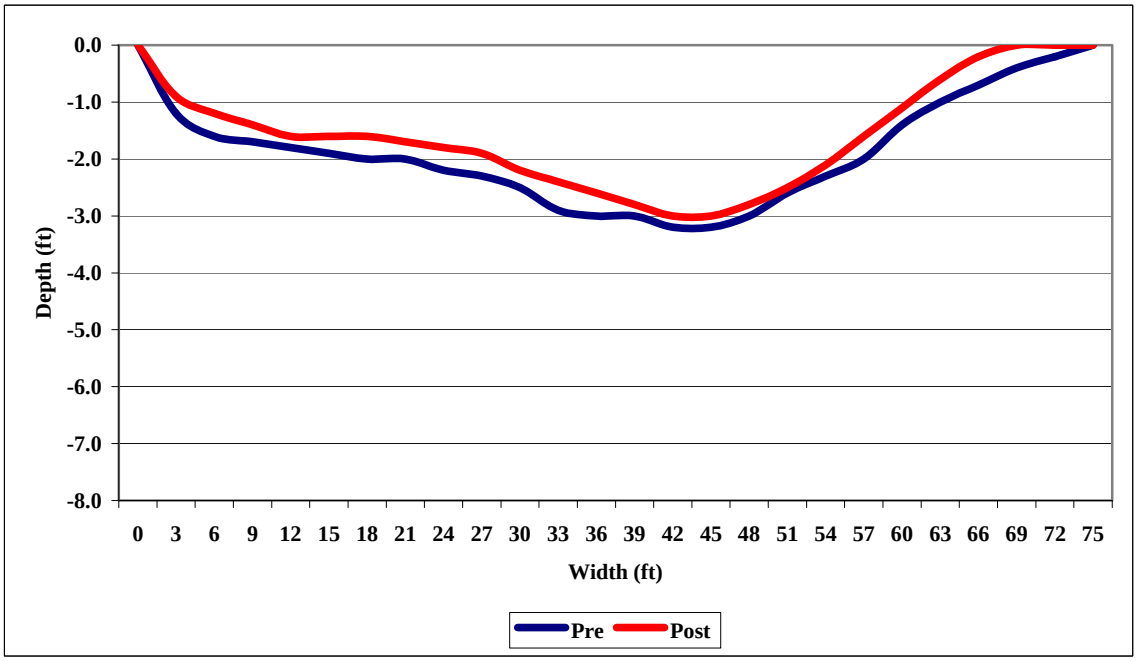
Appendix E-1. Pre and Post cross sections at Pool 1 Transect 1 – Diggers Bend Reach



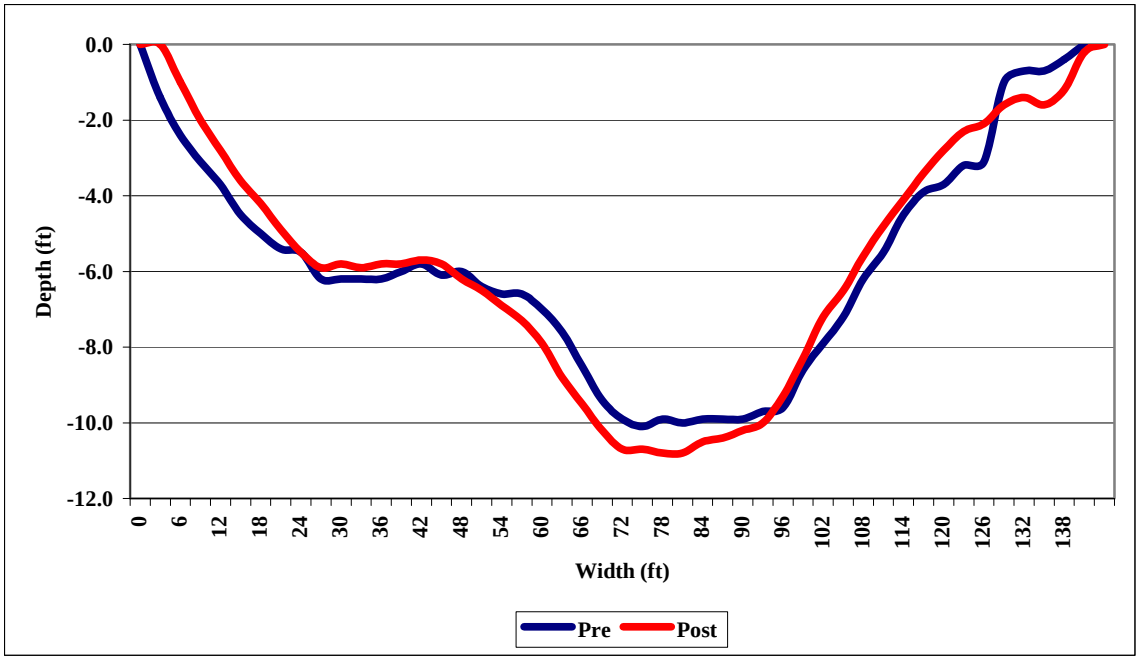
Appendix E-2. Pre and Post cross sections at Pool 1 Transect 2 – Diggers Bend Reach



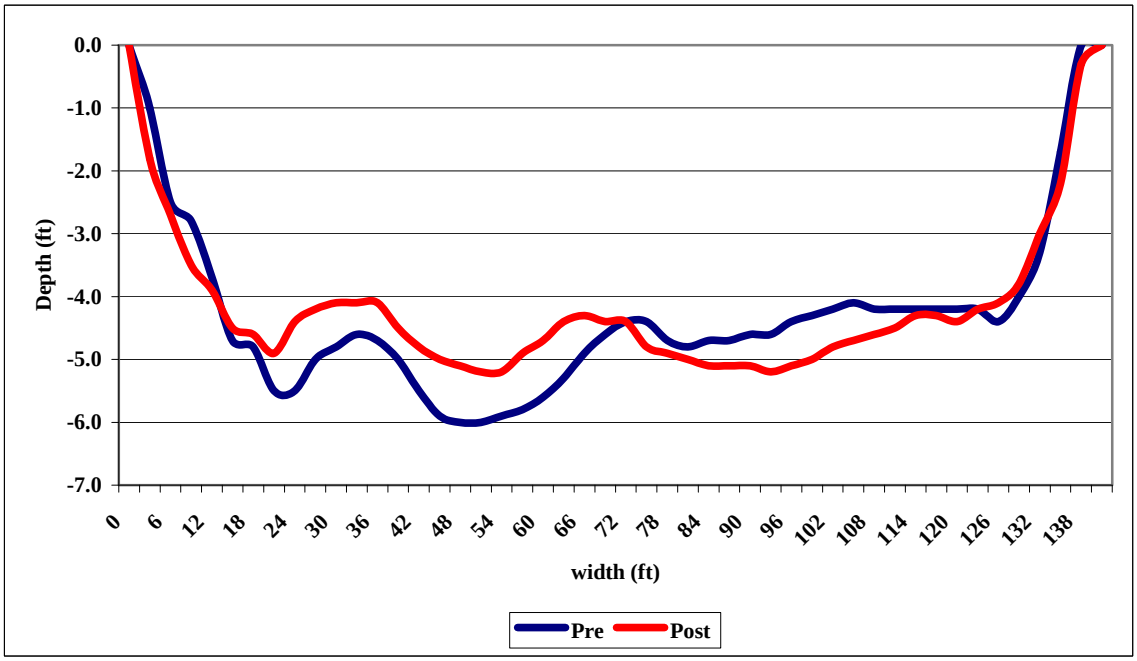
Appendix E-3. Pre and Post cross sections at Pool 1 Transect 3 – Diggers Bend Reach



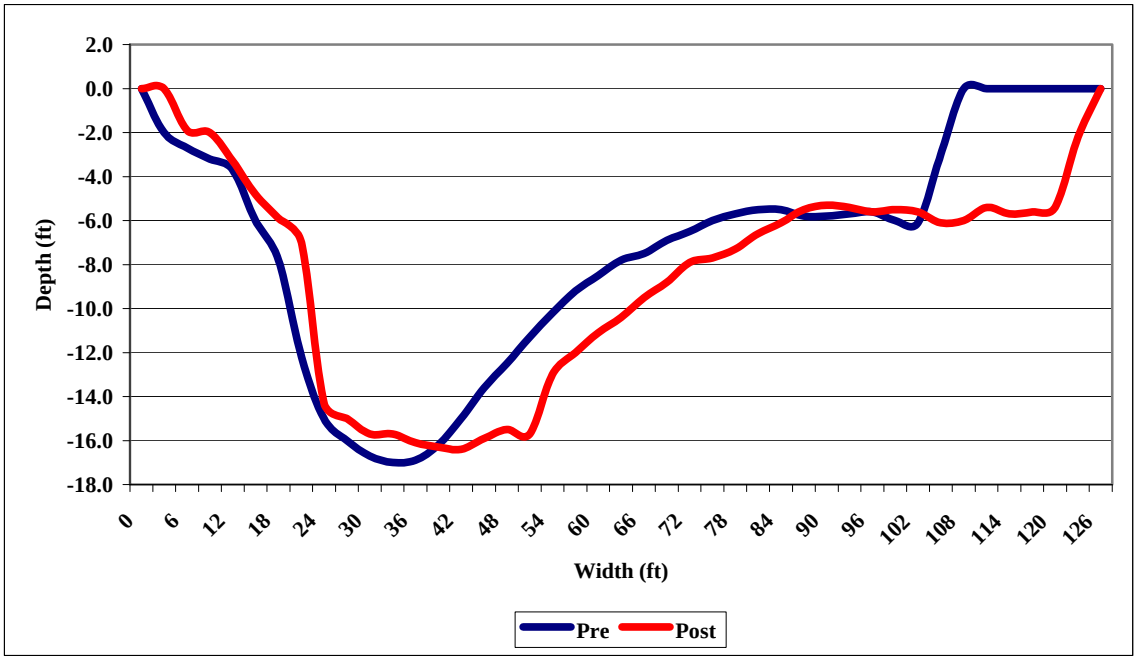
Appendix E-4. Pre and Post cross sections at Pool 1 Transect 4 – Diggers Bend Reach



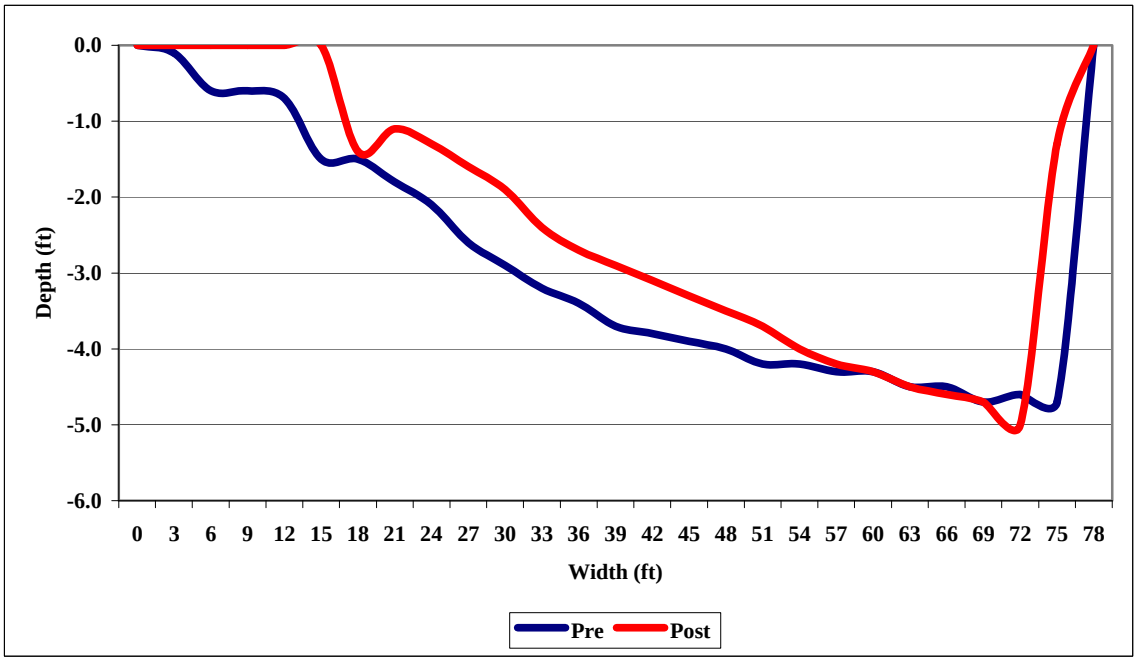
Appendix E-5. Pre and Post cross sections at Pool 2 Transect 1 – Diggers Bend Reach



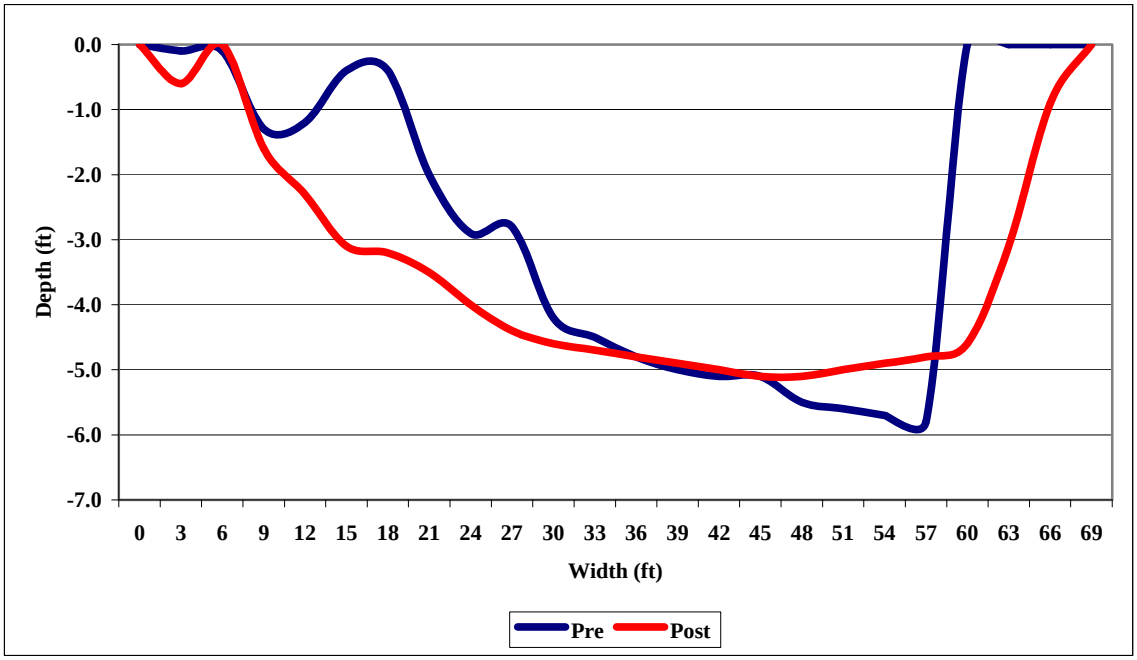
Appendix E-6. Pre and Post cross sections at Pool 2 Transect 2 – Diggers Bend Reach



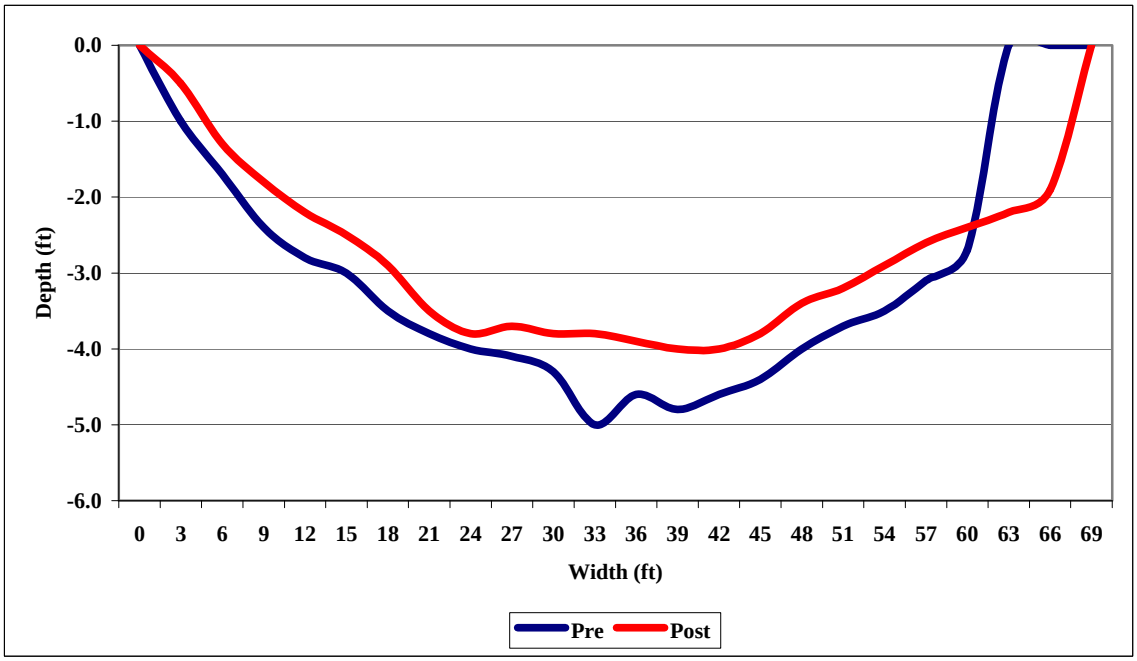
Appendix E-7. Pre and Post cross sections at Pool 2 Transect 3 – Diggers Bend Reach



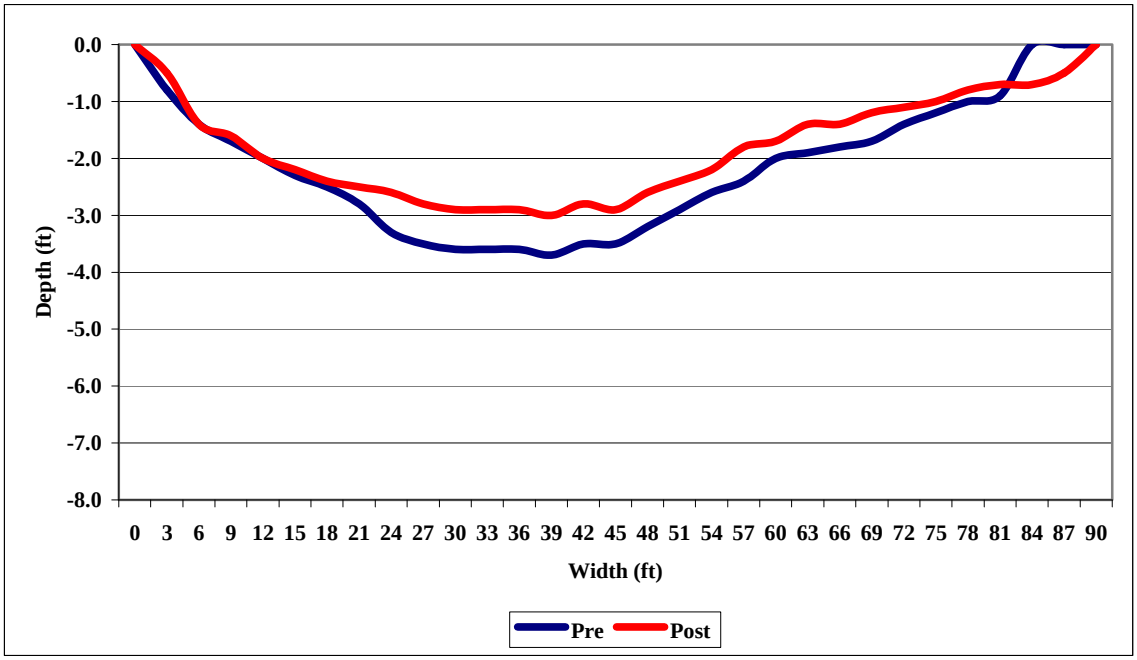
Appendix E-8. Pre and Post cross sections at Pool 3 Transect 1 – Diggers Bend Reach



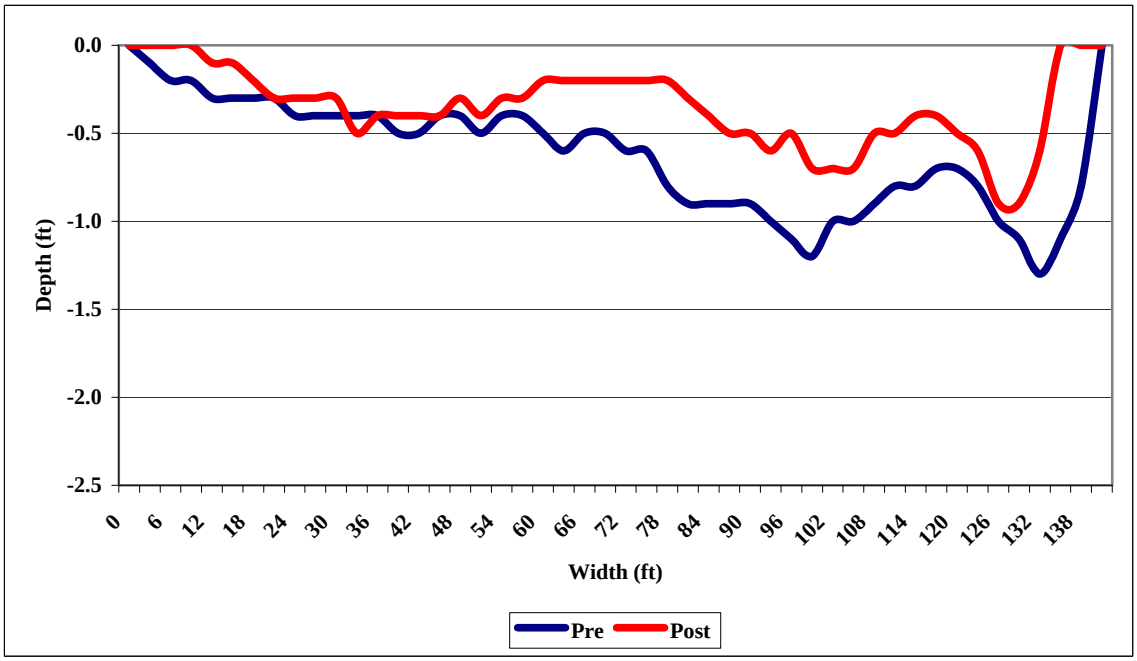
Appendix E-9. Pre and Post cross sections at Pool 3 Transect 2 – Diggers Bend Reach



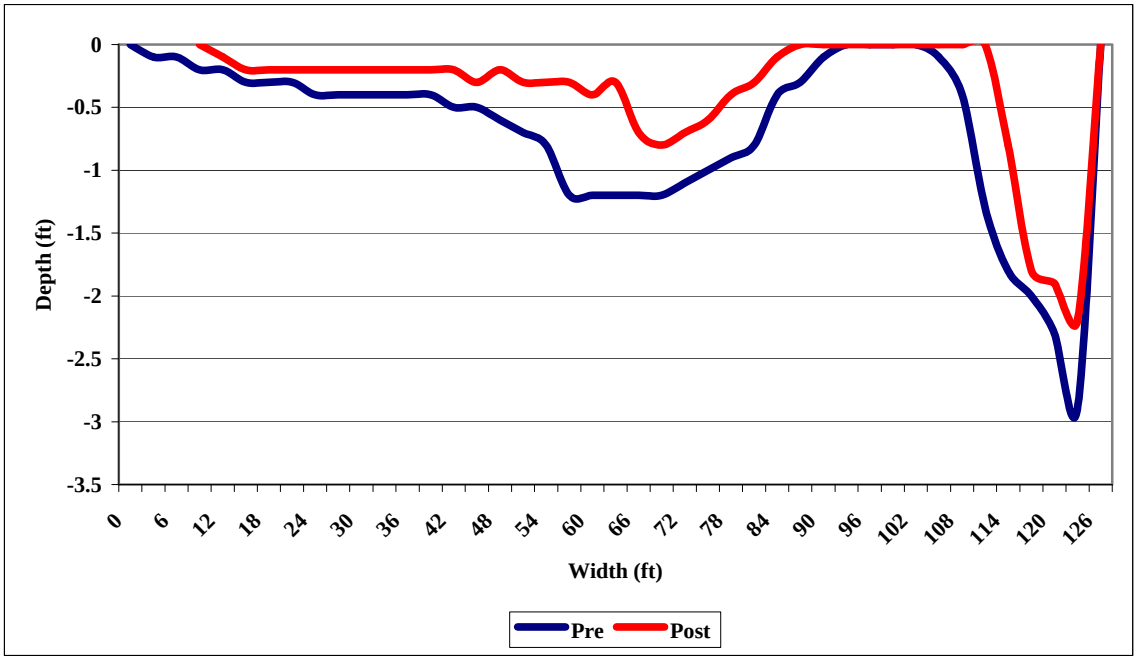
Appendix E-10. Pre and Post cross sections at Pool 3 Transect 3 – Diggers Bend Reach



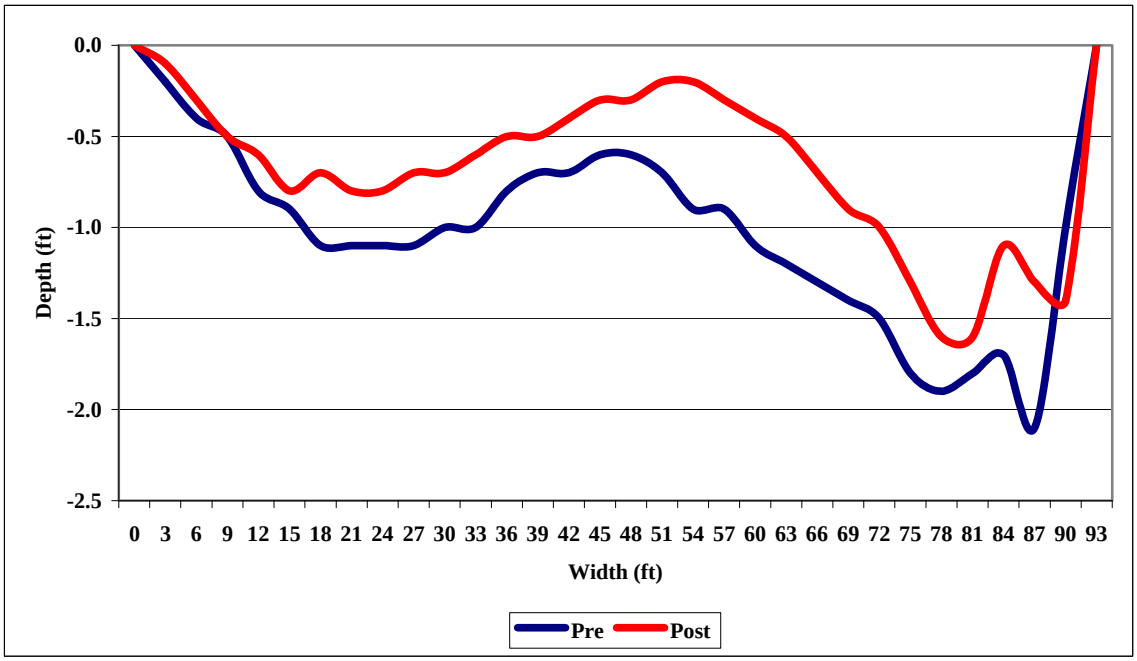
Appendix E-11. Pre and Post cross sections at Pool 3 Transect 4 – Diggers Bend Reach



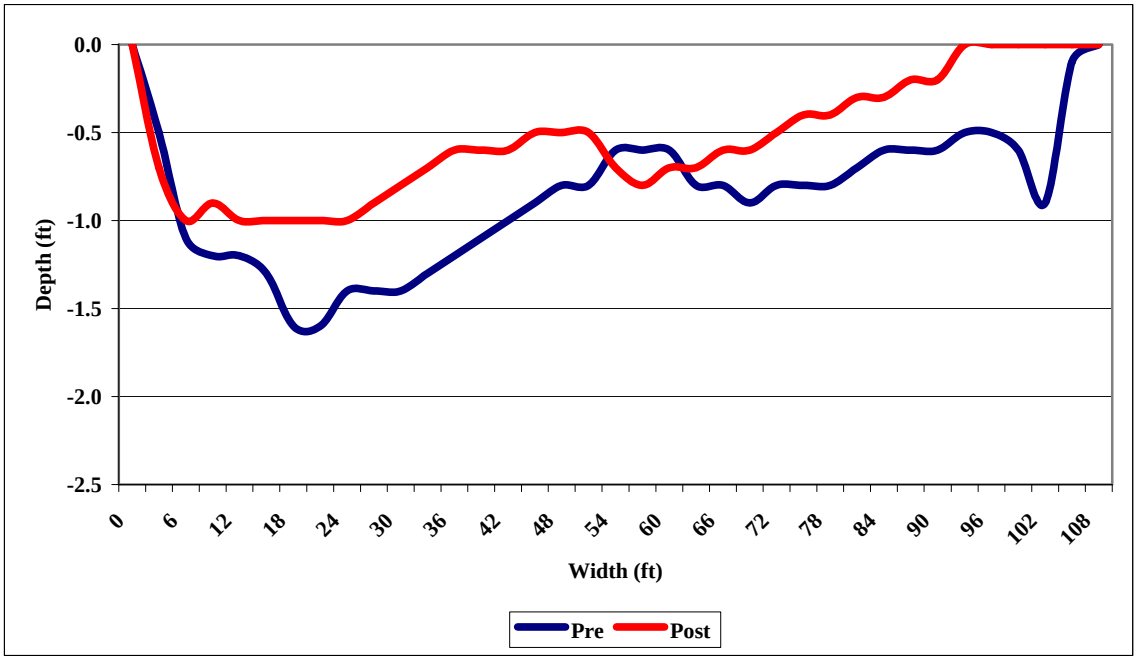
Appendix E-12. Pre and Post cross sections at Riffle 1 Transect 1 – Diggers Bend Reach



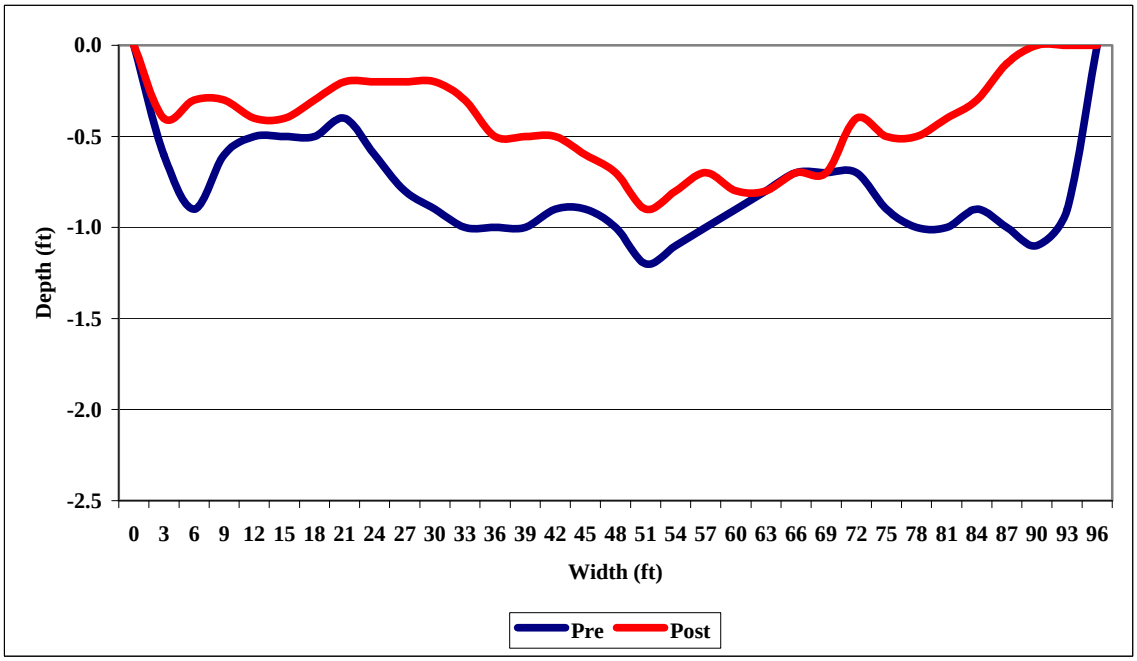
Appendix E-13. Pre and Post cross sections at Riffle 1 Transect 2 – Diggers Bend Reach



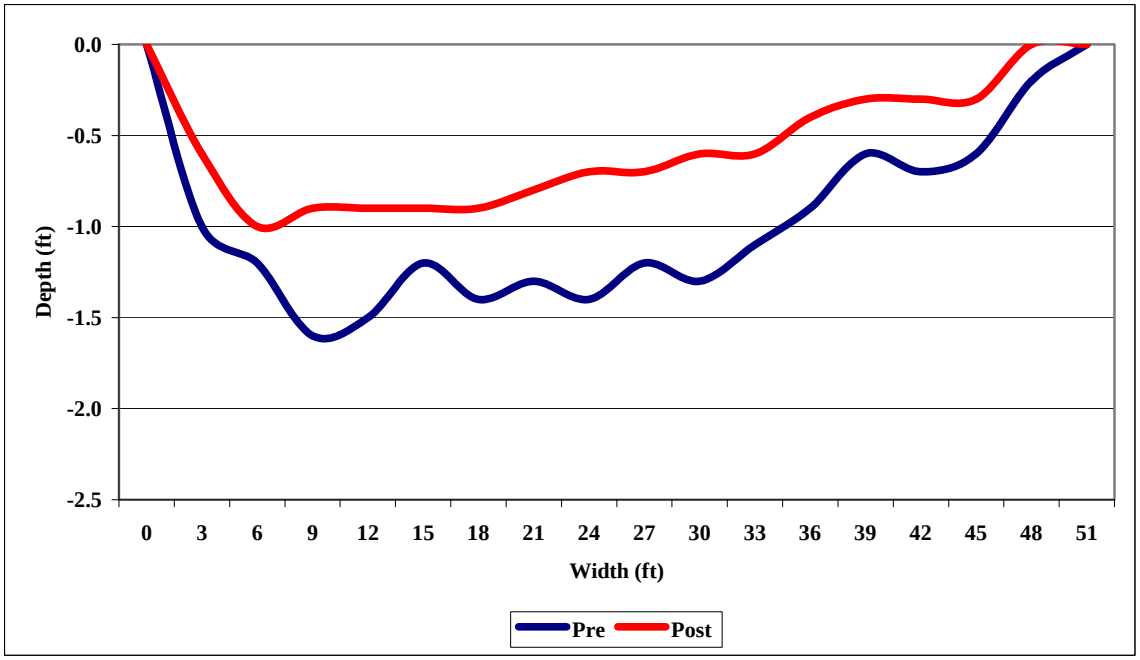
Appendix E-14. Pre and Post cross sections at Riffle 2 Transect 1 – Diggers Bend Reach



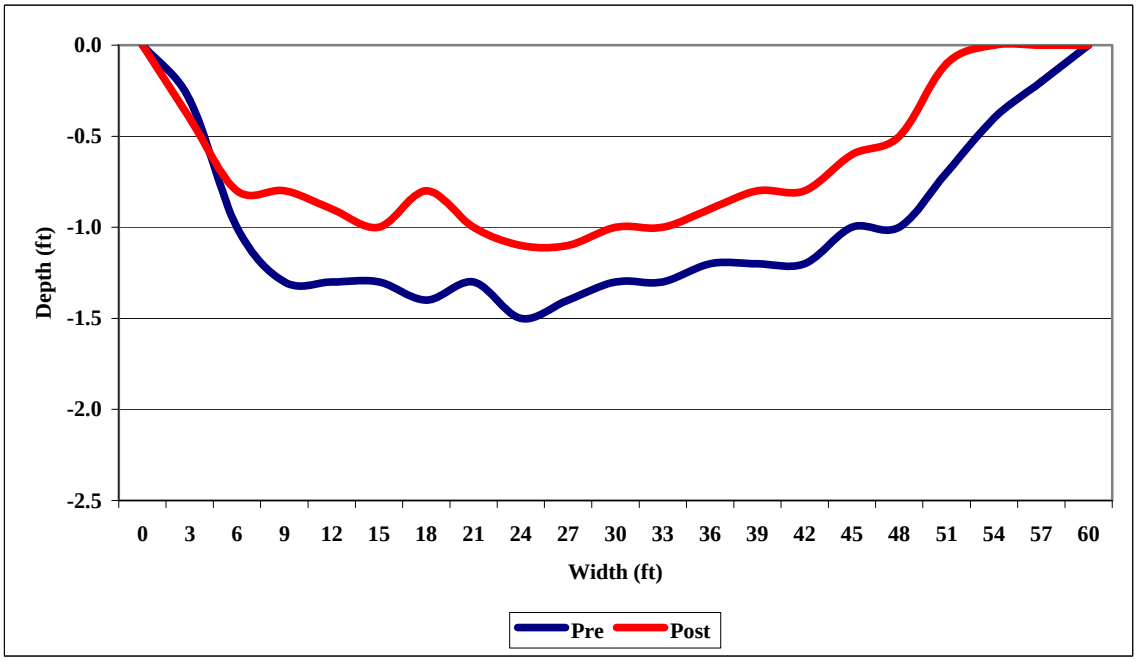
Appendix E-15. Pre and Post cross sections at Riffle 2 Transect 2 – Diggers Bend Reach



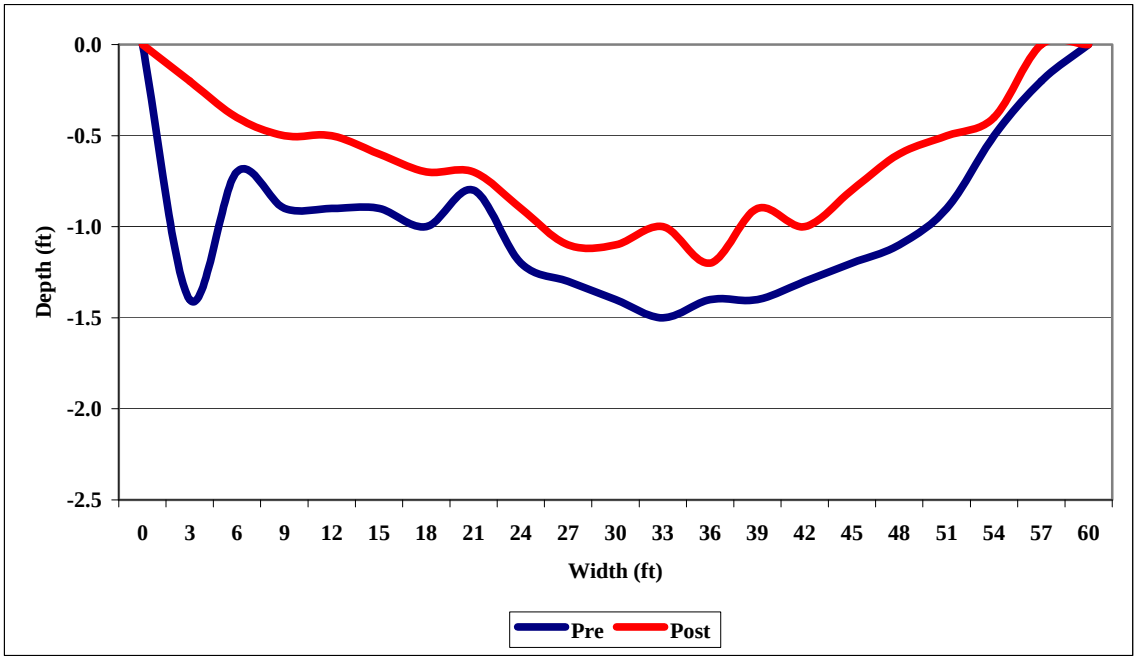
Appendix E-16. Pre and Post cross sections at Riffle 2 Transect 3 – Diggers Bend Reach



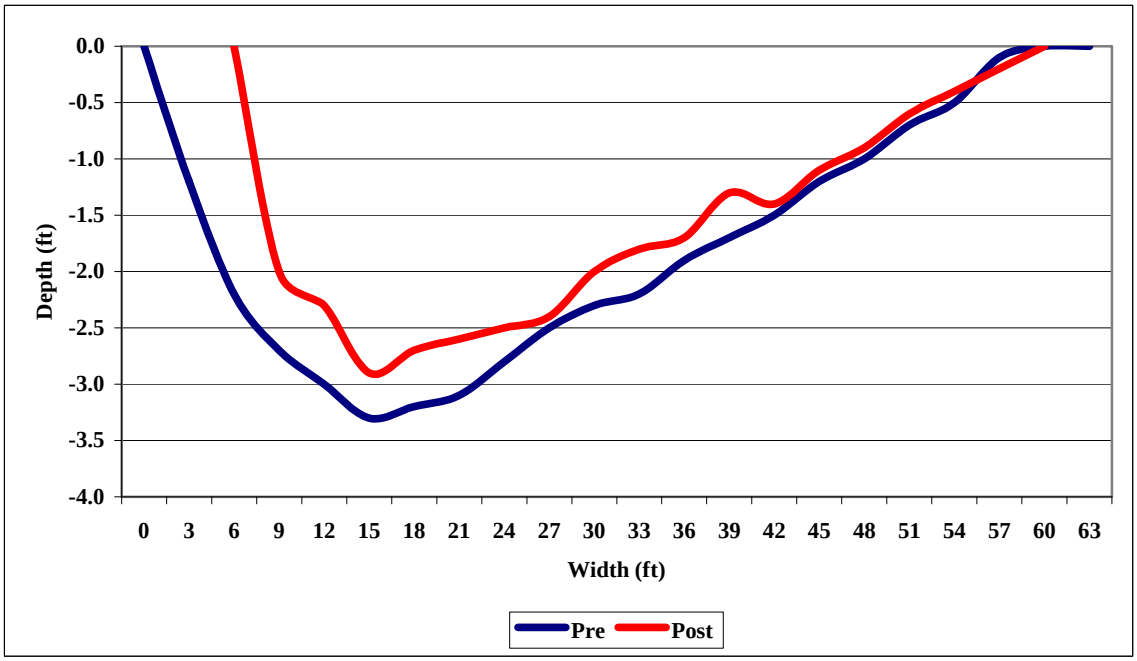
Appendix E-17. Pre and Post cross sections at Riffle 3 Transect 1 – Diggers Bend Reach



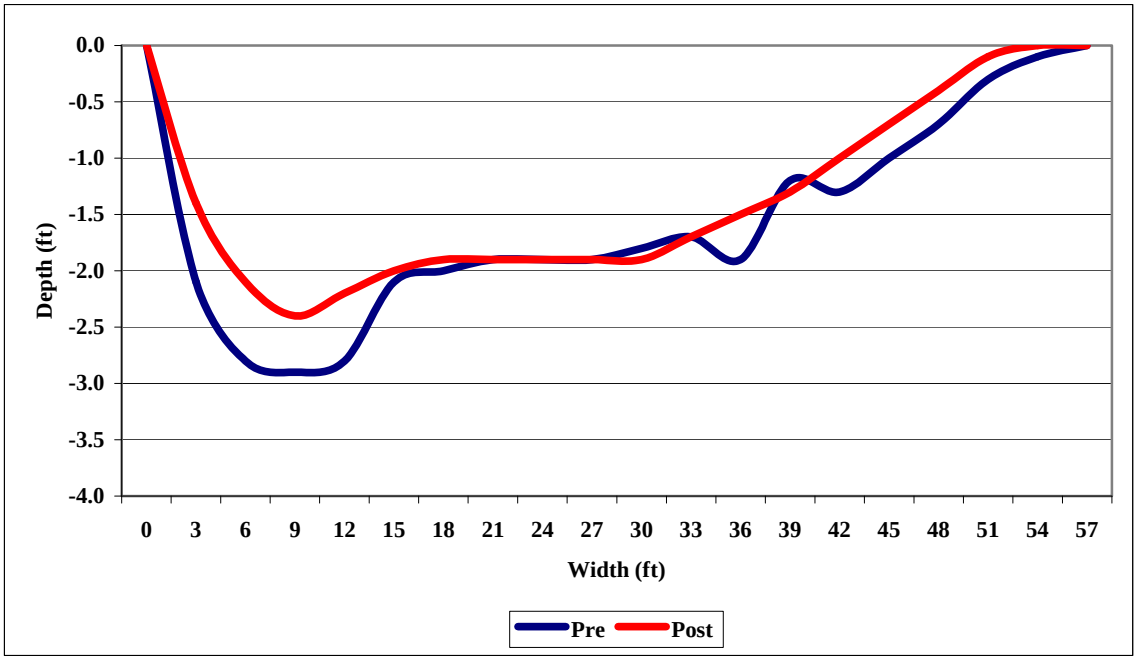
Appendix E-18. Pre and Post cross sections at Riffle 3 Transect 2 – Diggers Bend Reach



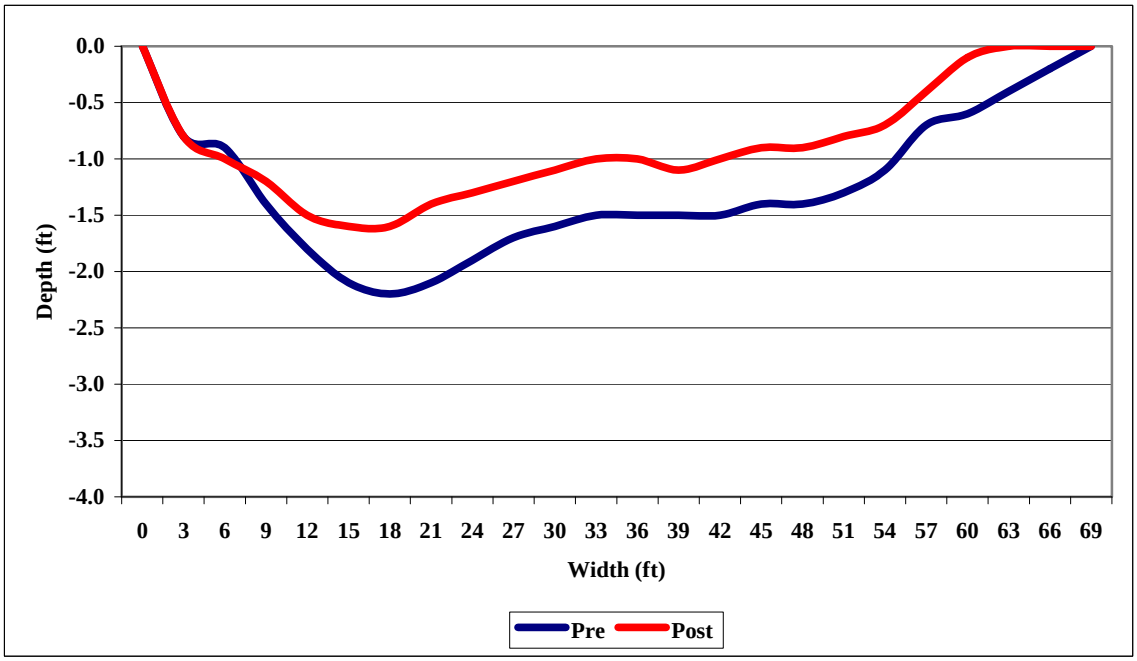
Appendix E-19. **Pre and Post cross sections at Riffle 3 Transect 3 – Diggers Bend Reach**



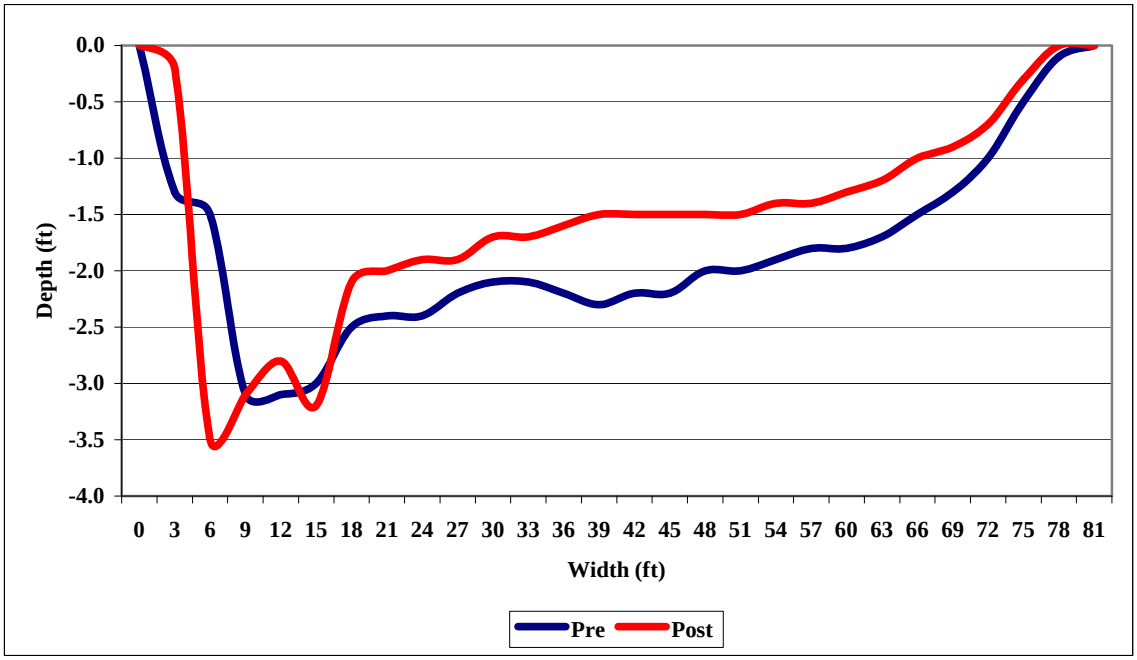
Appendix E-20. **Pre and Post cross sections at Flatwater 1 Transect 1 – Diggers Bend Reach**



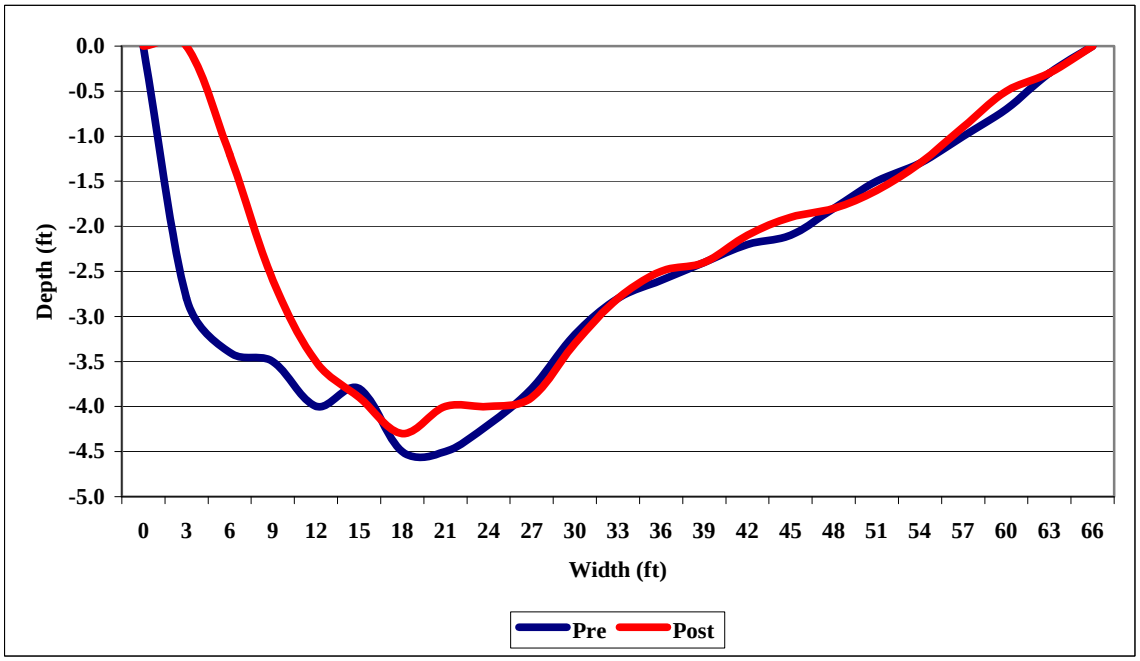
Appendix E-21. **Pre and Post cross sections at Flatwater 1 Transect 2 – Diggers Bend Reach**



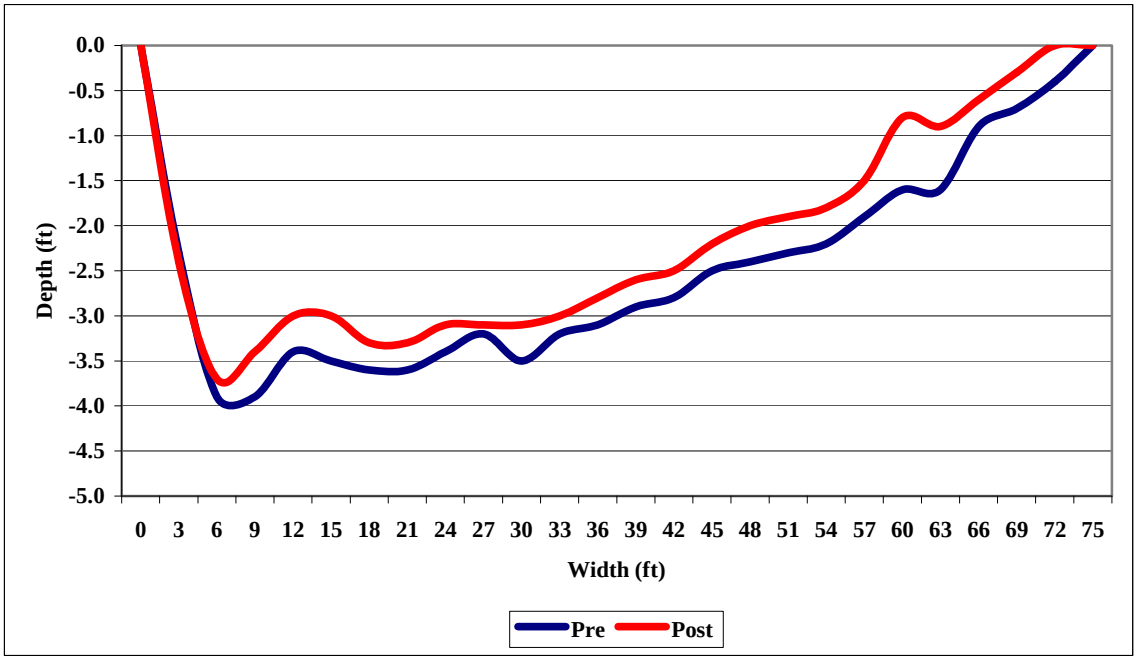
Appendix E-22. **Pre and Post cross sections at Flatwater 1 Transect 3 – Diggers Bend Reach**



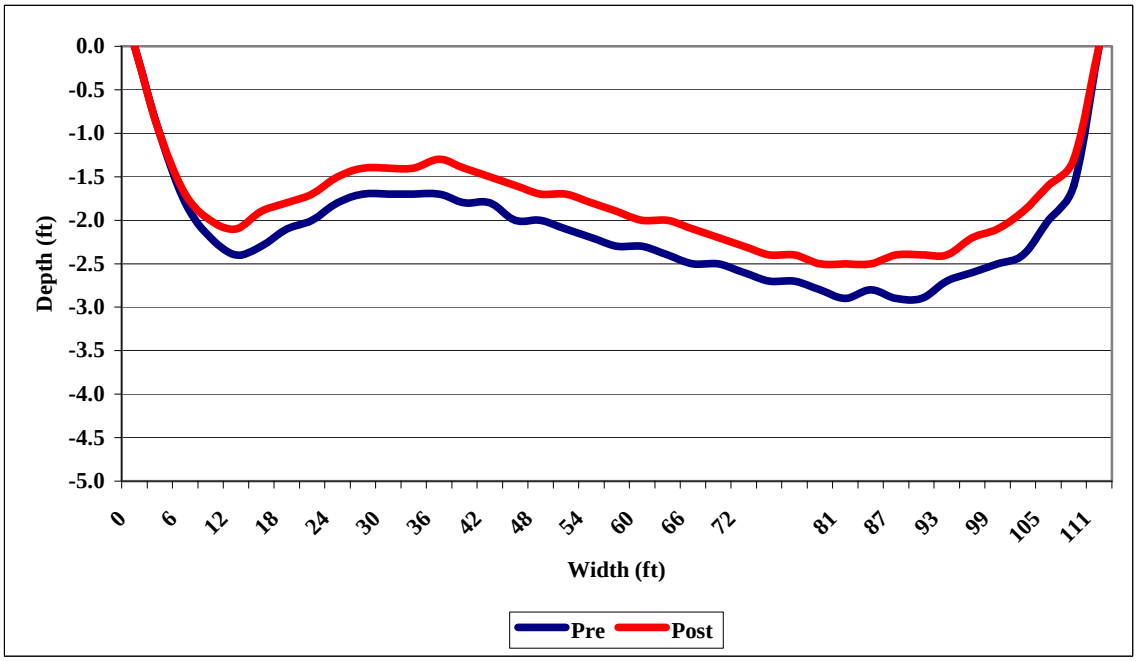
Appendix E-23. **Pre and Post cross sections at Flatwater 2 Transect 1 – Diggers Bend Reach**



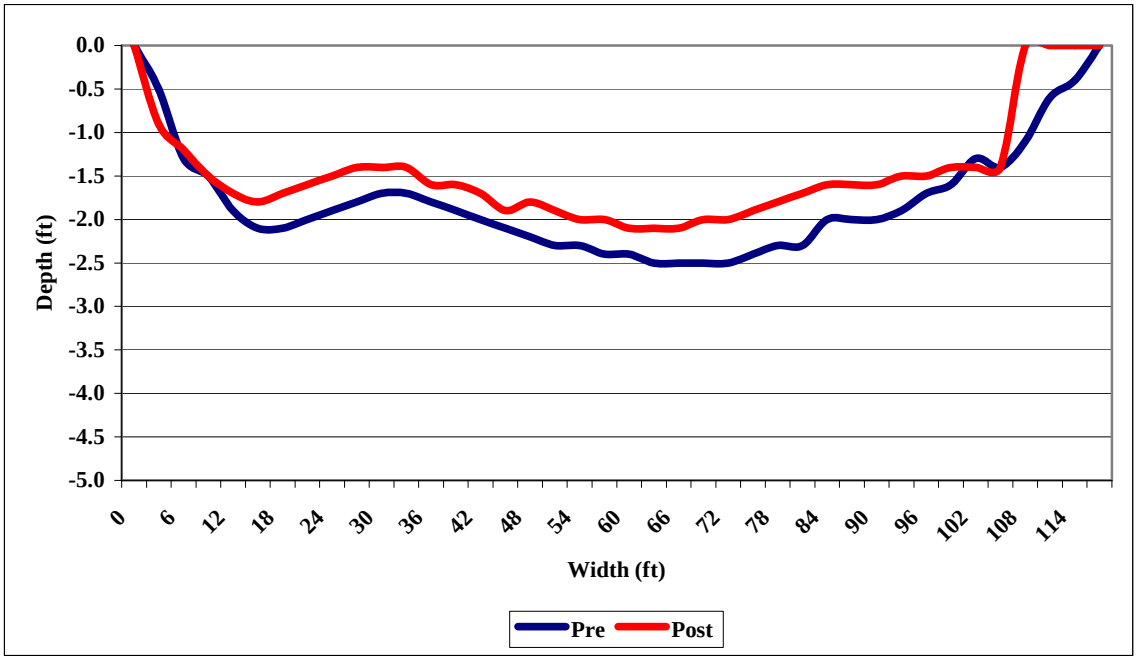
Appendix E-24. **Pre and Post cross sections at Flatwater 2 Transect 2 – Diggers Bend Reach**



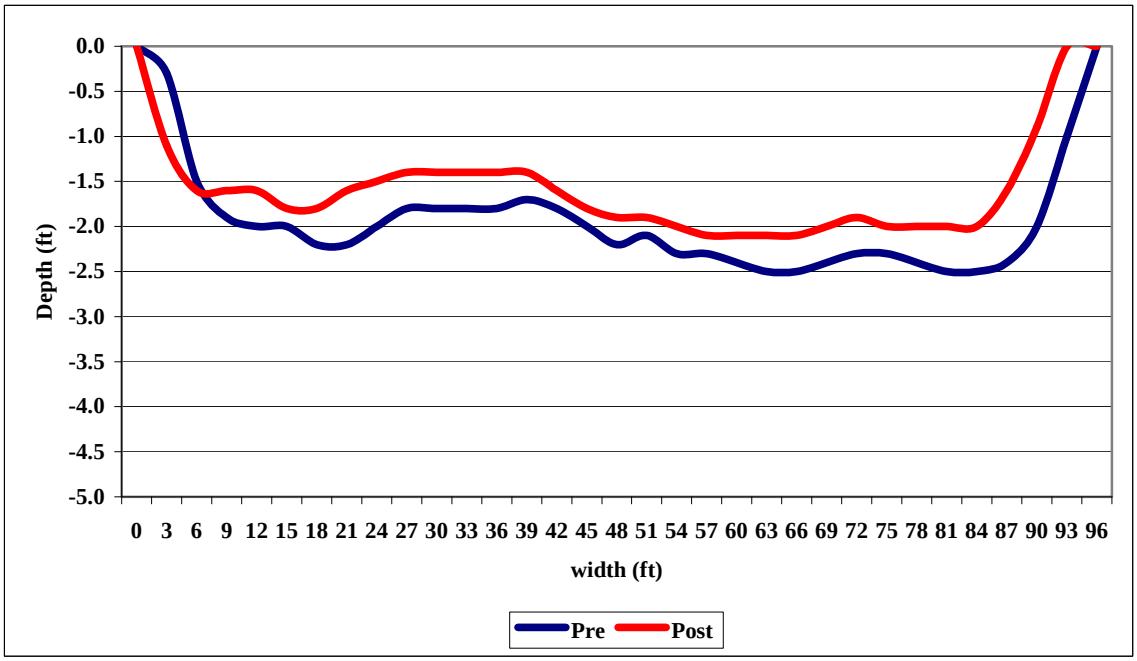
Appendix E-25. **Pre and Post cross sections at Flatwater 2 Transect 3 – Diggers Bend Reach**



Appendix E-26. **Pre and Post cross sections at Flatwater 3 Transect 1 – Diggers Bend Reach**



Appendix E-27. **Pre and Post cross sections at Flatwater 3 Transect 2 – Diggers Bend Reach**

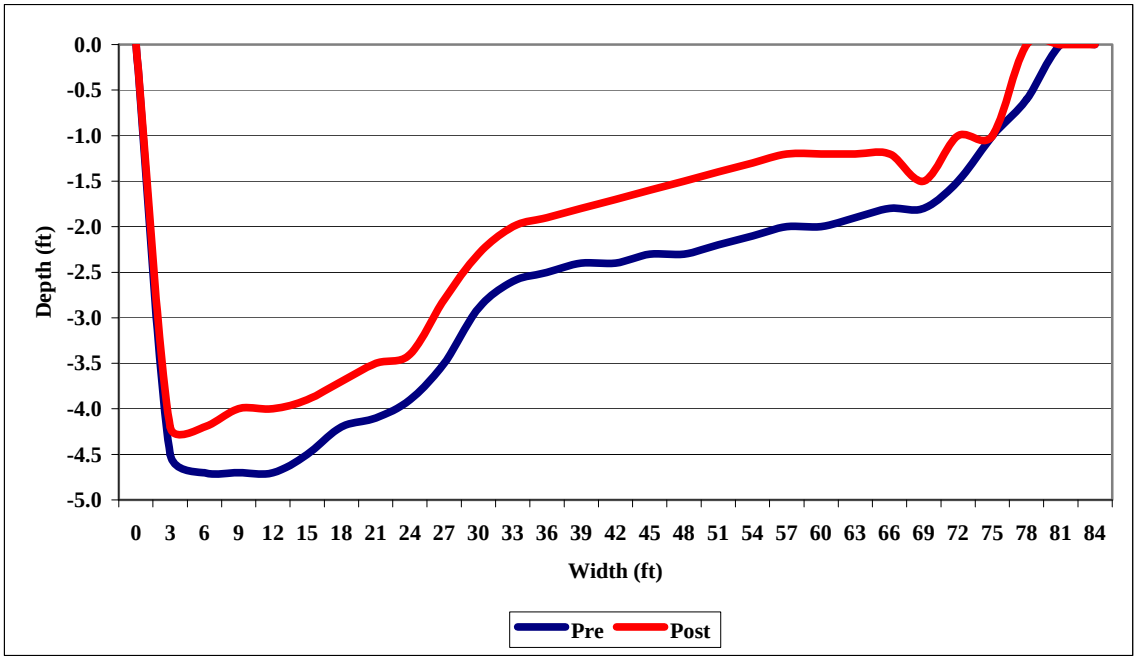


Appendix E-28. **Pre and Post cross sections at Flatwater 3 Transect 3 – Diggers Bend Reach**

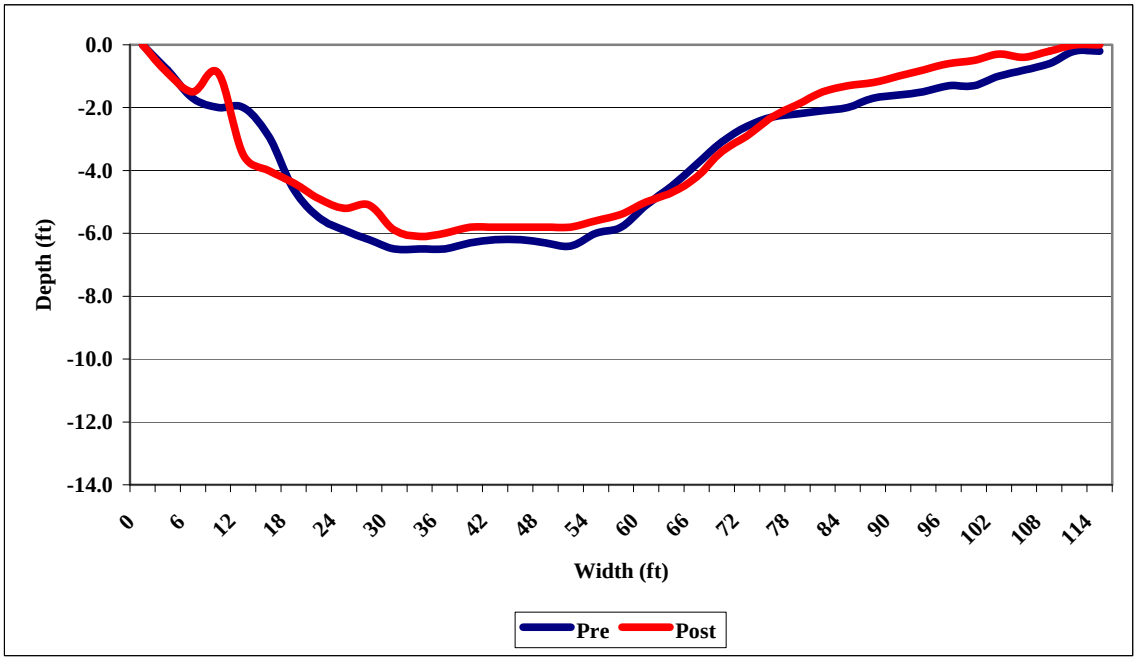
APPENDIX F

HEALDSBURG REACH CROSS SECTIONS

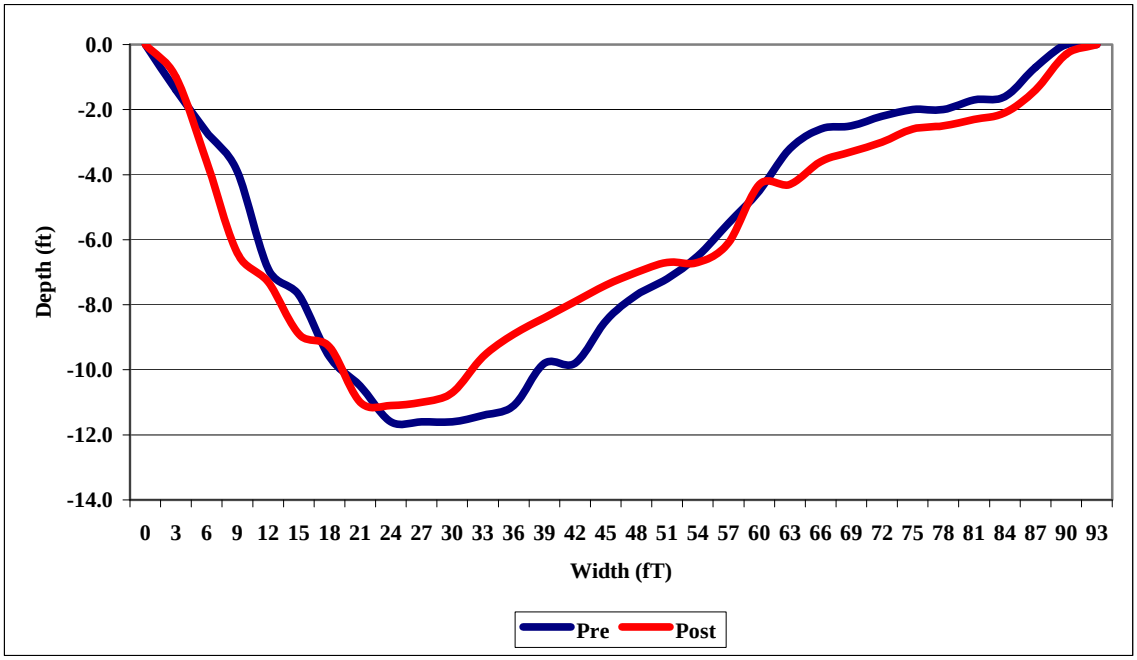
PRE AND POST FLOW REDUCTION SURVEYS



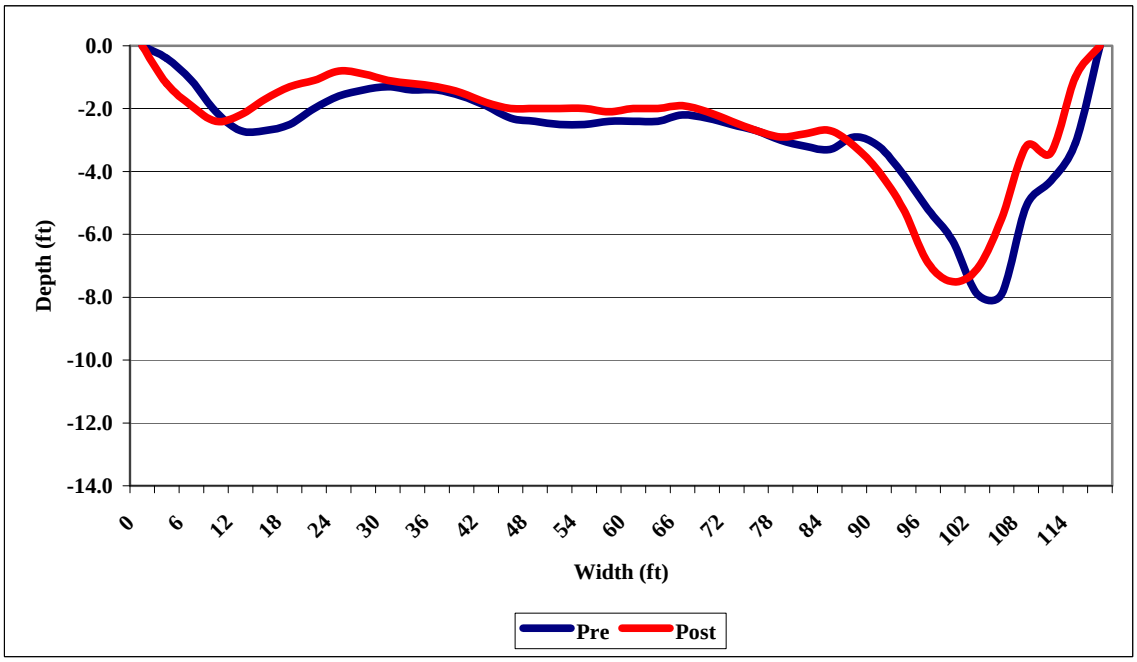
Appendix F-1. Pre and Post cross sections at Pool 1 Transect 1 – Healdsburg Reach



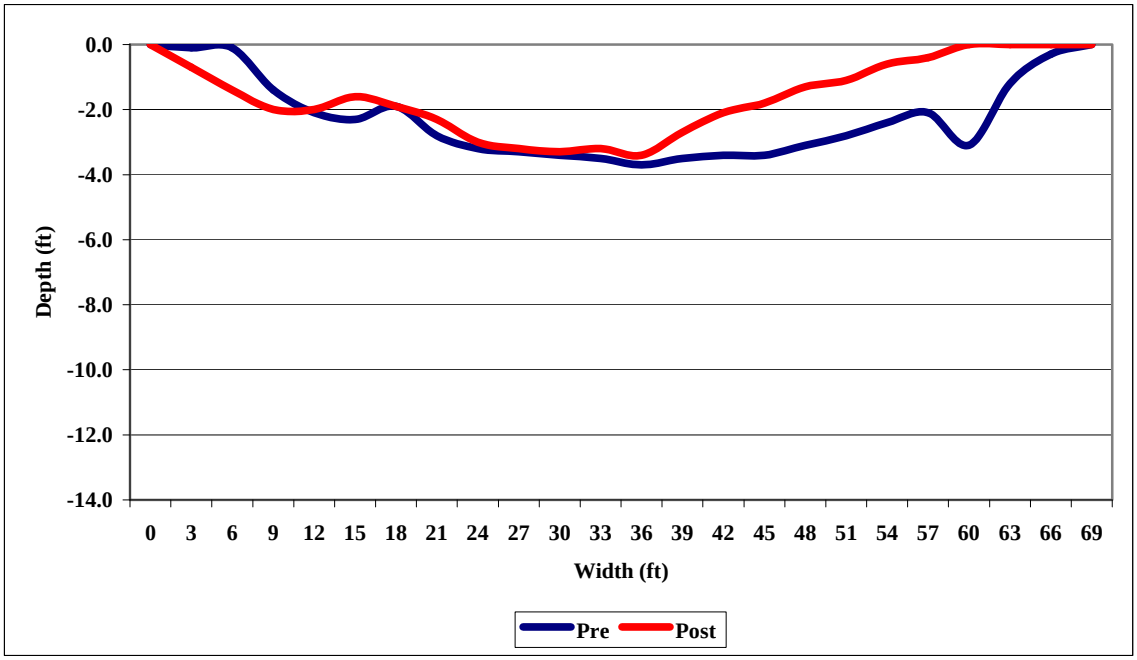
Appendix F-2. Pre and Post cross sections at Pool 1 Transect 2 – Healdsburg Reach



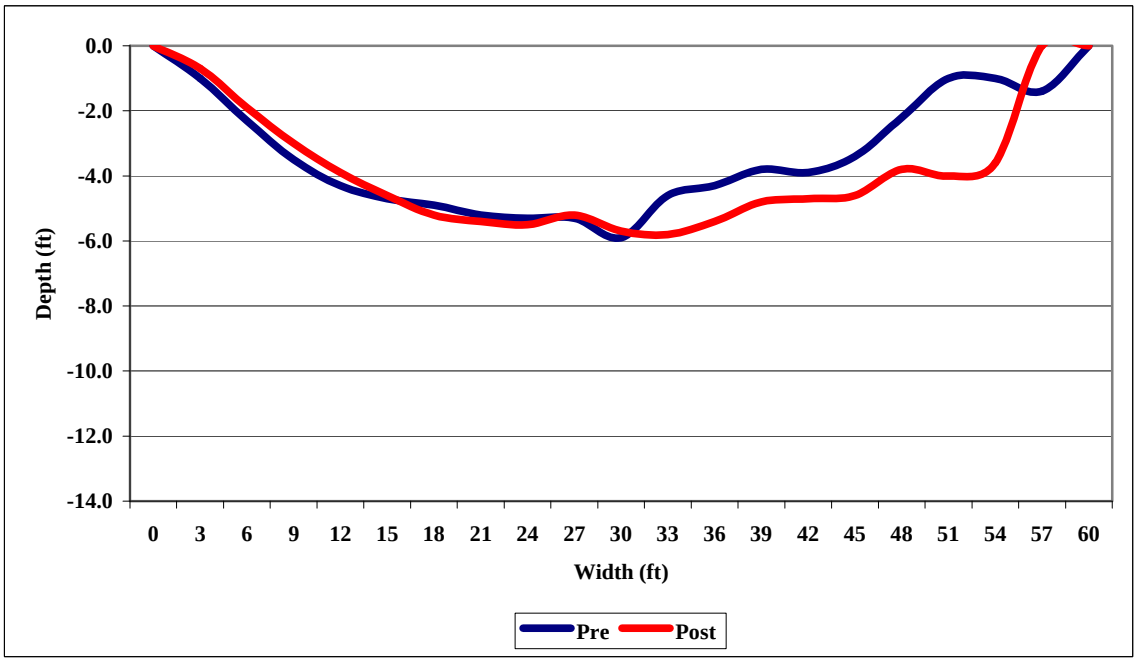
Appendix F-3. Pre and Post cross sections at Pool 1 Transect 3 – Healdsburg Reach



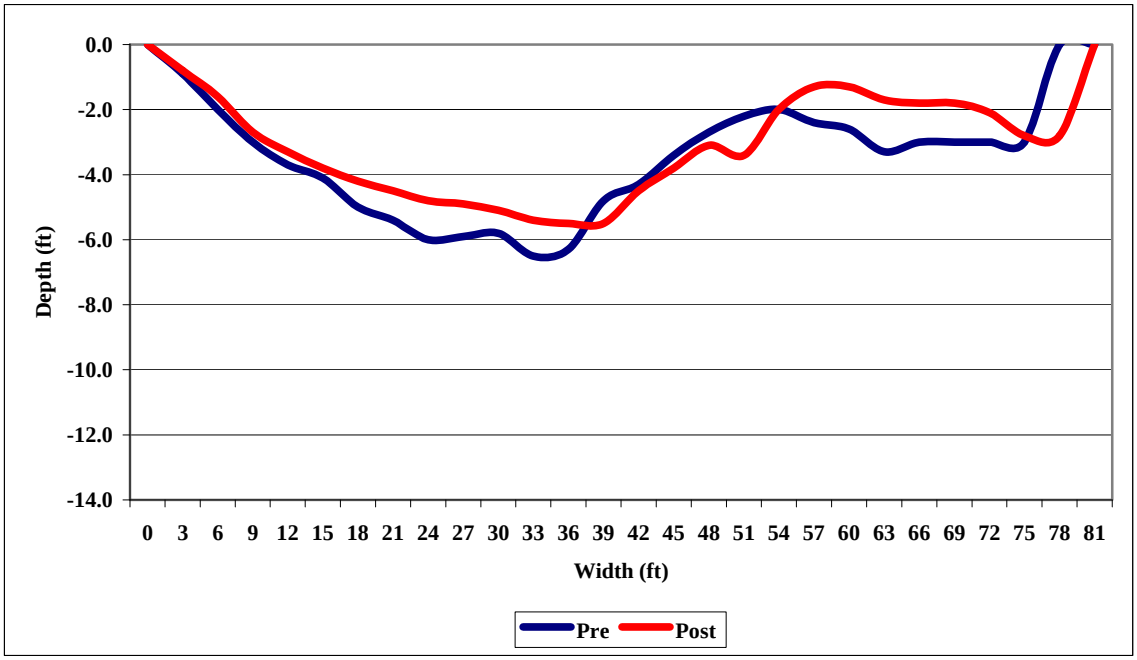
Appendix F-4. Pre and Post cross sections at Pool 1 Transect 4 – Healdsburg Reach



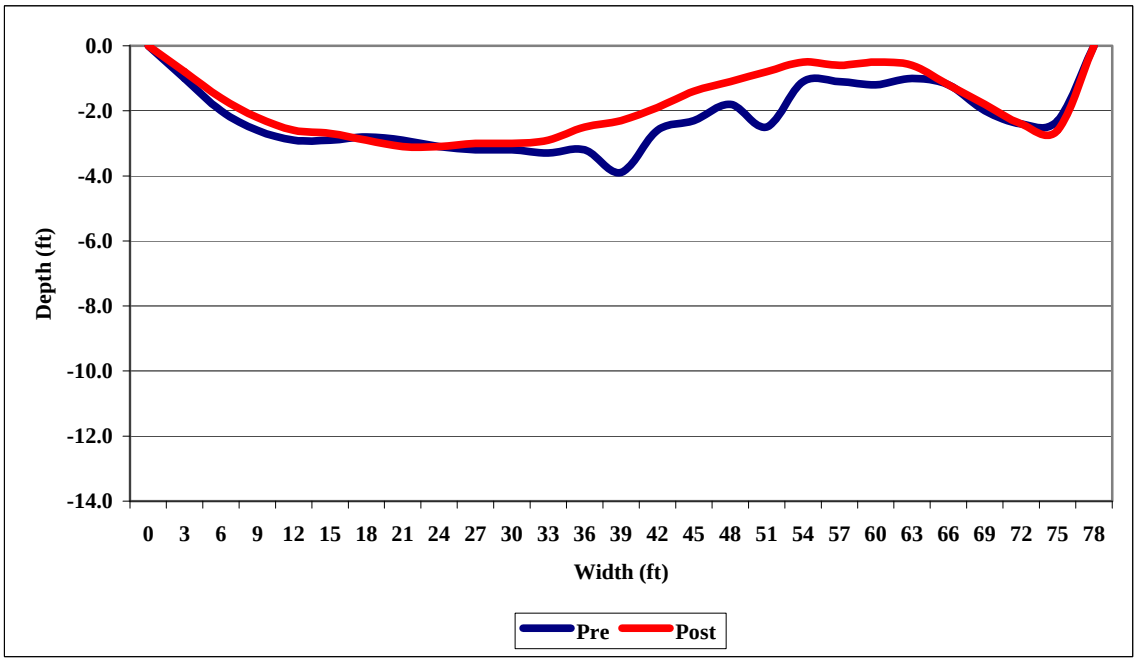
Appendix F-5. Pre and Post cross sections at Pool 2 Transect 1 – Healdsburg Reach



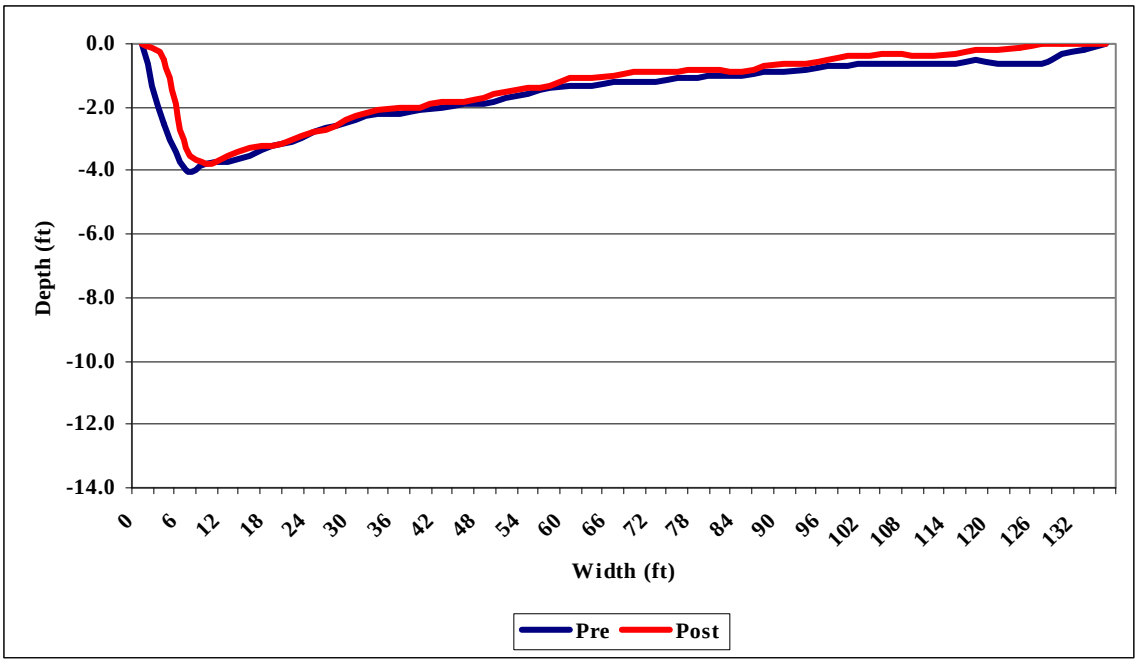
Appendix F-6. Pre and Post cross sections at Pool 2 Transect 2 – Healdsburg Reach



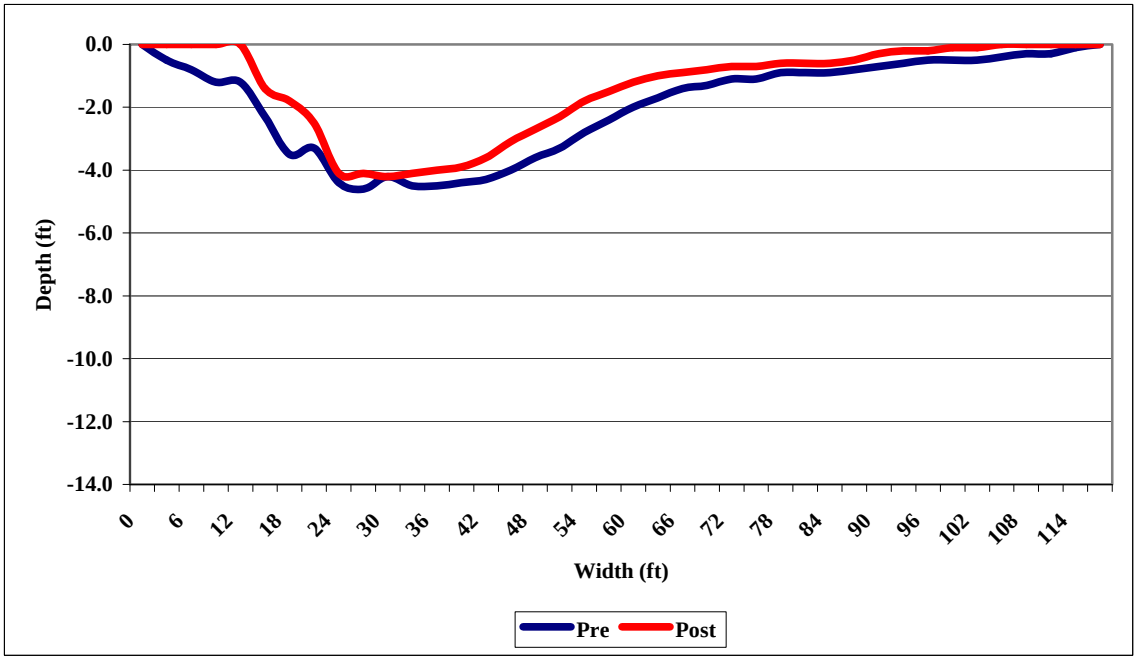
Appendix F-7. Pre and Post cross sections at Pool 2 Transect 3 – Healdsburg Reach



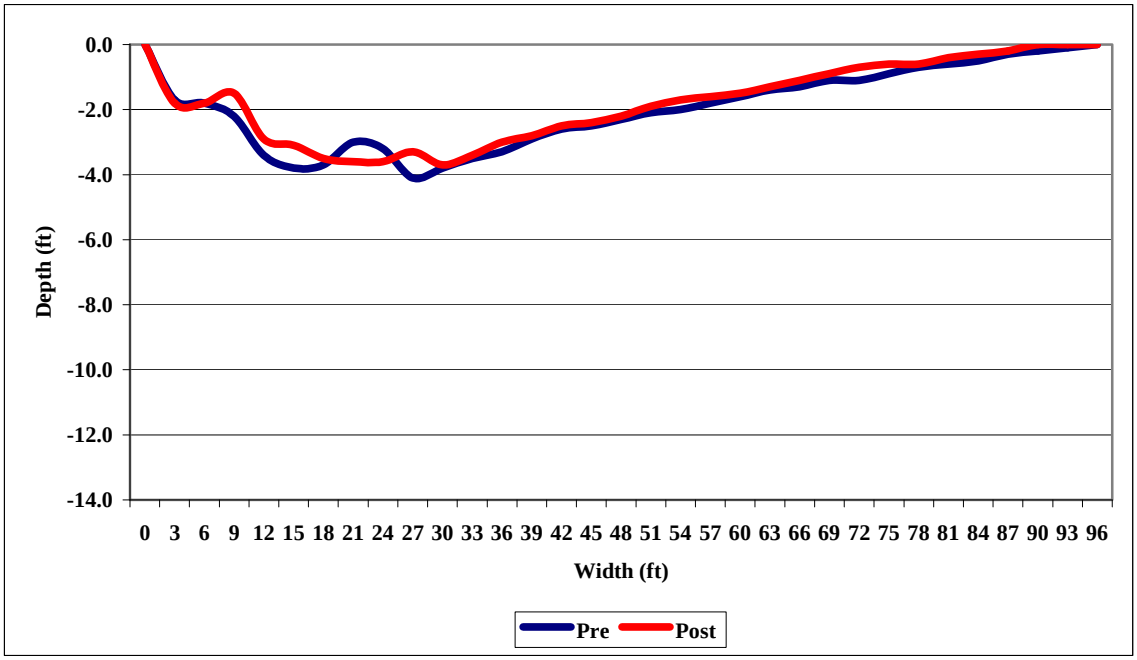
Appendix F-8. Pre and Post cross sections at Pool 2 Transect 4 – Healdsburg Reach



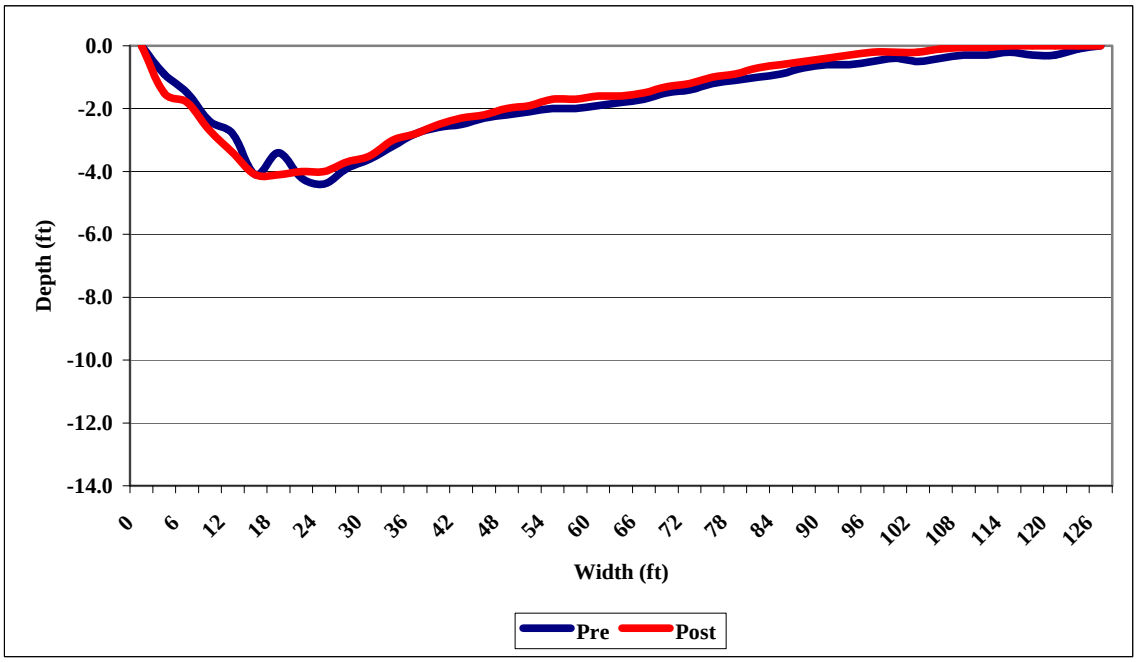
Appendix F-9. Pre and Post cross sections at Pool 3 Transect 1 – Healdsburg Reach



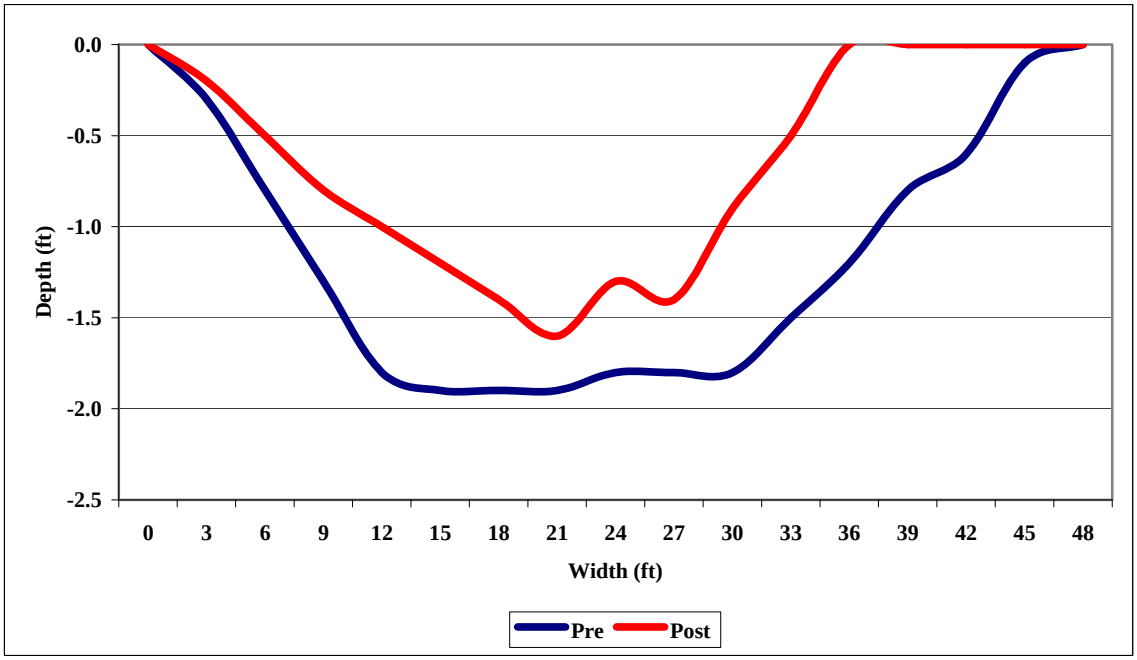
Appendix F-10. Pre and Post cross sections at Pool 3 Transect 2 – Healdsburg Reach



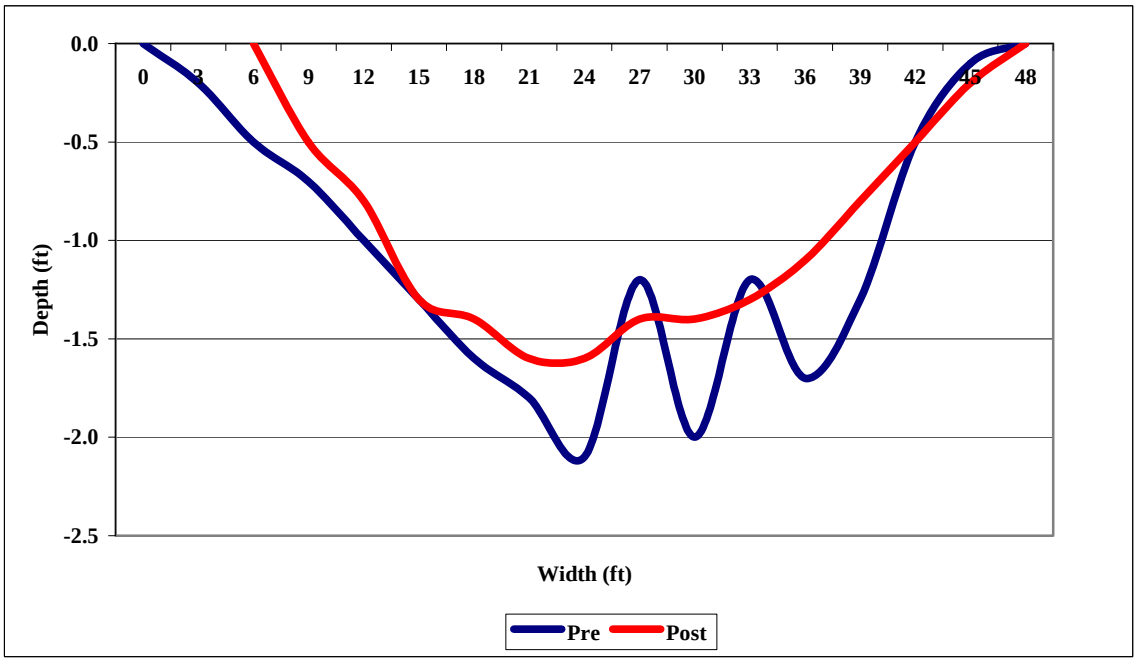
Appendix F-11. Pre and Post cross sections at Pool 3 Transect 3 – Healdsburg Reach



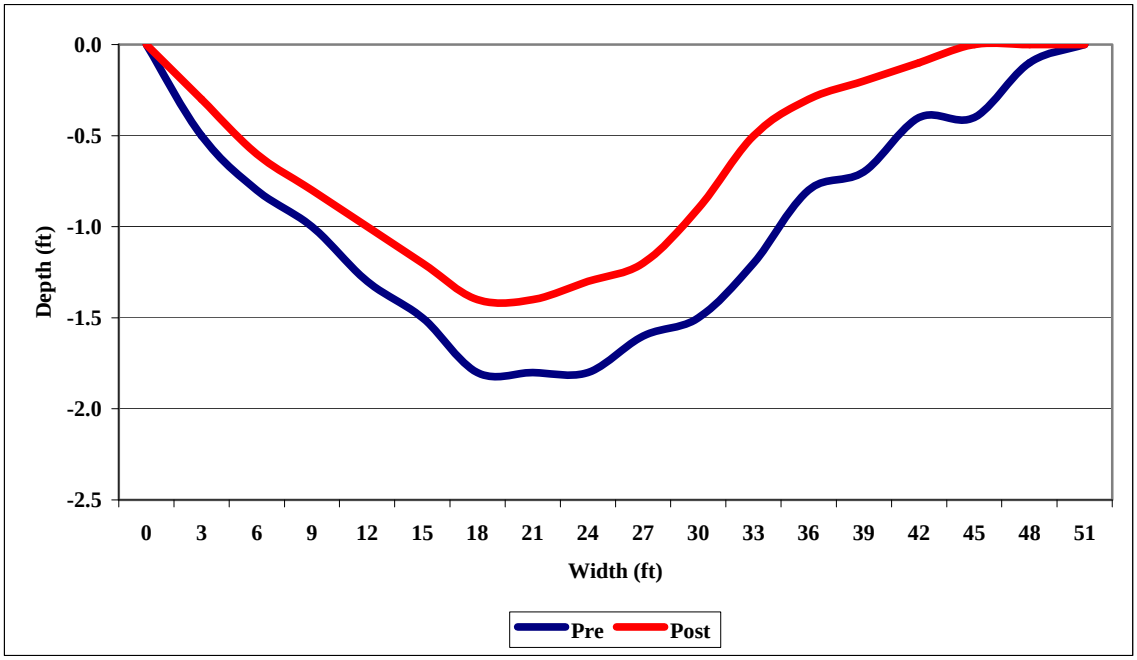
Appendix F-12. Pre and Post cross sections at Pool 3 Transect 4 – Healdsburg Reach



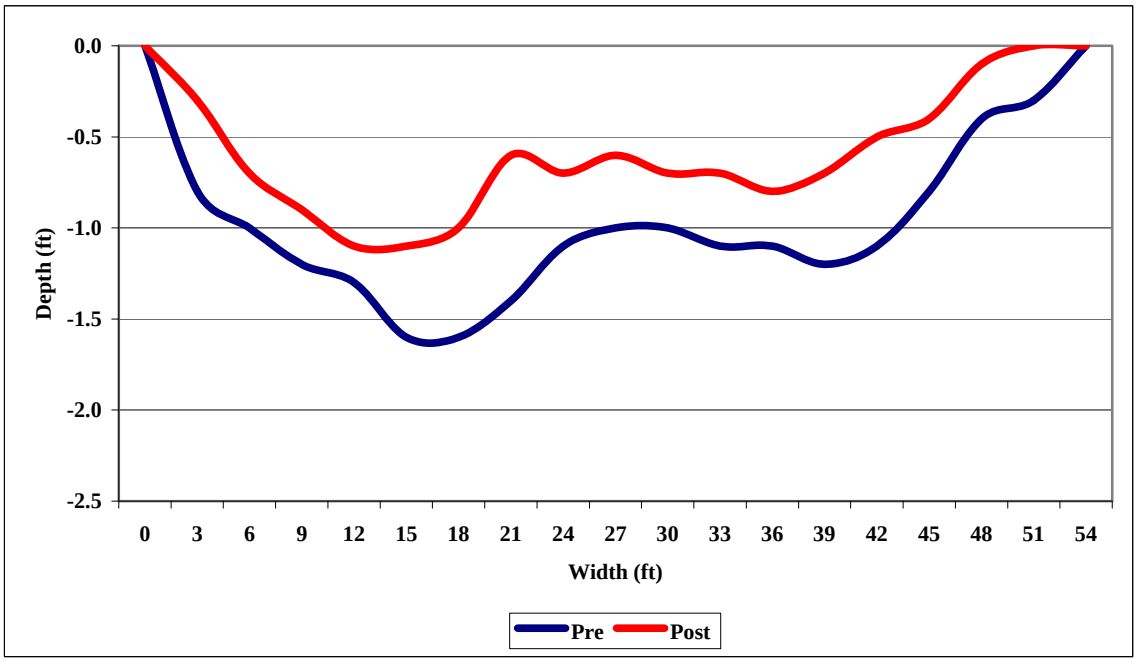
Appendix F-13. Pre and Post cross sections at Riffle 1 Transect 1 – Healdsburg Reach



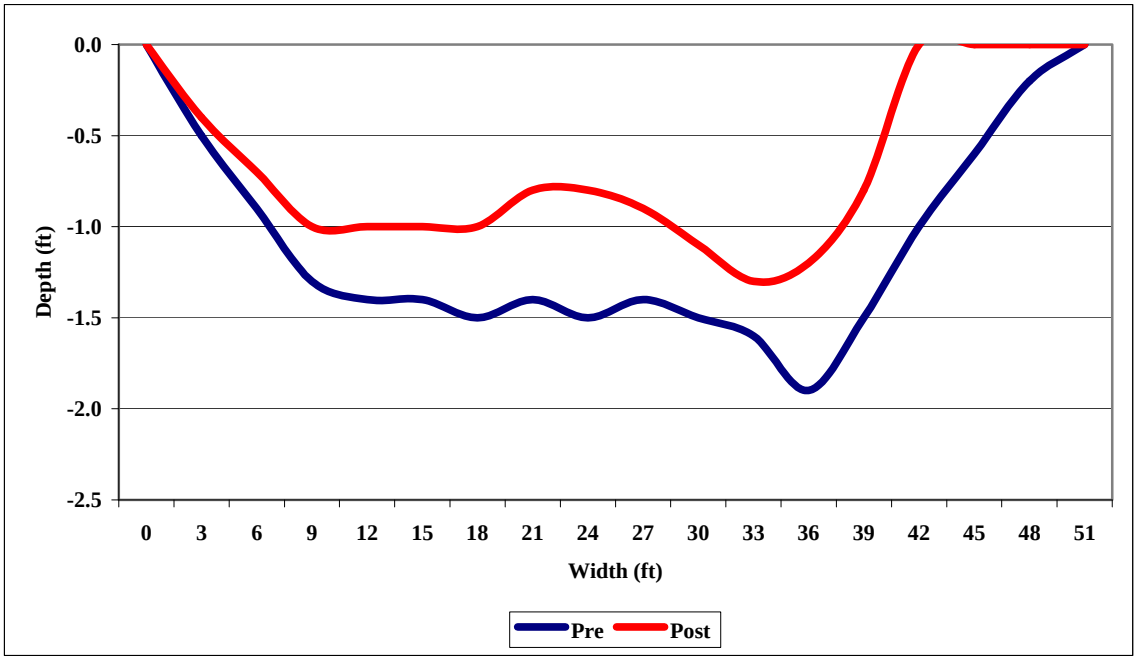
Appendix F-14. Pre and Post cross sections at Riffle 1 Transect 2 – Healdsburg Reach



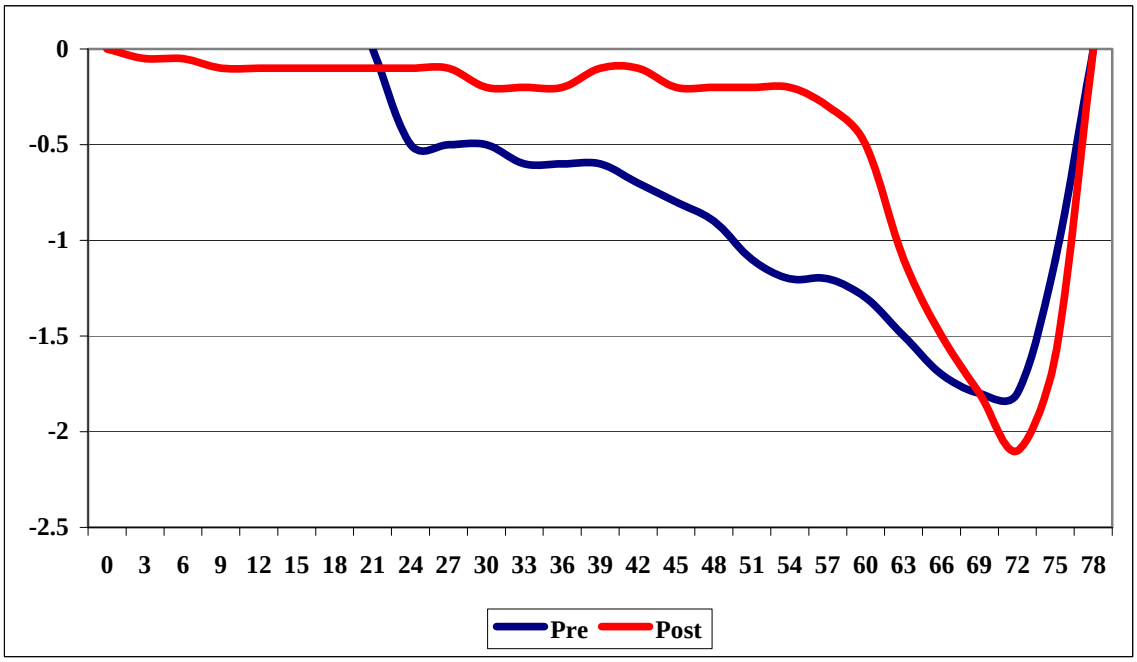
Appendix F-15. Pre and Post cross sections at Riffle 1 Transect 3 – Healdsburg Reach



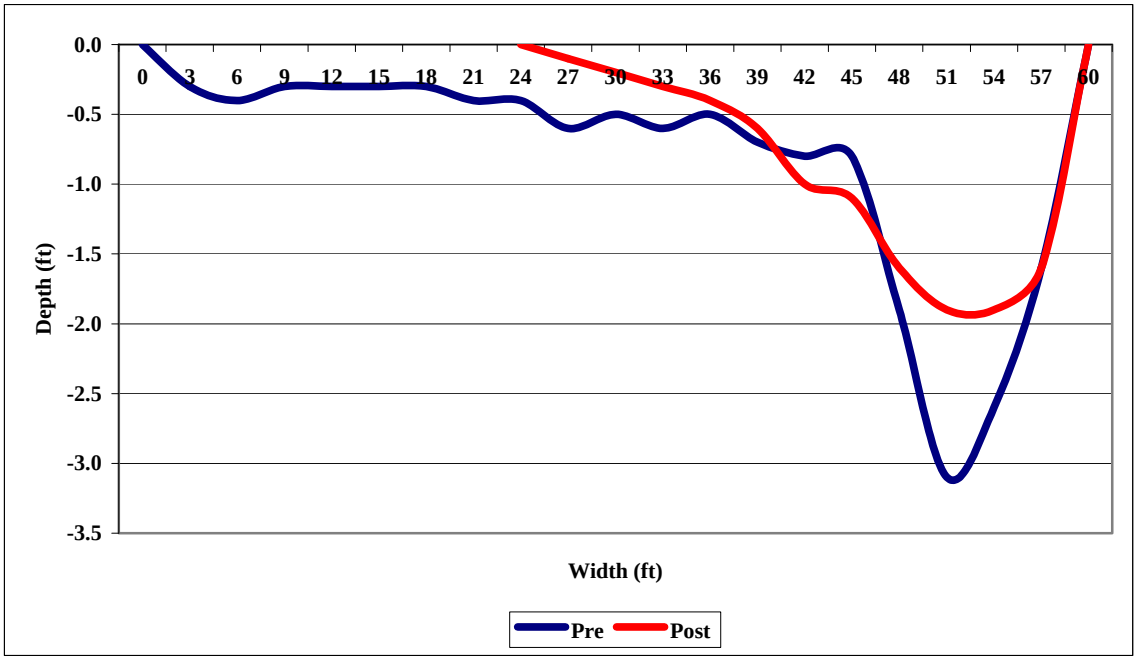
Appendix F-16. Pre and Post cross sections at Riffle 2 Transect 1 – Healdsburg Reach



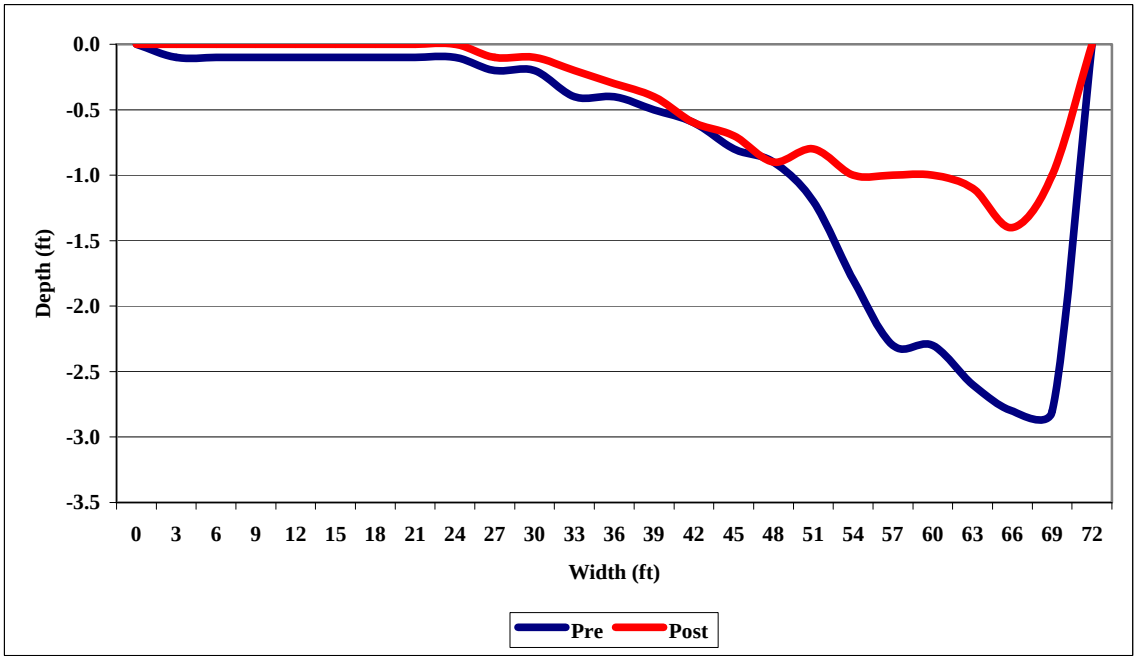
Appendix F-17. Pre and Post cross sections at Riffle 2 Transect 2 – Healdsburg Reach



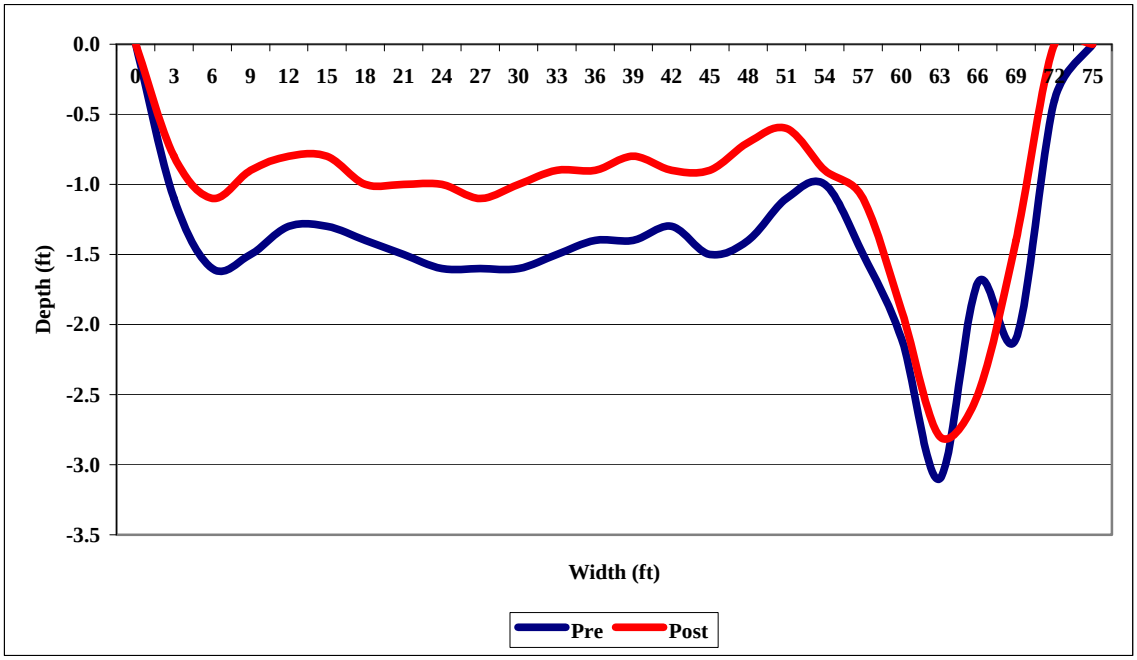
Appendix F-18. Pre and Post cross sections at Riffle 3 Transect 1 – Healdsburg Reach



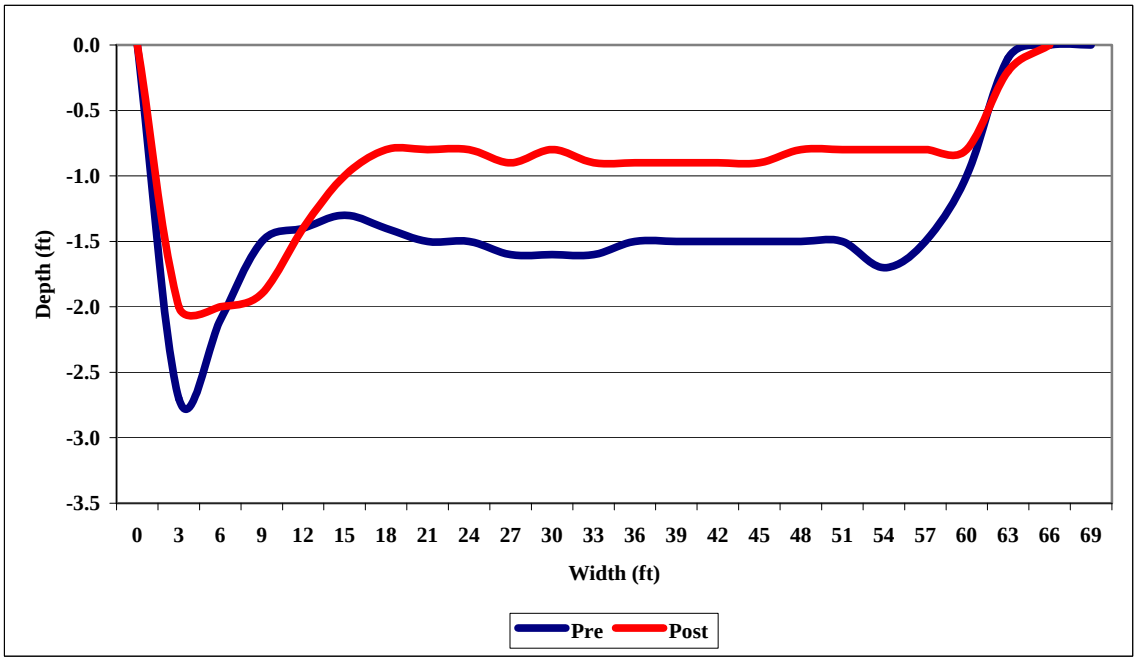
Appendix F-19. Pre and Post cross sections at Riffle 3 Transect 2 – Healdsburg Reach



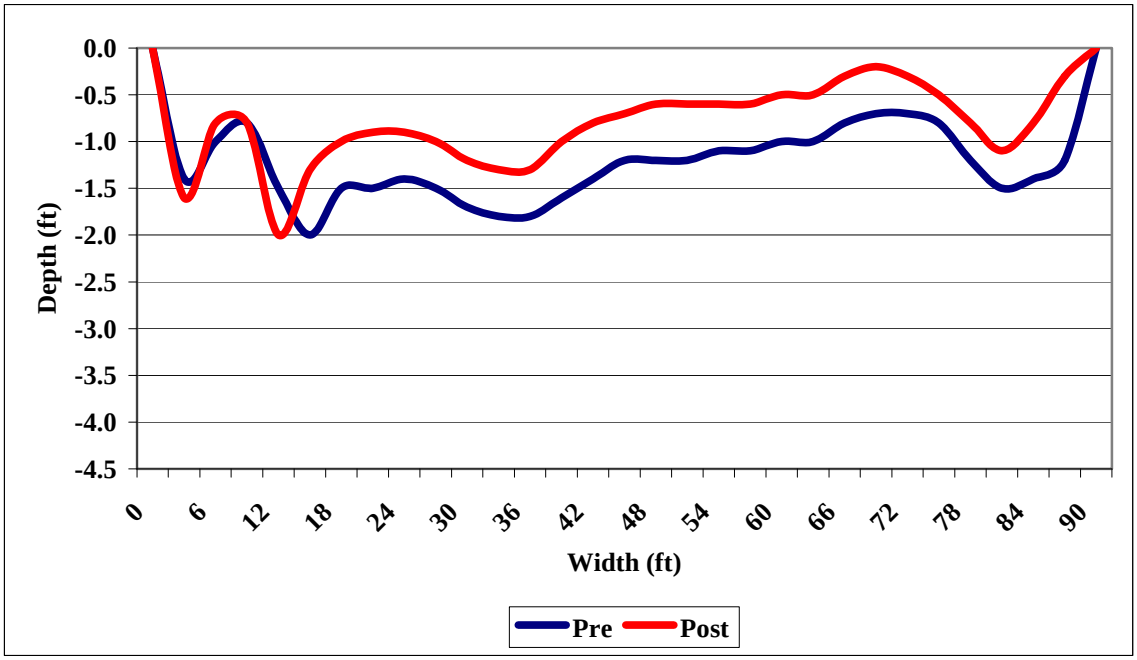
Appendix F-20. Pre and Post cross sections at Riffle 3 Transect 3 – Healdsburg Reach



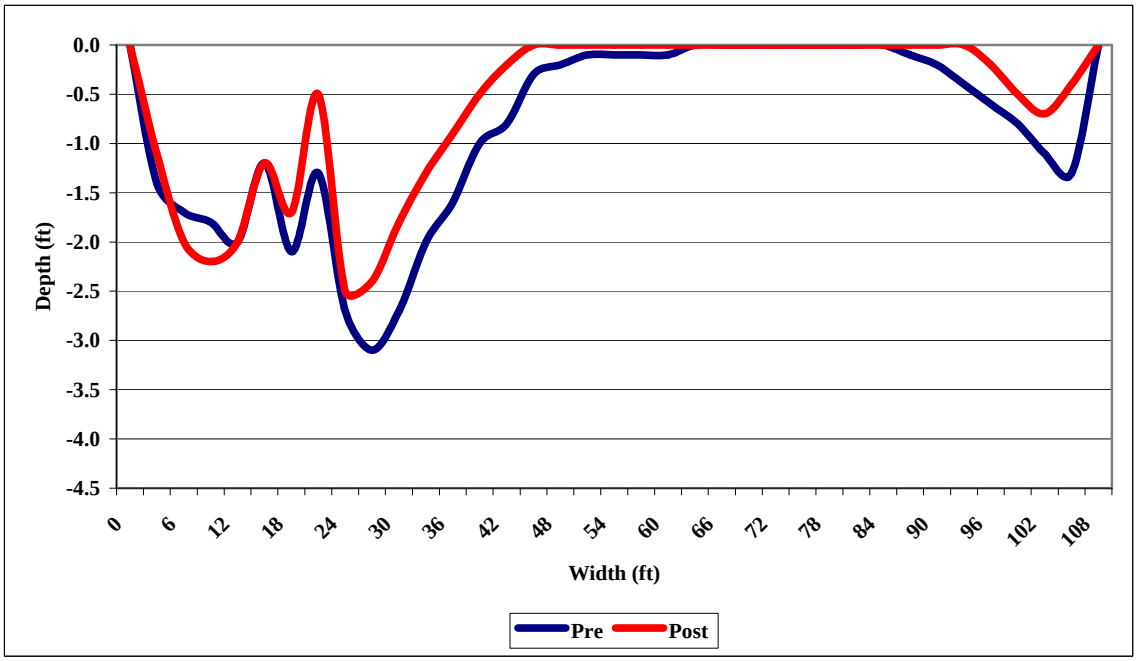
Appendix F-21. Pre and Post cross sections at Flatwater 1 Transect 1 – Healdsburg Reach



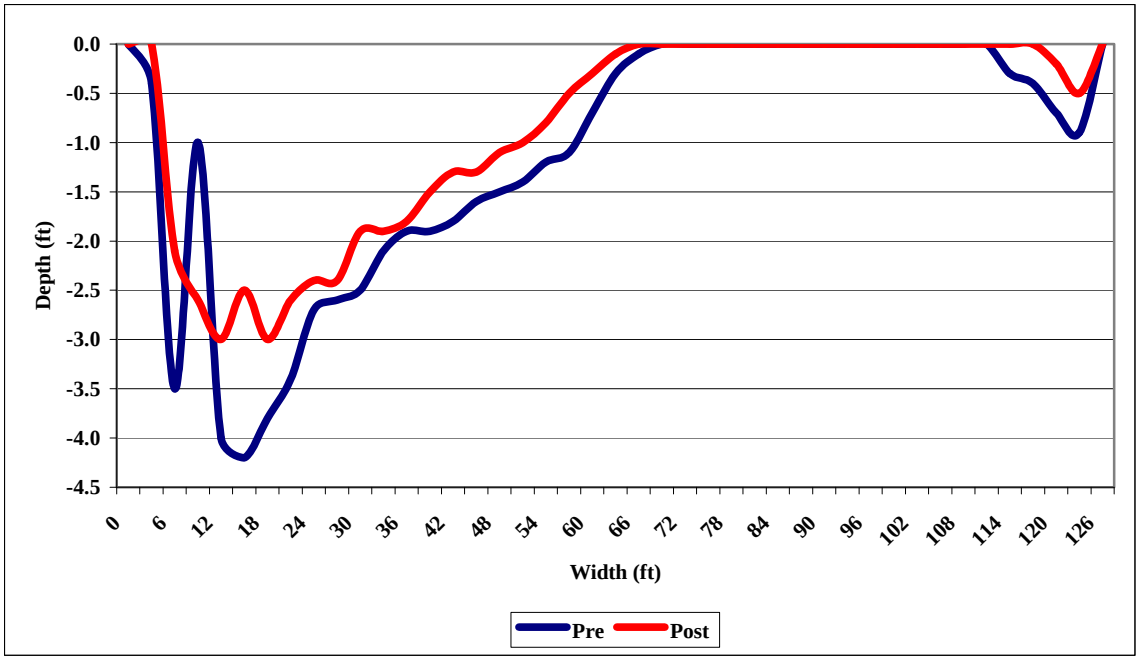
Appendix F-22. Pre and Post cross sections at Flatwater 1 Transect 2 – Healdsburg Reach



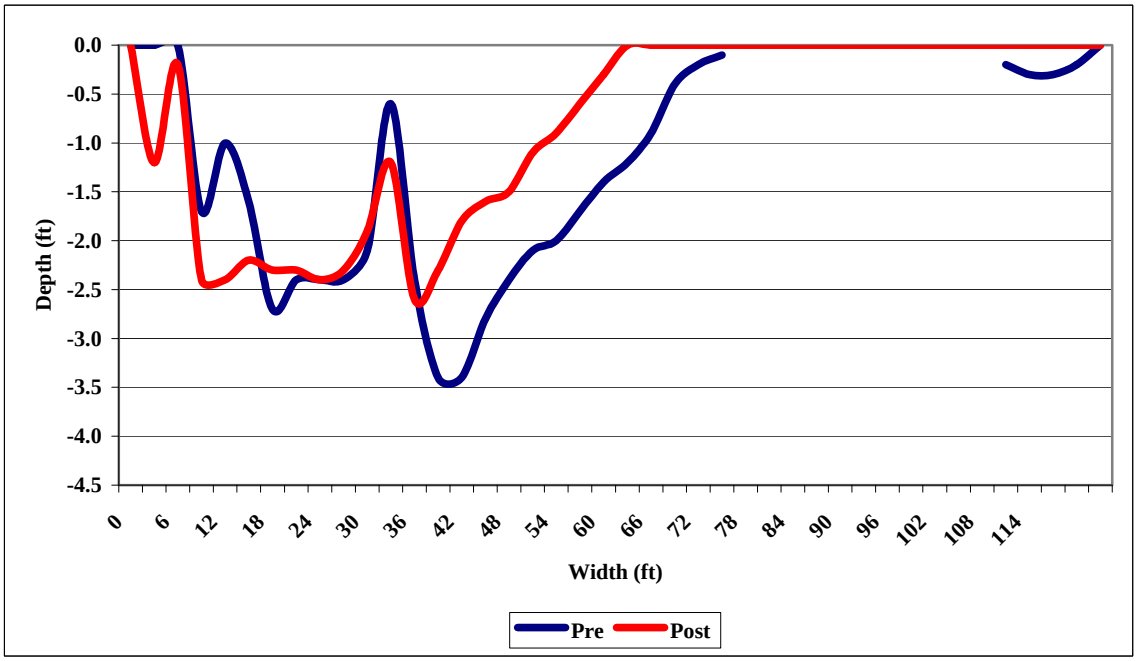
Appendix F-23. Pre and Post cross sections at Flatwater 1 Transect 3 – Healdsburg Reach



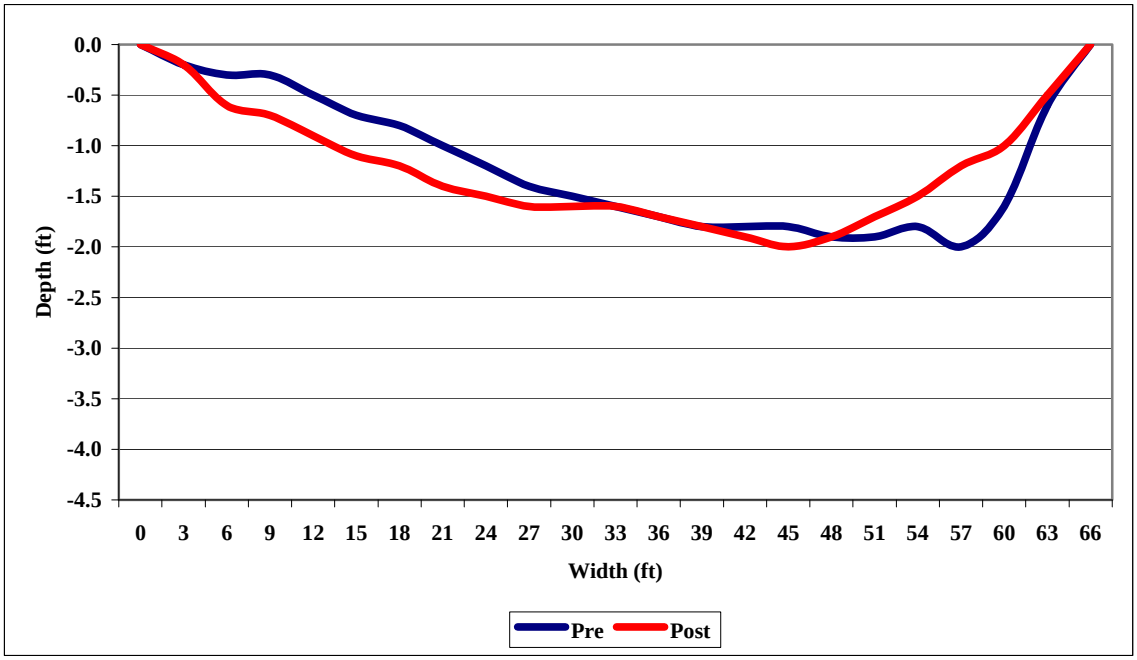
Appendix F-24. Pre and Post cross sections at Flatwater 2 Transect 1 – Healdsburg Reach



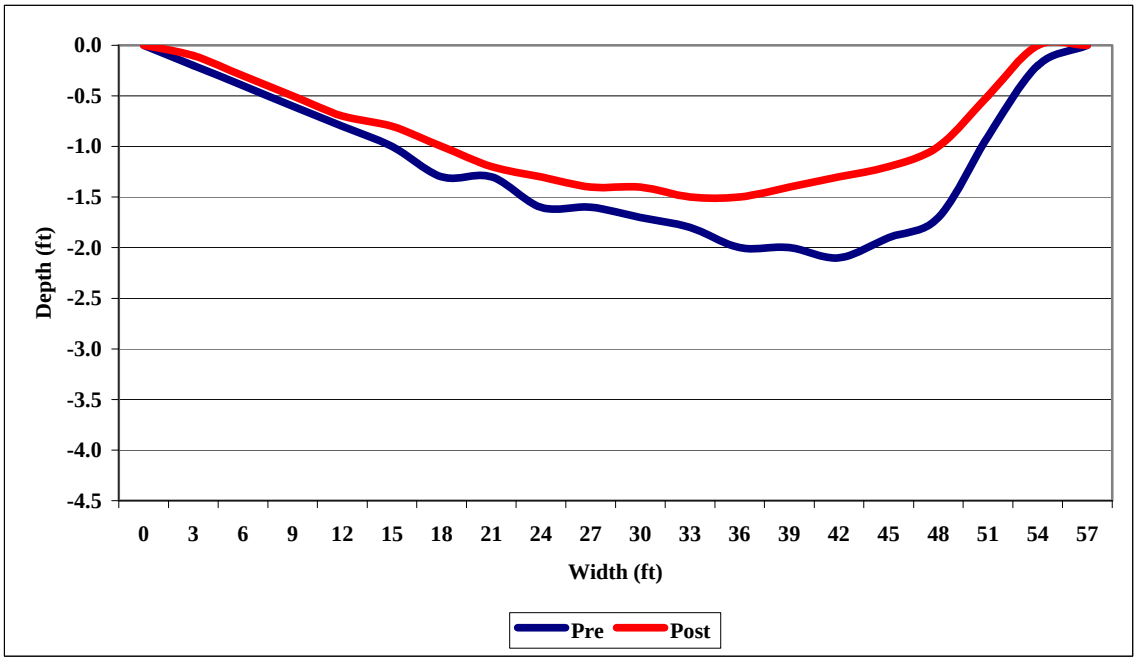
Appendix F-25. Pre and Post cross sections at Flatwater 2 Transect 2 – Healdsburg Reach



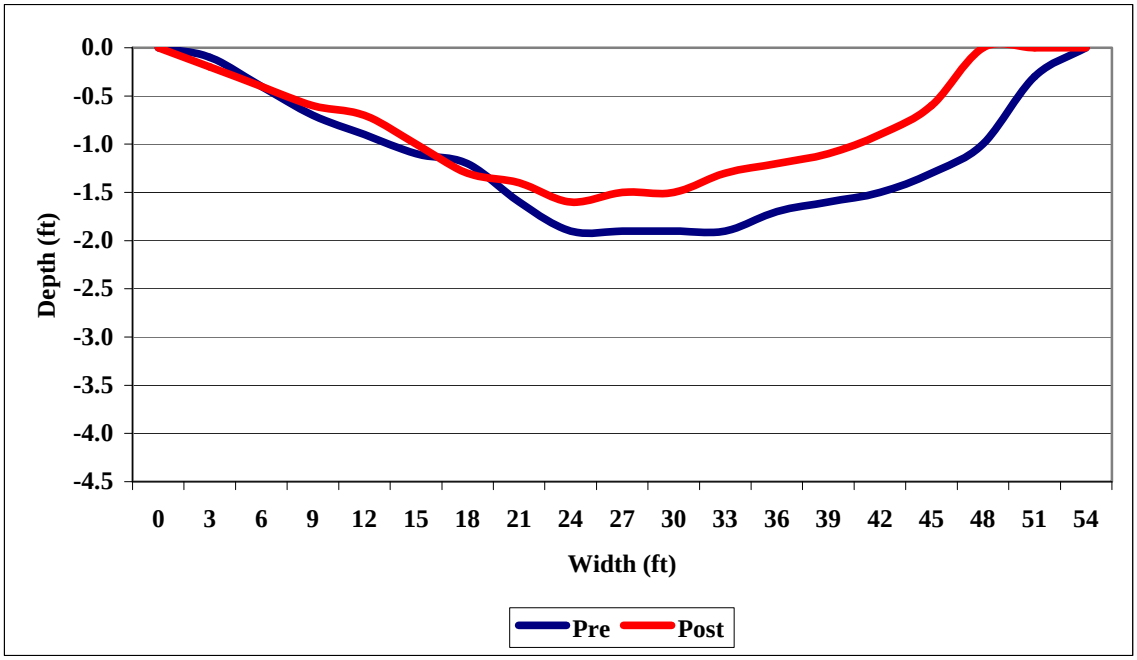
Appendix F-26. Pre and Post cross sections at Flatwater 2 Transect 3 – Healdsburg Reach



Appendix F-27. Pre and Post cross sections at Flatwater 3 Transect 1 – Healdsburg Reach



Appendix F-28. Pre and Post cross sections at Flatwater 3 Transect 2 – Healdsburg Reach

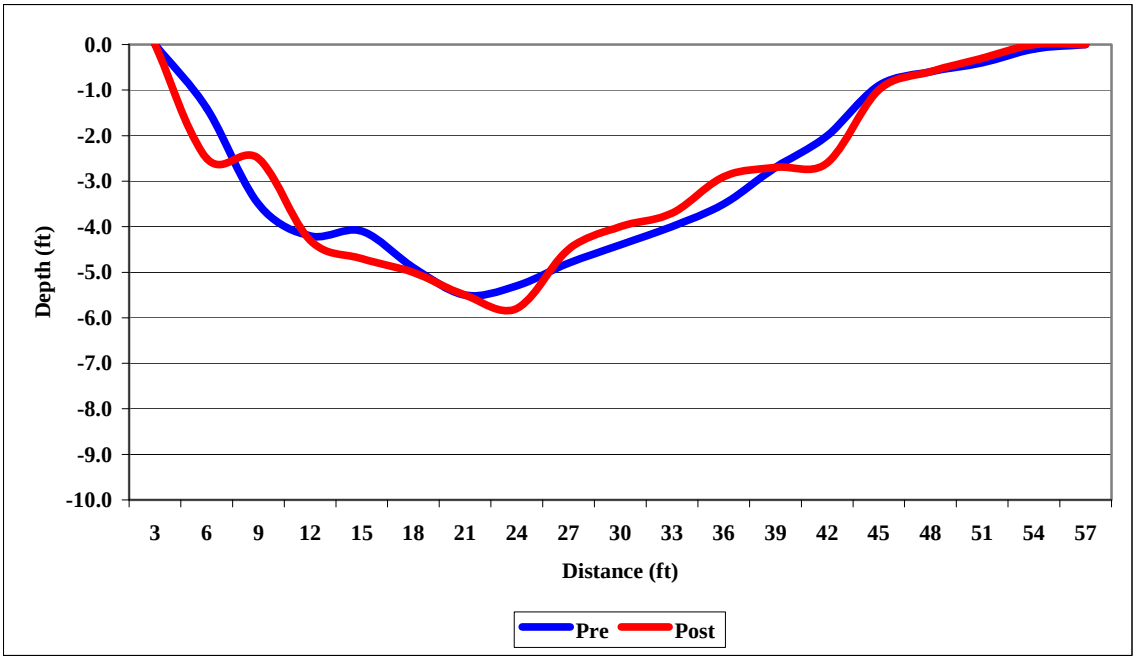


Appendix F-29. Pre and Post cross sections at Flatwater 3 Transect 3 – Healdsburg Reach

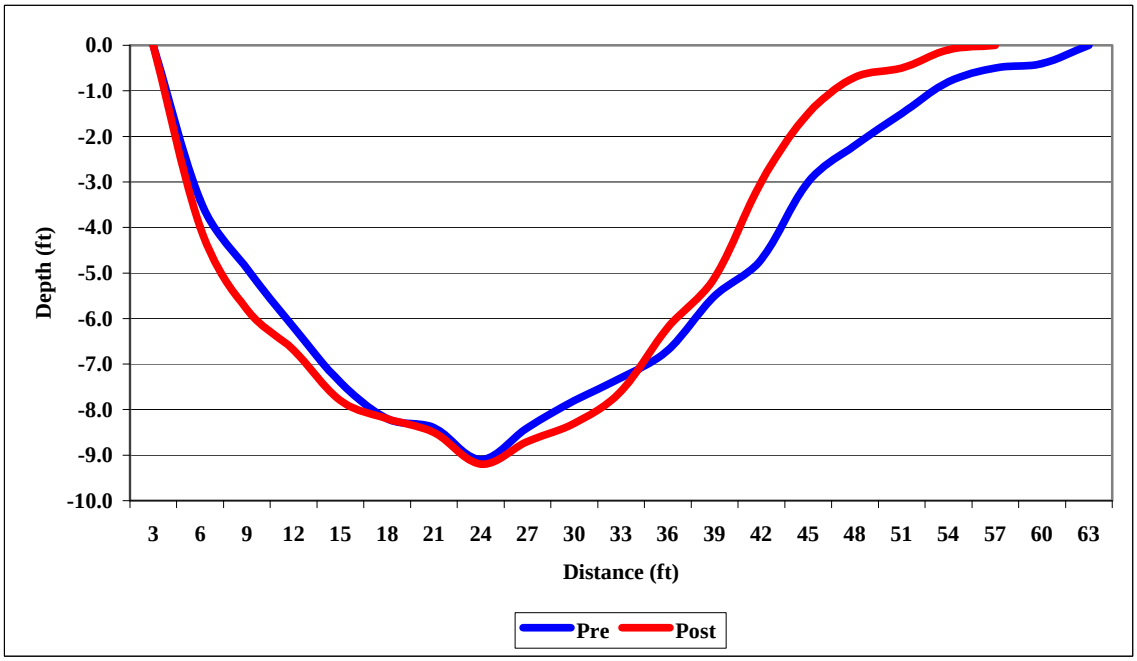
APPENDIX G

BELOW DRY CREEK REACH CROSS SECTIONS

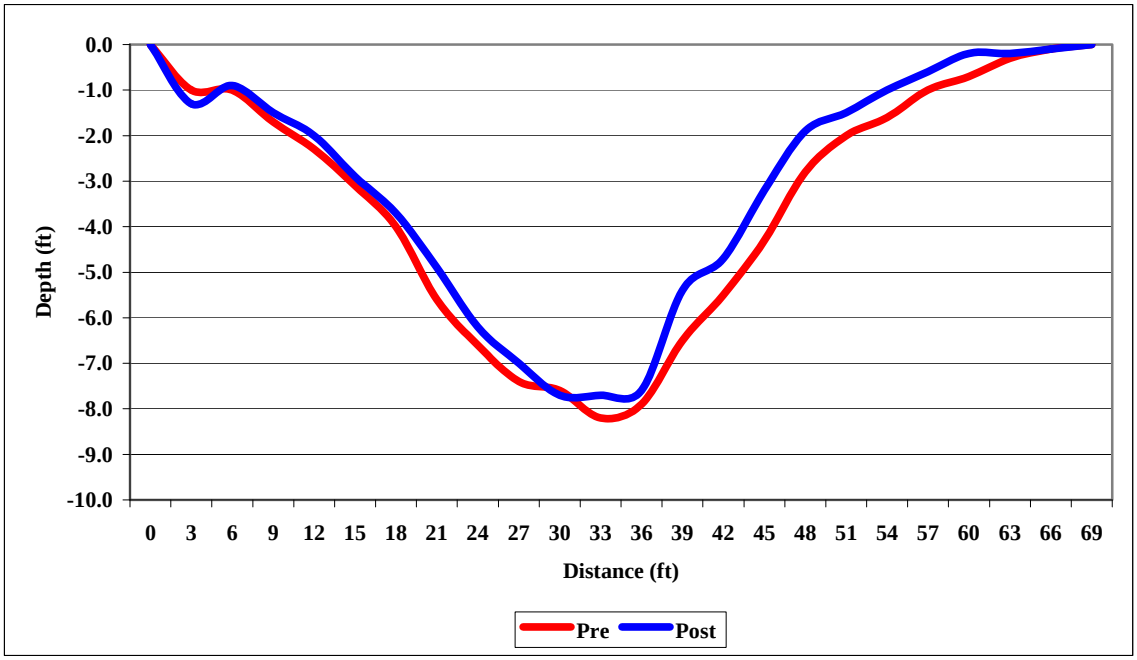
PRE AND POST FLOW REDUCTION SURVEYS



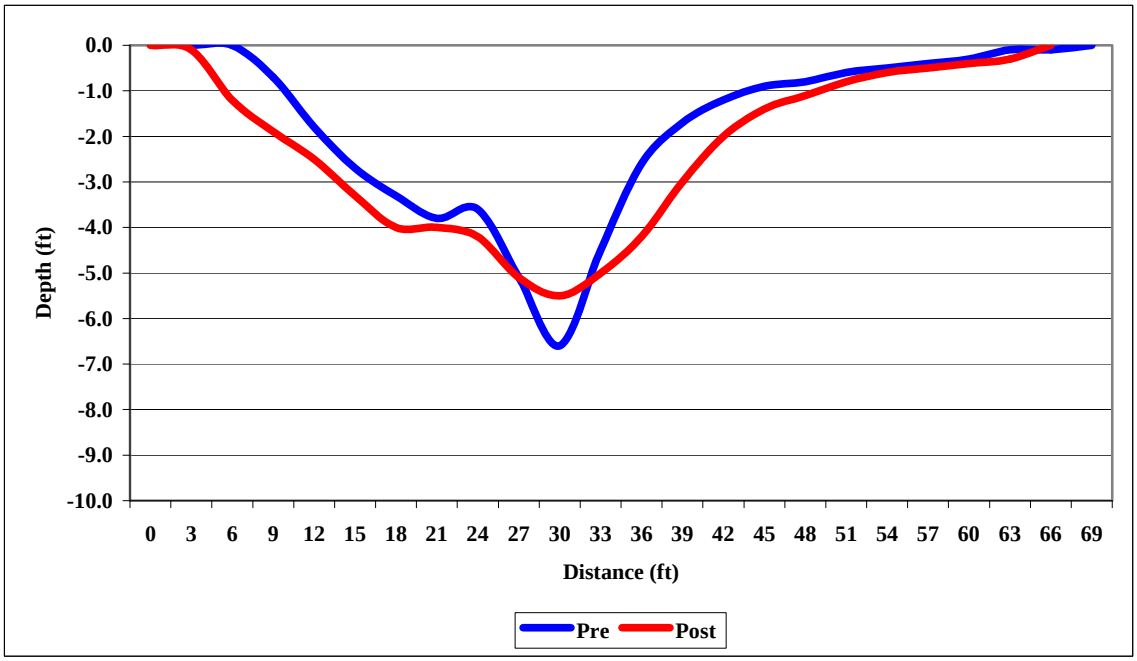
Appendix G-1. Pre and Post cross sections at Pool 1 Transect 1 – Below Dry Creek Reach



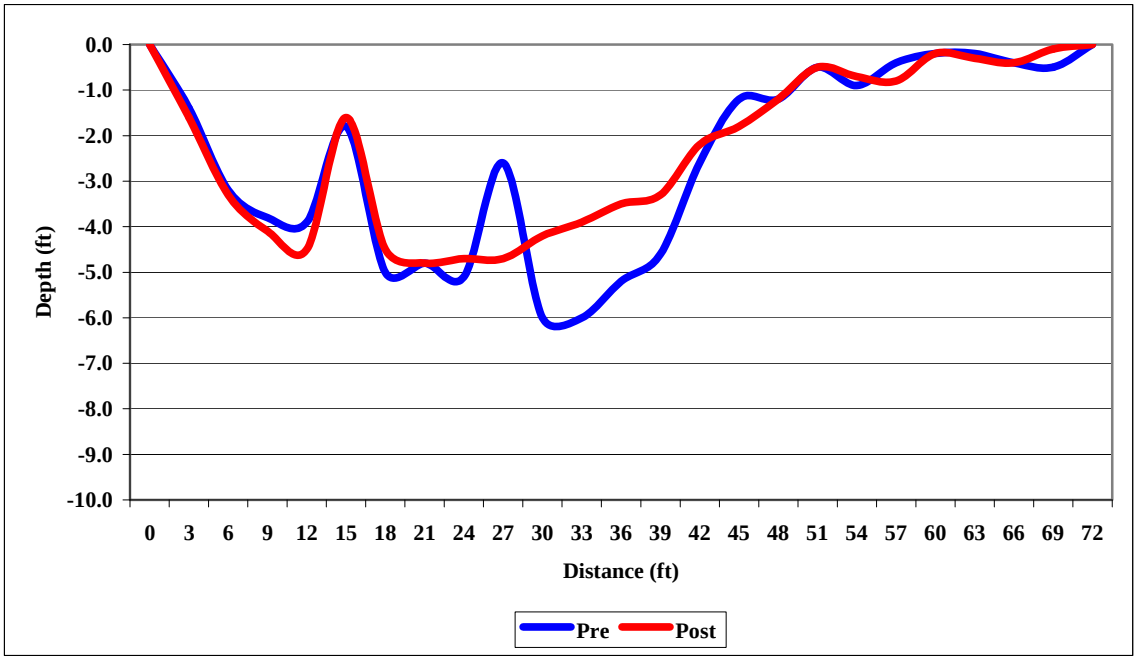
Appendix G-2. Pre and Post cross sections at Pool 1 Transect 2 – Below Dry Creek Reach



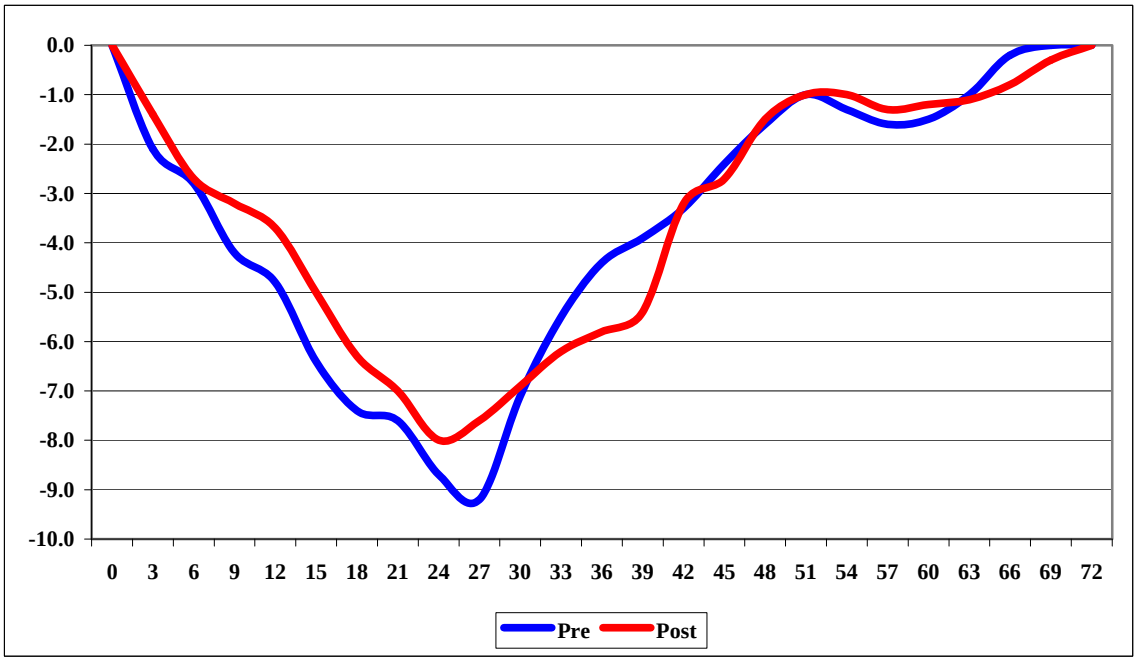
Appendix G-3. Pre and Post cross sections at Pool 1 Transect 3 – Below Dry Creek Reach



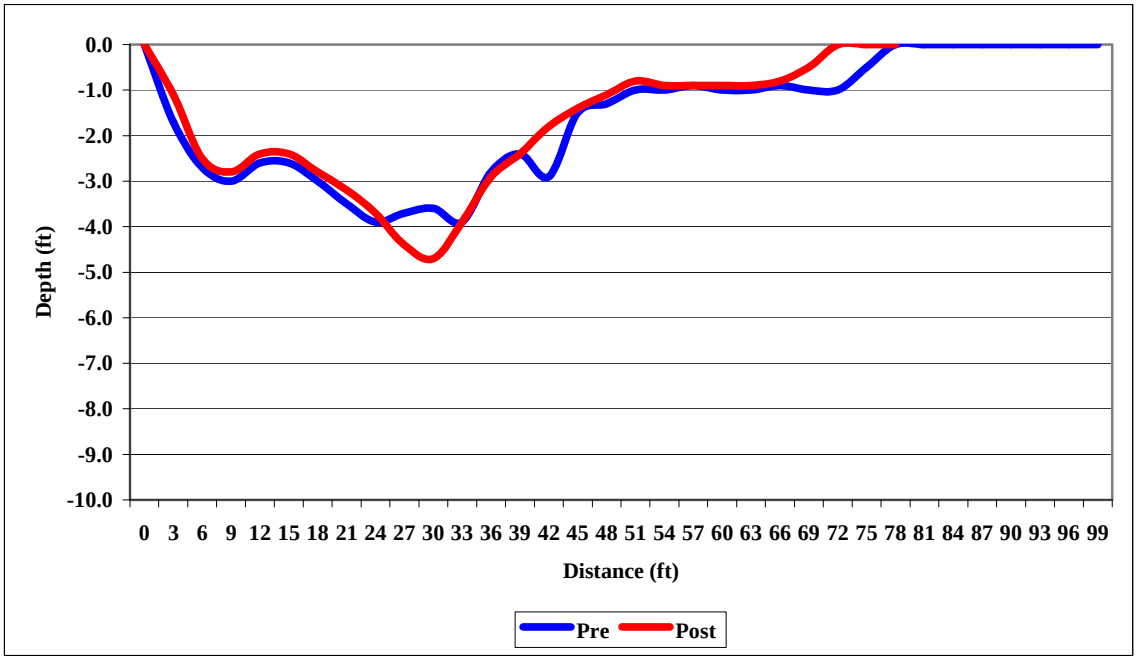
Appendix G-4. Pre and Post cross sections at Pool 2 Transect 1 – Below Dry Creek Reach



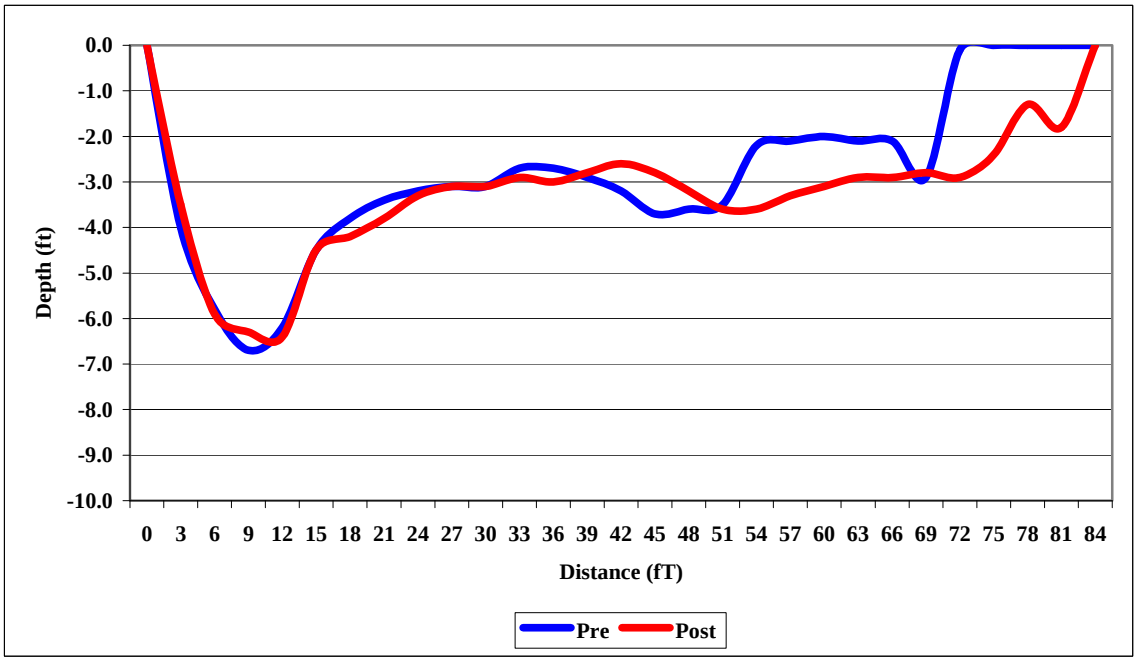
Appendix G-5. Pre and Post cross sections at Pool 2 Transect 2 – Below Dry Creek Reach



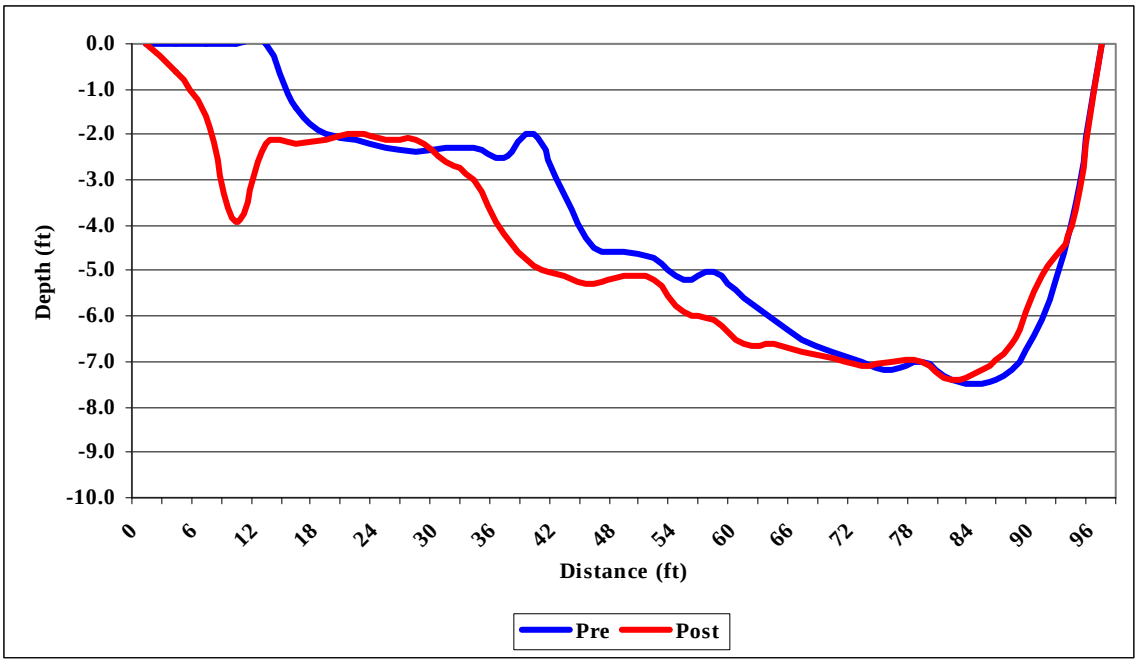
Appendix G-6. Pre and Post cross sections at Pool 2 Transect 3 – Below Dry Creek Reach



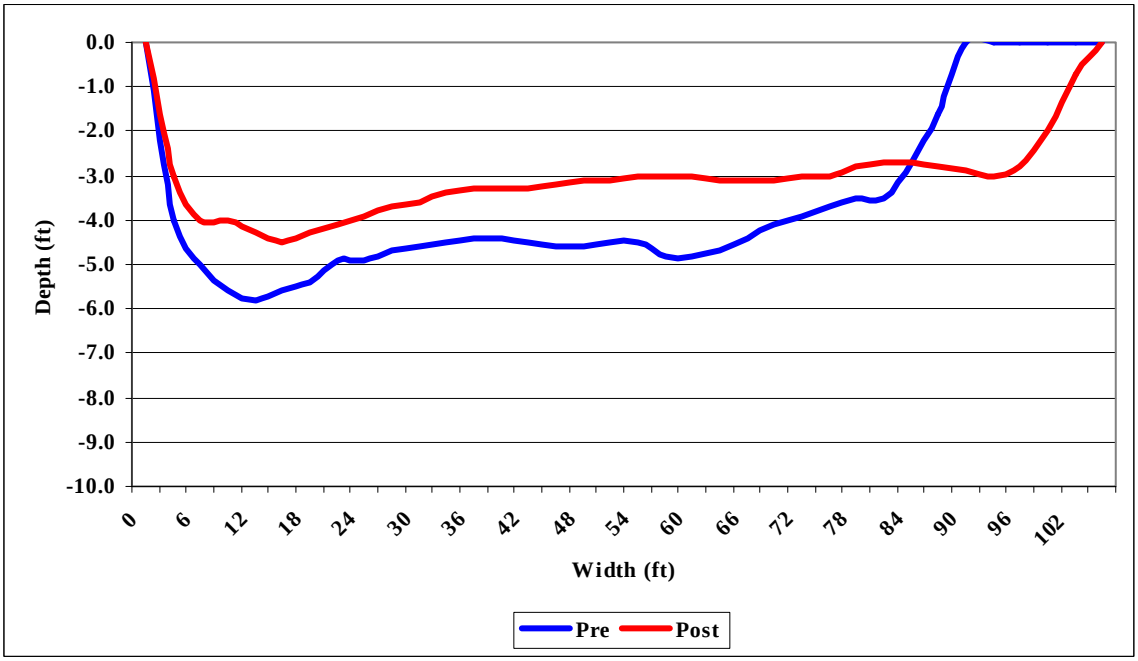
Appendix G-7. Pre and Post cross sections at Pool 2 Transect 4 – Below Dry Creek Reach



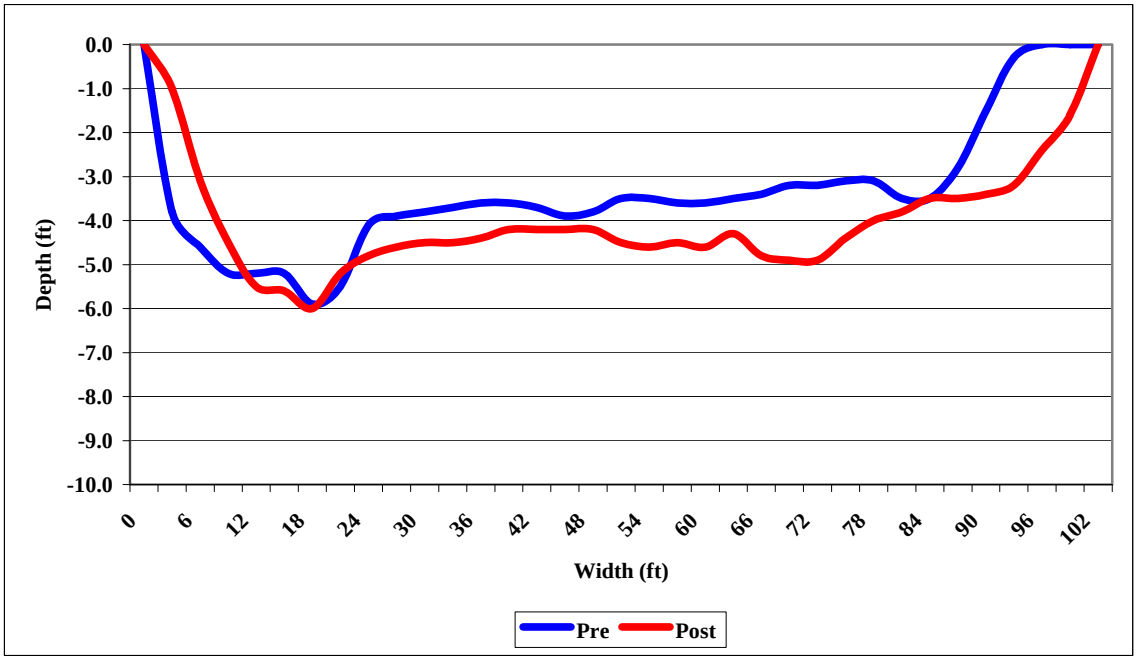
Appendix G-8. Pre and Post cross sections at Pool 3 Transect 1 – Below Dry Creek Reach



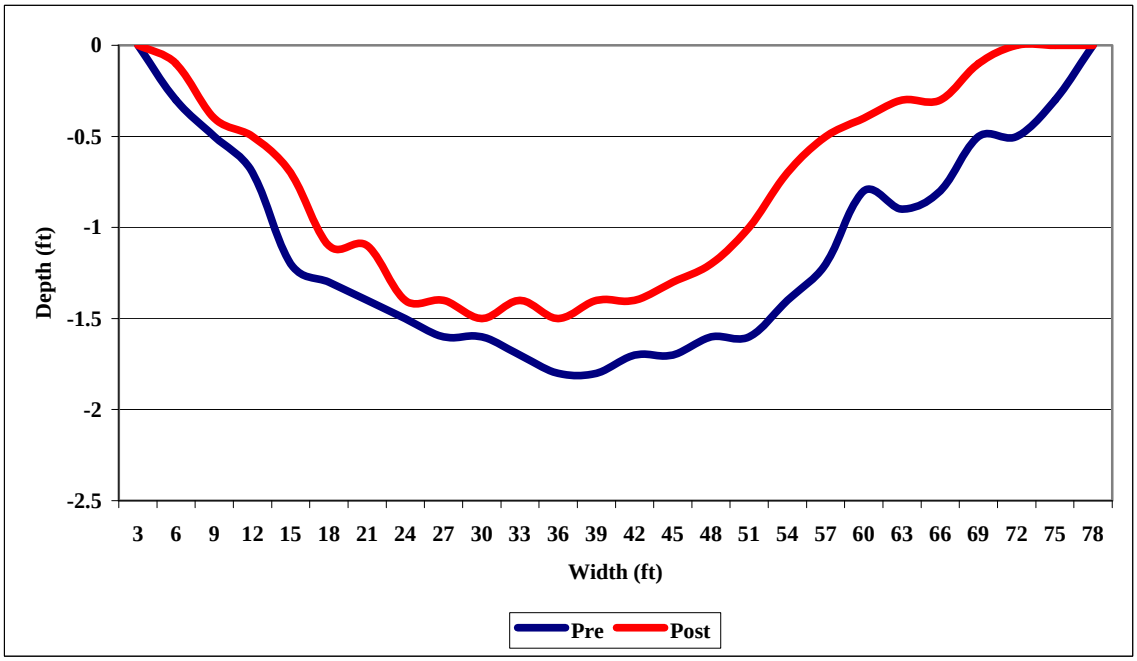
Appendix G-9. Pre and Post cross sections at Pool 3 Transect 2 – Below Dry Creek Reach



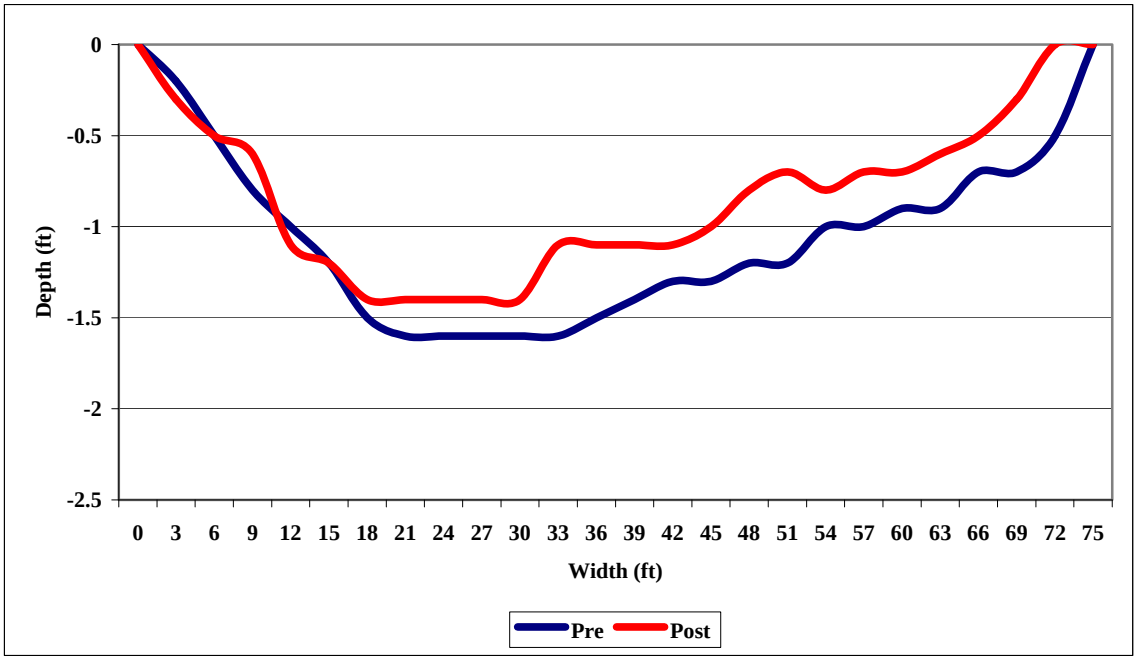
Appendix G-10. Pre and Post cross sections at Pool 3 Transect 3 – Below Dry Creek Reach



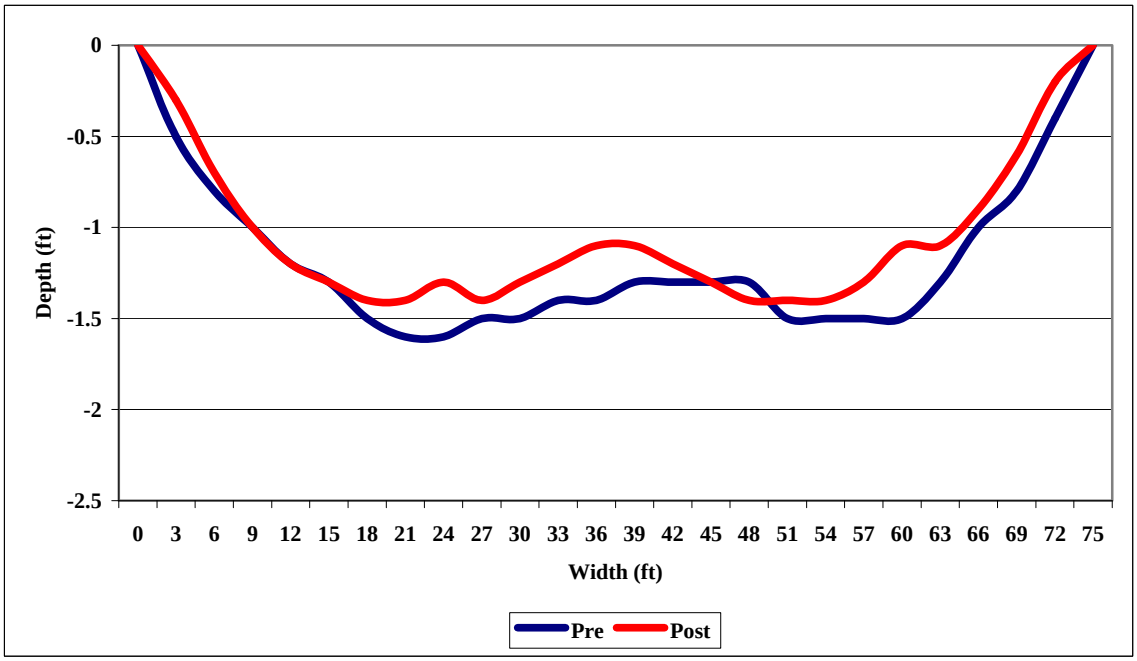
Appendix G-11. Pre and Post cross sections at Pool 3 Transect 4 – Below Dry Creek Reach



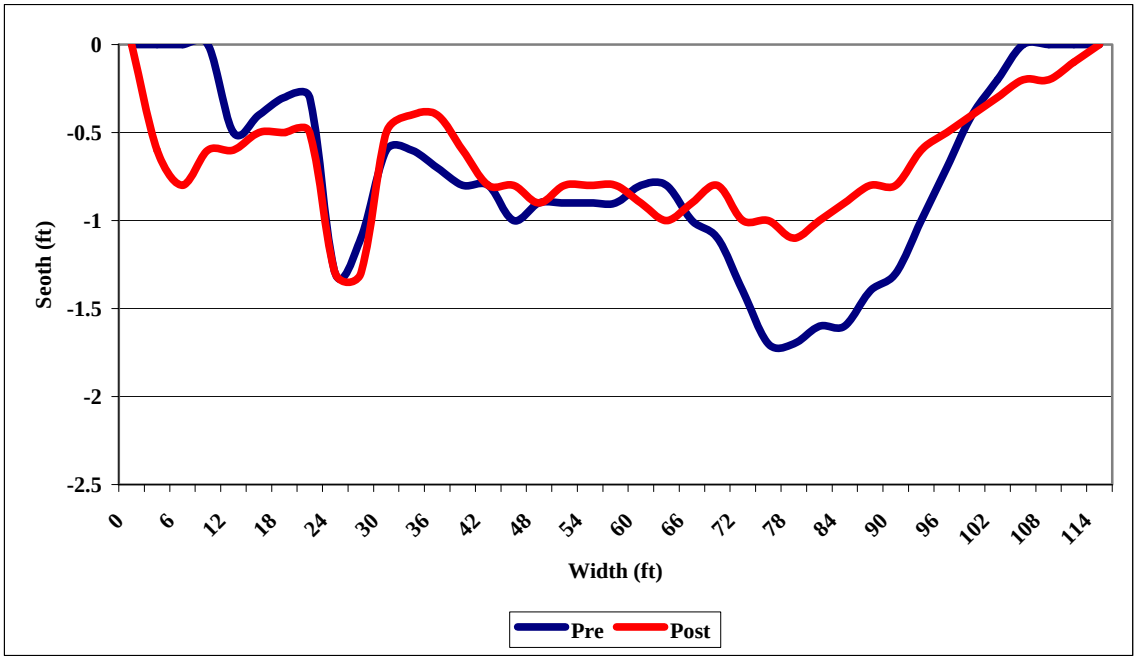
Appendix G-12. Pre and Post cross sections at Riffle 1 Transect 1 – Below Dry Creek Reach



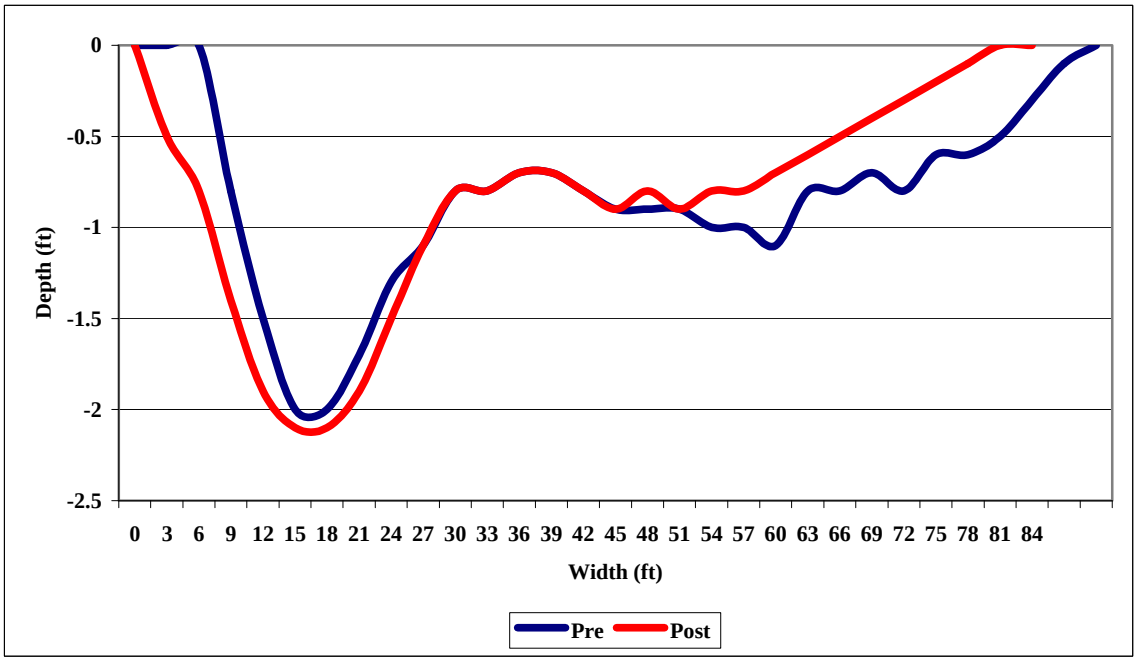
Appendix G-13. Pre and Post cross sections at Riffle 1 Transect 2 – Below Dry Creek Reach



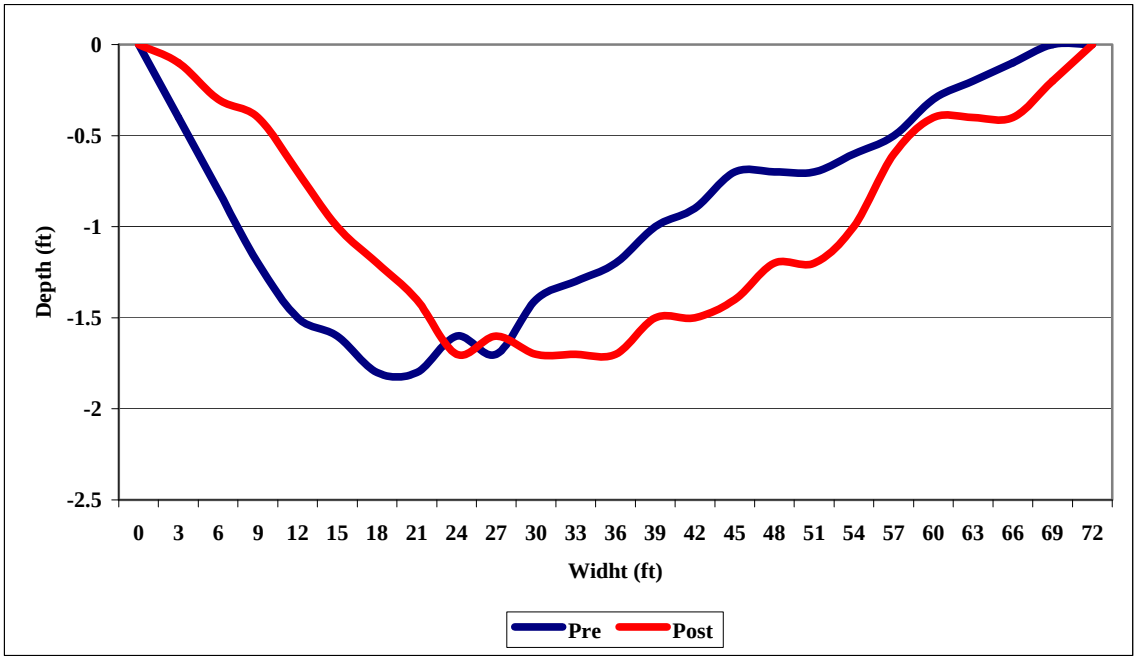
Appendix G-14. Pre and Post cross sections at Riffle 1 Transect 3 – Below Dry Creek Reach



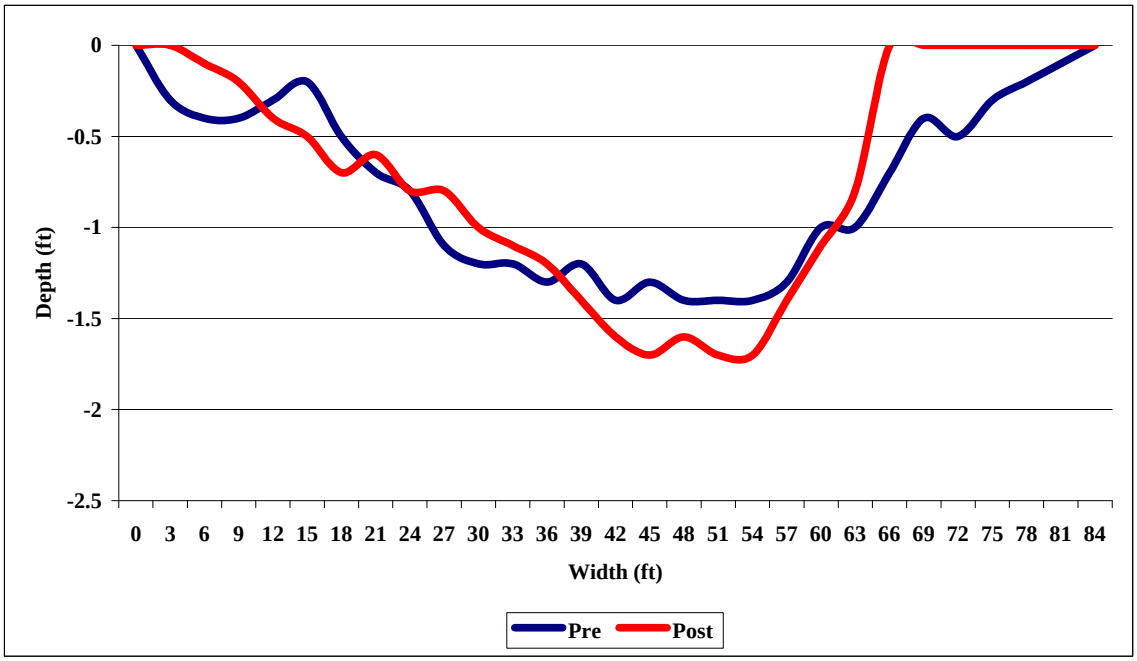
Appendix G-15. Pre and Post cross sections at Riffle 2 Transect 1 – Below Dry Creek Reach



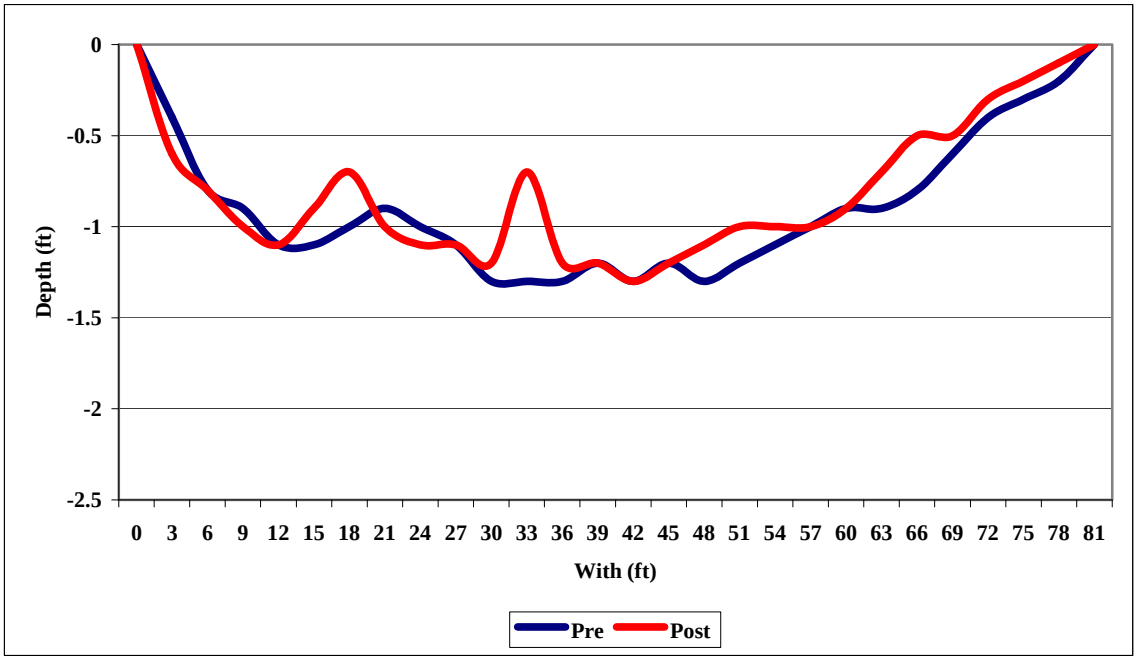
Appendix G-16. Pre and Post cross sections at Riffle 2 Transect 2 – Below Dry Creek Reach



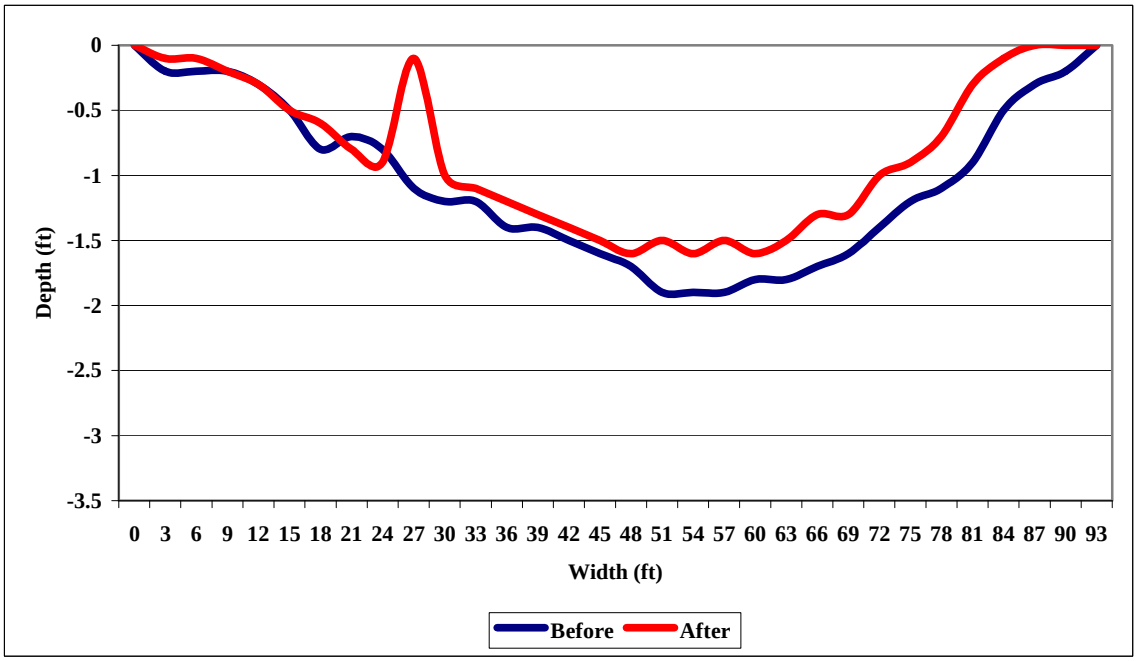
Appendix G-17. Pre and Post cross sections at Riffle 3 Transect 1 – Below Dry Creek Reach



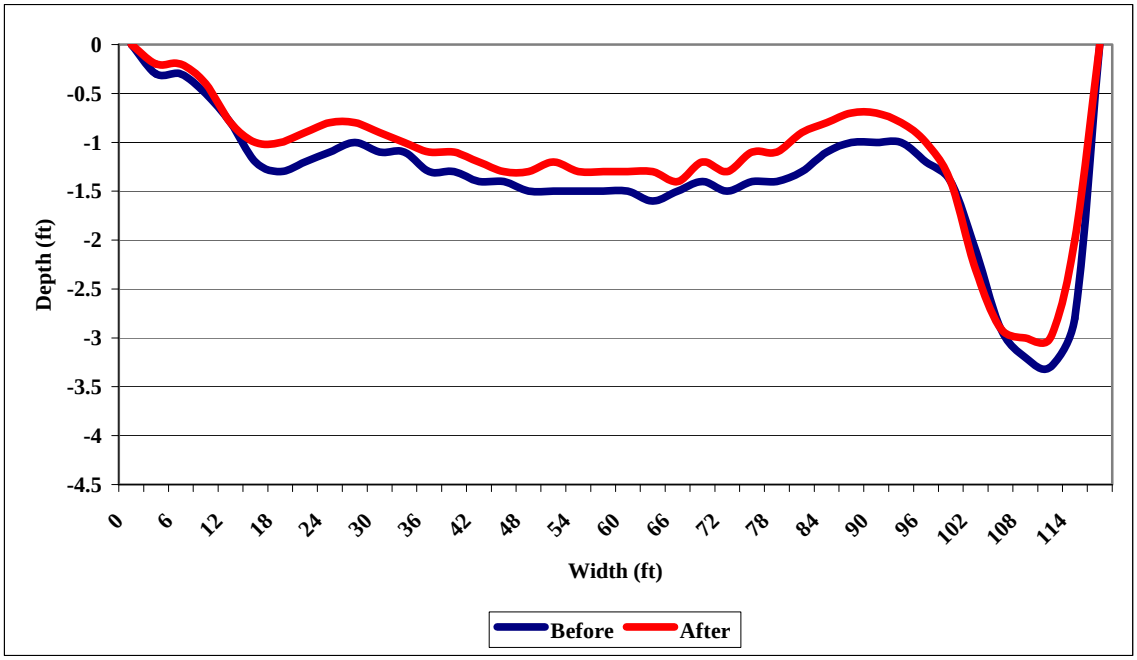
Appendix G-18. Pre and Post cross sections at Riffle 3 Transect 2 – Below Dry Creek Reach



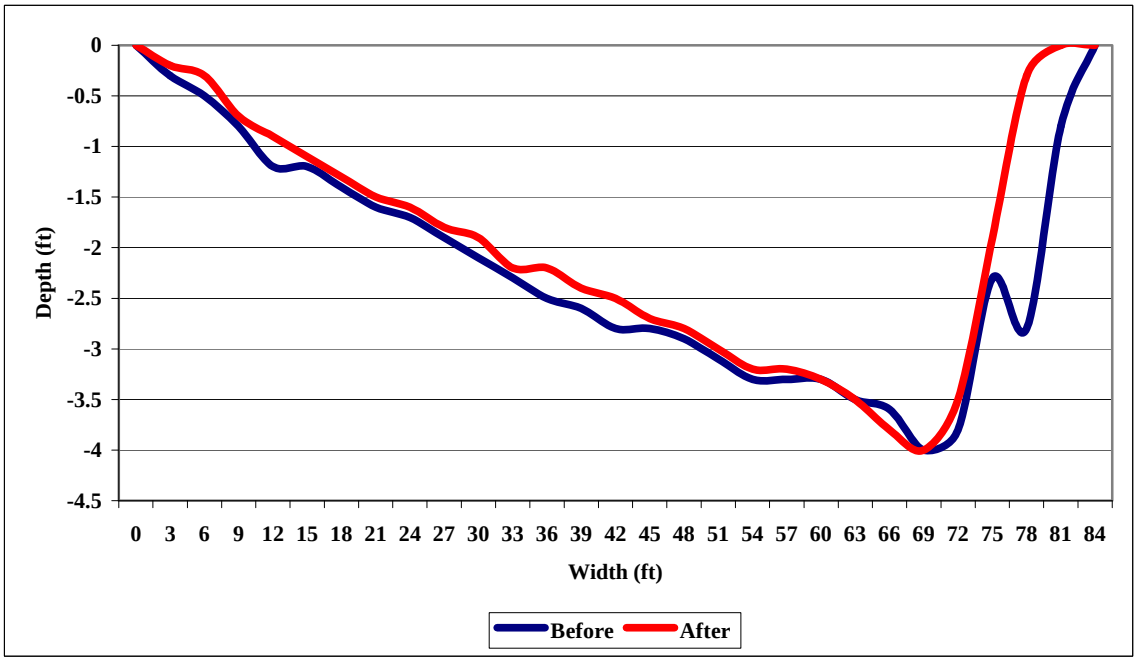
Appendix G-19. Pre and Post cross sections at Riffle 3 Transect 3 – Below Dry Creek Reach



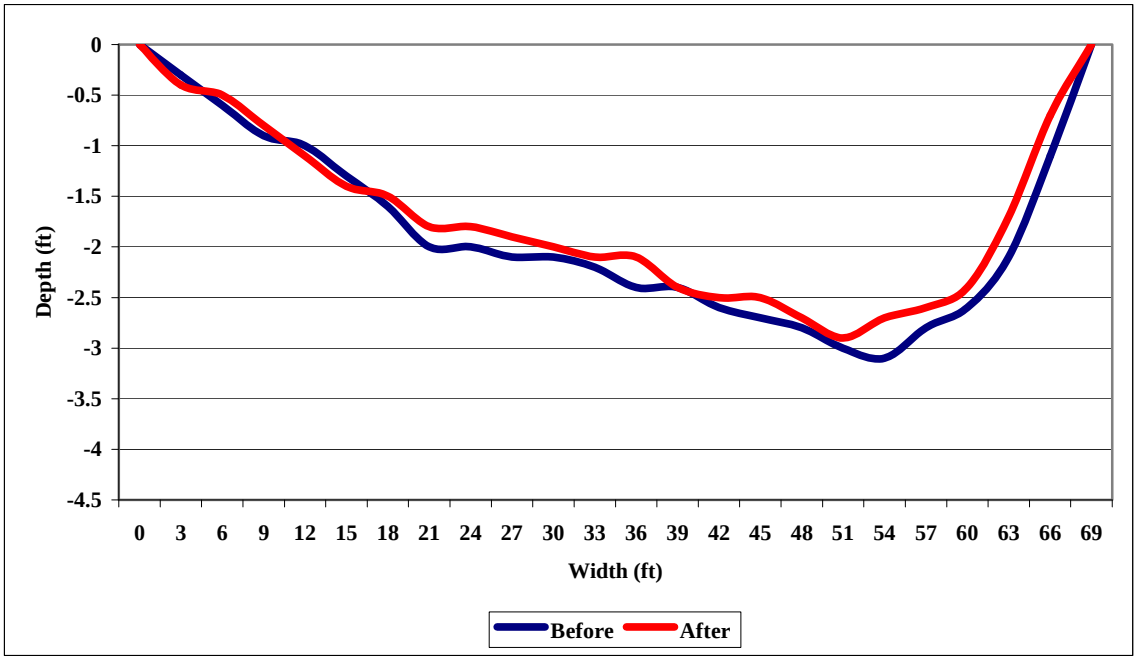
Appendix G-20. Pre and Post cross sections at Flatwater 1 Transect 1 – Below Dry Creek Reach



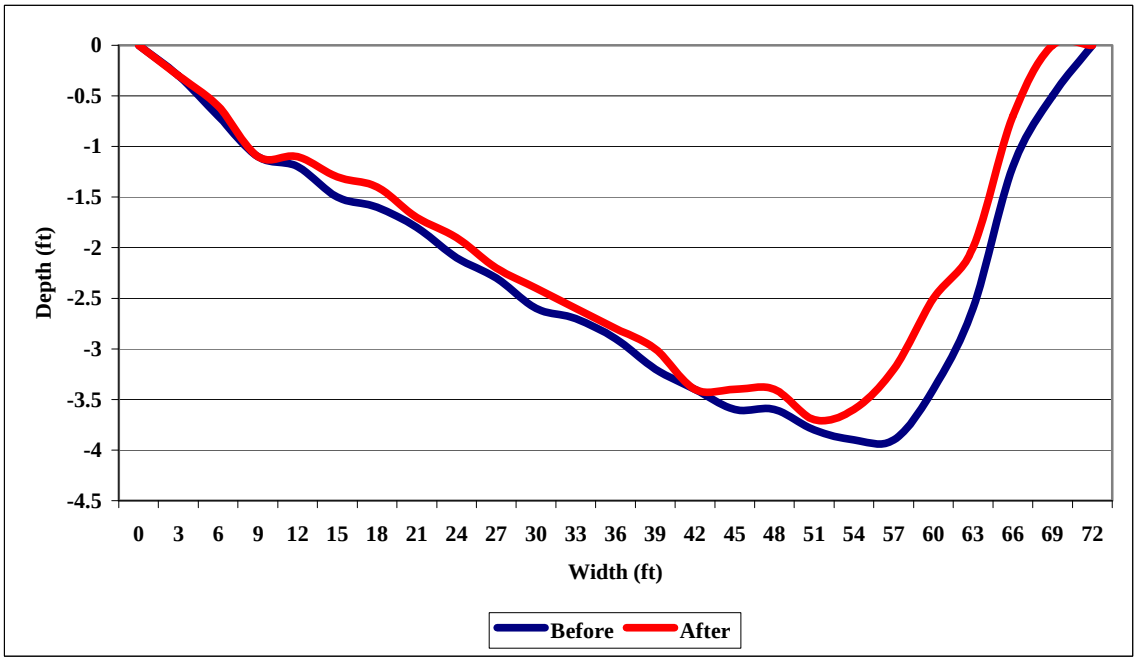
Appendix G-21. Pre and Post cross sections at Flatwater 1 Transect 2 – Below Dry Creek Reach



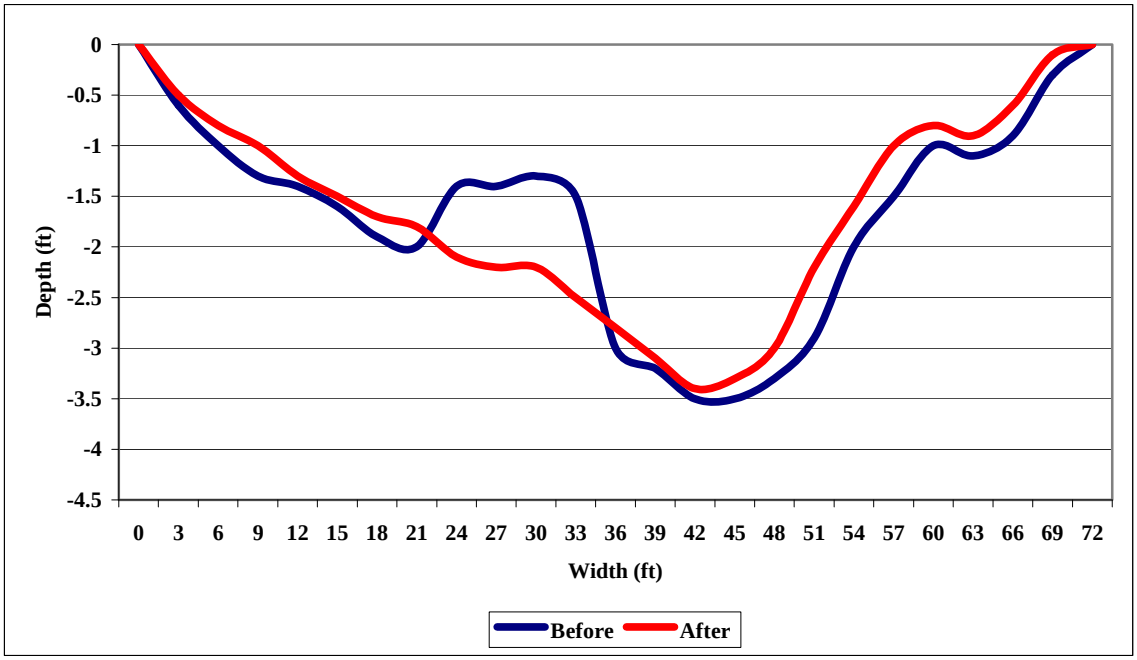
Appendix G-22. Pre and Post cross sections at Flatwater 1 Transect 3 – Below Dry Creek Reach



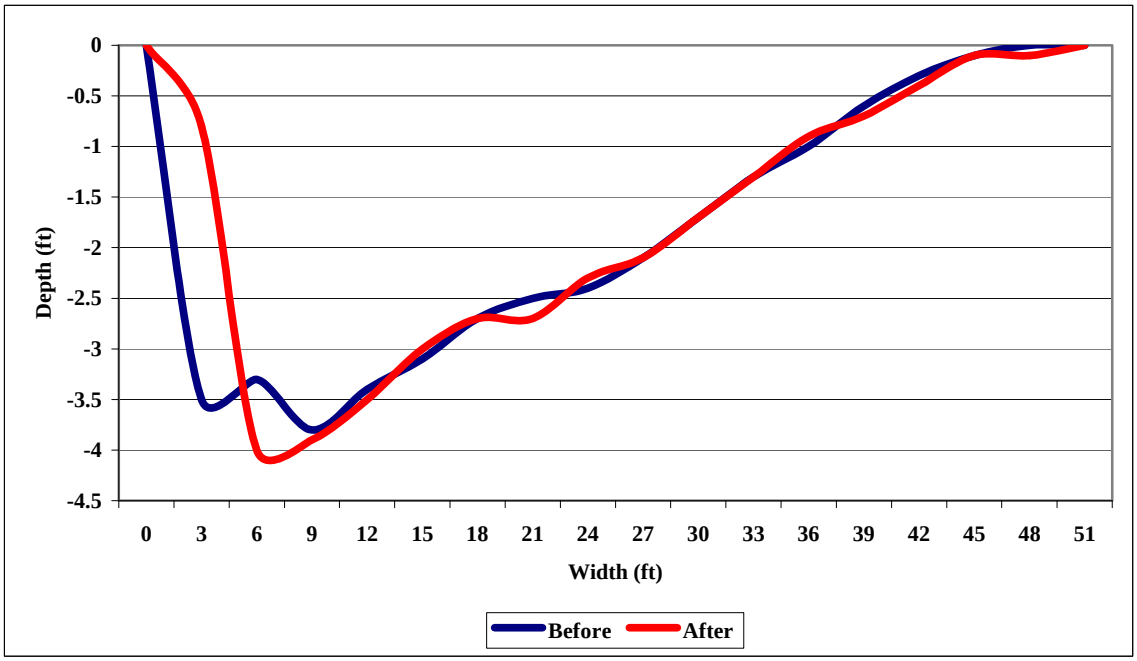
Appendix G-23. Pre and Post cross sections at Flatwater 2 Transect 1 – Below Dry Creek Reach



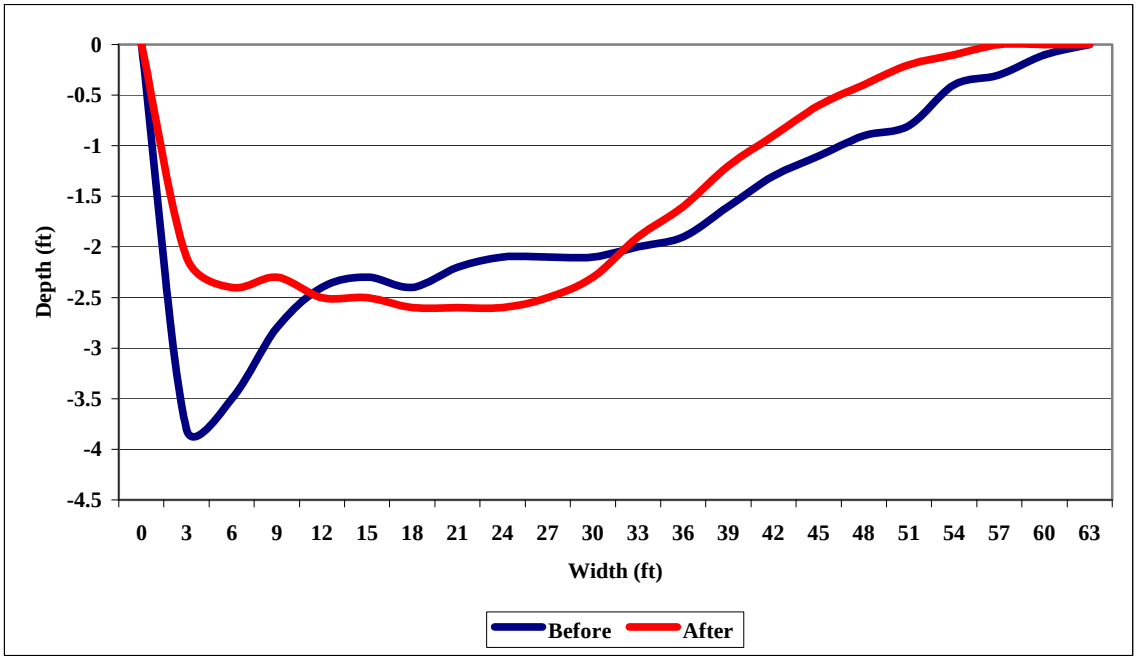
Appendix G-24. Pre and Post cross sections at Flatwater 2 Transect 2 – Below Dry Creek Reach



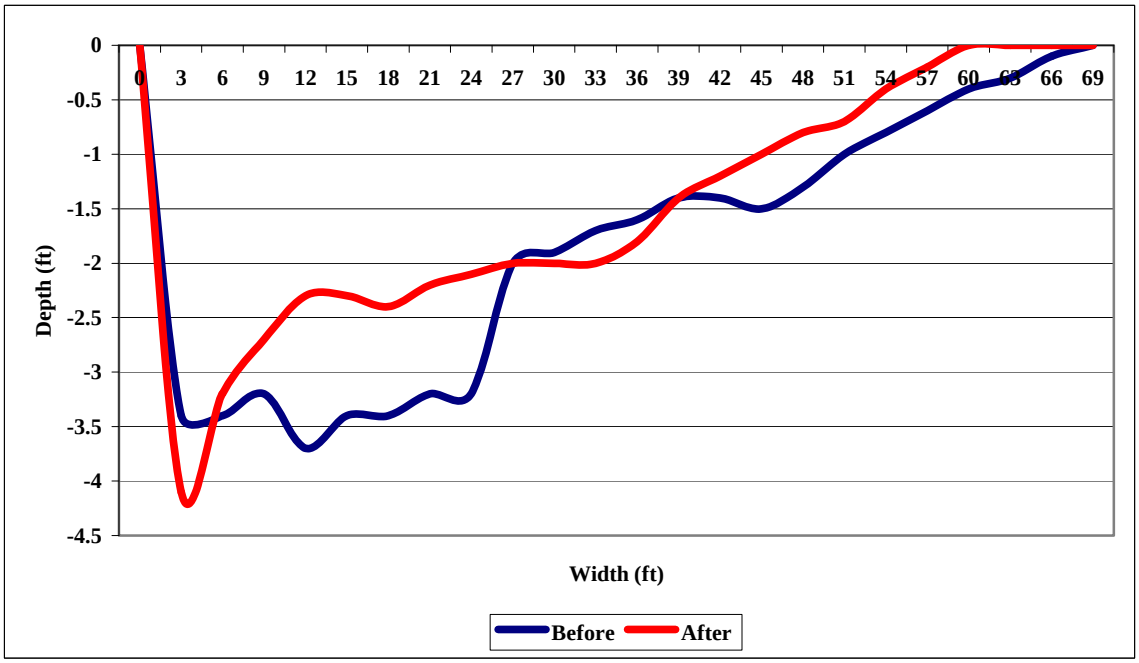
Appendix G-25. Pre and Post cross sections at Flatwater 2 Transect 3 – Below Dry Creek Reach



Appendix G-26. Pre and Post cross sections at Flatwater 3 Transect 1 – Below Dry Creek Reach



Appendix G-27. Pre and Post cross sections at Flatwater 3 Transect 2 – Below Dry Creek Reach



Appendix G-28. Pre and Post cross sections at Flatwater 3 Transect 3 – Below Dry Creek Reach

APPENDIX H

AVERAGE WIDTHS, DEPTHS AND CROSS SECTIONAL AREAS FOR EACH HABITAT UNIT AT EACH OF THE SEVEN REACHES, PRE AND POST FLOW REDUCTION SURVEYS.

Appendix H-1. Average widths, depths and cross sectional areas for Pool Transects measured in the Ukiah Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)	Width			Depth			Cross section			
		Pre- (ft)	Post (ft)	Difference (ft)	Pre- (ft)	Post (ft)	Difference (ft)	Pre- (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
Pool 1 T-1	4	60	60	0	1.9	1.7	-0.2	113.0	99.6	-13.4	-11.9%
Pool 1 T-2	4	65	64	-1	5.6	5.2	-0.4	116.3	111.4	-4.9	-4.2%
Pool 1 T-3	4	74	66	-8	1.9	1.9	-0.0	220.0	197.7	-22.3	-10.1%
Pool 1 T-4	4	81	76	-5	5.5	5.3	-0.2	205.5	175.3	-30.2	-14.7%
Pool 2 T-2	4	35	35	0	3.0	2.8	-0.2	98.7	93.3	-5.4	-5.5%
Pool 2 T-3	4	32	33	+1	2.7	2.7	0.0	80.3	79.8	-0.5	-0.6%
Pool 2 T-4	4	42	44	+2	2.5	2.8	+0.3	92.2	117.6	+25.4	+27.5%
Pool 3 T-2	9	65	65	0	4.1	4.3	+0.2	258.3	268.7	+10.4	+4.0%
Pool 3 T-3	9	65	62	-3	4.6	4.3	-0.3	278.6	254.1	-24.5	-8.8%
Pool 3 T-4	9	64	65	+1	2.8	3.0	+0.2	178.8	187.2	+8.4	+4.7%
Overall		**58.3**	**57.0**	**-.3**	**3.5**	**3.4**	**-0.1**	**164.2**	**158.5**	**-5.7**	**-2.0%**

Appendix H -2. Average widths, depths and cross sectional areas for Riffle Transects measured in the Ukiah Reach (transects excluded from analysis are presented in Appendix A). Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)	Width			Depth			Cross section			
		Pre- (ft)	Post (ft)	Difference (ft)	Pre- (ft)	Post (ft)	Difference (ft)	Pre- (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
Riffle 1 T-1	-3	53.0	54.0	+.0	1.1	1.1	0.0	54.6	61.0	+6.4	+11.7%
Riffle 2 T-1	-3	94.0	92.0	-2.0	0.6	0.6	0.0	56.1	54.0	-2.1	-3.7%
Riffle 2 T-2	-3	77.0	76.0	-1.0	0.9	0.9	0.0	63.5	65.2	+1.7	+2.7%
Riffle 2 T-3	-3	74.0	73.0	-1.0	0.8	0.8	0.0	56.2	58.0	+1.8	+3.2%
Riffle 3 T-1	+4	34.0	33.5	-0.5	1.2	1.2	0.0	39.3	39.0	-0.3	-0.8%
Riffle 3 T-2	+4	32.0	32.0	-0.0	1.2	1.2	0.0	36.3	37.5	+.2	+3.3%
Riffle 3 T-3	+4	36.0	36.0	0.0	1.5	1.5	0.0	50.4	49.2	-1.2	-2.4%
Overall		**57.1**	**56.6**	**-.5**	**1.0**	**1.0**	**0.0**	**50.9**	**52.0**	**+.1**	**+2.0%**

Appendix H-3. Average widths, depths and cross sectional areas for Flatwater Transects measured in the Ukiah Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)	Width			Depth			Cross section			
		Pre- (ft)	Post (ft)	Difference (ft)	Pre- (ft)	Post (ft)	Difference (ft)	Pre- (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
FW 1 T-3	-3	72	78	+6.0	1.7	1.7	0.0	122.6	130.2	+7.6	+6.2%
FW 2 T-1	+4	61	61	0.0	0.9	0.9	0.0	52.2	51.9	-0.3	-0.6%
FW 2 T-2	+4	55	56	+1.0	2.5	2.7	+0.2	128.1	151.2	+23.1	+18.0%
FW 2 T-3	+4	58	56	-2.0	2.0	1.9	-0.1	109.7	109.8	+0.1	+0.1%
FW 3 T-1	+4	28	30	+2.0	2.2	2.0	-0.2	59.4	56.6	-2.8	-4.7%
FW 3 T-2	+4	32	34	+2.0	2.2	1.9	-0.3	60.8	69.0	+8.2	+13.5%
FW 3 T-3	+4	35	32	-3.0	2.3	2.2	-0.1	75.0	65.5	-9.5	-12.7%
Overall		**48.7**	**49.6**	**+0.9**	**2.0**	**1.9**	**-0.1**	**86.8**	**90.6**	**+3.8**	**+2.8%**

Appendix H-4. Average widths, depths and cross sectional areas for Pool Transects measured in the Comminsky Station Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)e	Width			Depth			Cross section			
		Pre (ft)	Post (ft)	Difference (ft)	Pre (ft)	Post (ft)	Difference (ft)	Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
Pool 1 T-1	20	84	85	+1.0	2.5	2.2	-0.3	207.3	180.1	-27.2	-13.1%
Pool 1 T-2	20	116	116	0.0	3.5	3.5	0.0	400.6	398.9	-1.7	-0.4%
Pool 1 T-3	20	110	108	-2.0	3.4	3.2	-0.2	379	343.8	-35.2	-9.3%
Pool 1 T-4	20	75	83	+8.0	4.6	4.4	-0.2	334.8	339.1	+4.3	+1.3%
Pool 2 T-2	20	64	65	+1.0	3.6	3.4	-0.2	117.9	113.1	-4.8	-4.1%
Pool 3 T-1	20	63	70	+7.0	3.8	3.6	-0.2	230.7	248.7	+18.0	+7.8%
Pool 3 T-2	20	76	64	-12.0	5.9	5.5	-0.4	426.3	366	-60.3	-14.1%
Pool 3 T-3	20	96	101	+5.0	3.6	3.5	-0.1	331.5	334.2	+2.7	+0.8%
Pool 3 T-4	20	117	119	+2.0	3.0	3.0	-0.0	345	356.4	+11.4	+3.3%
Overall		**89.0**	**90.1**	**+1.1**	**3.8**	**3.6**	**-0.2**	**308.1**	**297.8**	**-10.3**	**-3.3%**

Appendix H-5. **Average widths, depths and cross sectional areas for Riffle Transects measured in the Comminsky Station Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.**

Transect	Change in flow (cfs)	Width			Depth			Cross section			
		Pre (ft)	Post (ft)	Difference (ft)	Pre (ft)	Post (ft)	Difference	Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
Riffle 1 T-1	20	120.0	122.0	+2.0	0.7	0.6	-0.1	85.2	76.3	-8.9	-10.4%
Riffle 1 T-2	20	91.0	91.0	0.0	0.7	0.6	-0.1	57.6	50.4	-7.2	-12.5%
Riffle 1 T-3	20	81.0	79.0	-2.0	0.6	0.5	-0.1	44.4	40.5	-3.9	-8.8%
Riffle 2 T-1	20	72.0	70.0	-2.0	0.9	1.1	+0.2	62.7	72.9	+10.2	+16.3%
Riffle 2 T-2	20	60.2	62.0	+1.8	1.2	1.2	-0.0	74.7	71.8	-2.9	-3.9%
Riffle 2 T-3	20	64.0	67.0	+3.0	1.7	1.5	-0.2	105.2	78.8	-26.4	-25.1%
Riffle 3 T-1	20	28.0	26.0	-2.0	1.1	0.9	-0.2	33.9	27.6	-6.3	-18.6%
Riffle 3 T-2	20	36.0	34.0	-2.0	1.4	1.2	-0.2	50.7	41.7	-9.0	-17.8%
Riffle 3 T-3	20	34.0	33.0	-1.0	2.3	2.0	-0.3	72.5	64.5	-8.0	-11.0%
Overall		**65.1**	**64.9**	**-0.2**	**1.2**	**1.1**	**0.1**	**65.2**	**58.3**	**-6.9**	**-10.6%**

Appendix H-6. **Average widths, depths and cross sectional areas for Flatwater Transects measured in the Comminsky Station Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.**

Transect	Change in flow (cfs)	Width			Depth			Cross section			
		Pre (ft)	Post (ft)	Difference (ft)	Pre (ft)	Post (ft)	Difference (ft)	Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
FW 1, T-1	20	83	81	-2.0	3.1	2.9	-0.2	248.7	231.6	-17.1	-6.9%
FW 1, T-2	20	108	113	+5.0	2.8	2.5	-0.3	311.7	282.9	-28.8	-9.2%
FW 2, T-1	20	71	71	-0.0	1.1	1.0	-0.1	72.9	67.2	-5.7	-7.8%
FW 2, T-2	20	52	53	+1.0	1.4	1.2	-0.2	70.4	62.4	-8.0	-11.4%
FW 2, T-3	20	52	55	+3.0	1.6	1.5	-0.1	80.7	76.2	-4.5	-5.6%
FW 3, T-1	20	61	59	-2.0	2.6	2.6	0.0	156.4	151.2	-5.2	-3.3%
FW 3, T-2	20	57	58	+1.0	1.7	1.6	-0.1	95.7	93.6	-2.1	-2.2%
FW 3, T-3	20	61	64	+3.0	2.0	1.9	-0.1	119.1	102.6	-16.5	-13.9%
Overall		**68.1**	**69.3**	**+0.8**	**2.0**	**1.9**	**-0.1**	**144.5**	**133.5**	**-11.0**	**-7.6%**

Appendix H-7. **Average widths, depths and cross sectional areas for Pool Transects measured in the Cloverdale Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.**

Transect	Change in flow (cfs)e	Width			Depth			Cross section			
		Pre (ft)	Post (ft)	Difference (ft)	Pre (ft)	Post (ft)	Difference (ft)	Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
Pool 1 T-1	17	107	102.5	-4.5	1.8	1.6	-0.2	184.1	163.5	-20.6	-11.2%
Pool 1 T-2	17	82	85	+3.0	1.8	1.8	0.0	141.8	148.5	+6.7	+4.7%
Pool 1 T-3	17	75	73	-2.0	2.1	2.0	-0.1	166.1	146.4	-19.7	-11.9%
Pool 1 T-4	17	82	79	-3.0	1.9	1.8	-0.1	142.2	141.1	-1.1	-0.8%
Pool 2 T-1	17	102	82	-20.0	1.9	1.8	-0.1	161.1	144.3	-16.8	-10.4%
Pool 2 T-2	17	82	78	-4.0	2.2	2.1	-0.1	178.8	164.1	-14.7	-8.2%
Pool 2 T-3	17	92	84	-8.0	2.5	2.3	-0.2	222.6	206.1	-16.5	-7.4%
Pool 2 T-4	17	98	91	-7.0	2.0	2.0	0.0	188.8	182.3	-6.5	3.4%
Pool 3 T-1	17	62	55	-7.0	2.8	3.4	+0.6	167.7	166.8	-0.9	-0.5%
Pool 3 T-2	17	46	44	-2.0	2.9	3.0	+0.1	113.1	127.5	+14.4	+12.7%
Pool 3 T-3	17	48	53	+5.0	3.1	3.2	+0.1	159.3	160.5	+1.2	+0.8%
Pool 3 T-4	17	51	61	+10.0	3.7	3.5	-0.2	188.7	186.9	-1.8	-1.0%
Overall		**77.3**	**74.0**	**-3.3**	**2.4**	**2.4**	**0.0**	**167.9**	**161.5**	**-11.0**	**-3.8%**

Appendix H-8. **Average widths, depths and cross sectional areas for Riffle Transects measured in the Cloverdale Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.**

Transect	Change in flow (cfs)	Width			Depth			Cross section			
		Pre (ft)	Post (ft)	Difference (ft)	Pre (ft)	Post (ft)	Difference (ft)	Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
Riffle 1 T-1	17	142	152	+10.0	0.9	0.6	-0.3	102.6	66.3	-36.3	-35.4%
Riffle 1 T-2	17	181	179	-2.0	0.7	0.6	-0.1	49.8	40.8	-9.0	-18.1%
Riffle 2 T-1	17	81	80	-1.0	1.1	0.9	-0.2	80.4	68.1	-12.3	-15.3%
Riffle 2 T-3	17	39	38	-1.0	1.8	1.6	-0.2	66.3	57.3	-9.0	-13.6%
Riffle 3, T-2	17	65	58	-7.0	0.8	0.8	0.0	45.0	37.2	-7.8	-17.3%
Riffle 3 T-3	17	51	54	+3.0	1.2	1.1	-0.1	59.1	60.8	+1.7	+2.9%
Overall		**92.9**	**92.8**	**-0.1**	**1.1**	**0.9**	**-0.2**	**67.2**	**55.1**	**-12.1**	**-18.0%**

Appendix H-9. Average widths, depths and cross sectional areas for Flatwater Transects measured in the Cloverdale Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)	Width			Depth			Cross section			
		Pre (ft)	Post (ft)	Difference (ft)	Pre (ft)	Post (ft)	Difference (ft)	Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
FW 1 T-1	17	84	80	-4.0	0.9	0.9	-0	79.5	64.5	-15.0	-18.9%
FW 1 T-2	17	73	73	-0.0	2.2	1.9	-0.3	147.3	134.4	-12.9	-8.8%
FW 1 T-3	17	129	123	-6.0	1.4	1.3	-0.1	171.9	159	-12.9	-7.5%
FW 2 T-1	17	51	55	+4.0	1.5	1.6	+0.1	83.4	85.2	+1.8	+2.2%
FW 2 T-2	17	67	70	+3.0	1.8	1.6	-0.2	116.1	111.6	-4.5	-3.9%
FW 2 T-3	17	54	62	+8.0	1.6	1.7	+0.1	90.0	98.4	+8.4	+9.3%
FW 3 T-1	17	116	109	-7.0	1.1	0.9	-0.2	120.9	93.9	-27.0	-22.3%
FW 3 T-2	17	132	130	-2.0	1.0	0.9	-0.1	127.2	120.9	-6.3	-5.0%
FW 3 T-3	17	116	112	-4.0	1.3	1.2	-0.1	151.5	123.3	-28.2	-18.6%
Overall		**91.3**	**90.4**	**-0.9**	**1.4**	**1.3**	**-0.1**	**120.9**	**110.1**	**-15.3**	**-8.9%**

Appendix H-10. Average widths, depths and cross sectional areas for Pool Transects measured in the Geyserville Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)	Width			Depth			Cross section			
		Pre (ft)	Post (ft)	Difference (ft)	Pre (ft)	Post (ft)	Difference (ft)	Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
Pool 1 T-1	13	65.0	61.0	-4.0	2.3	2.5	+0.2	131.4	147	+15.6	+11.9%
Pool 1 T-2	13	63.0	65.0	+2.0	3.9	3.7	-0.2	235.2	217.2	-18.0	-7.7%
Pool 1 T-3	13	75.0	70.0	-5.0	2.8	3.0	+0.2	166.8	178.8	+12.0	+7.2%
Pool 1 T-4	13	84.0	79.0	-5.0	1.6	1.4	-0.2	132.9	108.0	-24.9	-18.7%
Pool 2 T-1	13	58.0	57.0	-1.0	2.8	2.5	-0.3	157.2	136.8	-20.4	-13.0%
Pool 2 T-2	13	73.0	74.0	+1.0	2.7	2.3	-0.4	183.9	156.0	-27.9	-15.2%
Pool 2 T-3	13	83.0	79.0	-4.0	1.8	1.7	-0.1	146.1	129.9	-16.2	-11.1%
Pool 2 T-4	13	84.0	83.0	-1.0	1.5	1.2	-0.3	127.5	104.1	-23.4	-18.4%
Pool 3 T-2	13	64.0	57.0	-7.0	3.6	3.4	-0.2	215.7	191.4	-24.3	-11.3%
Pool 3 T-3	13	63.0	64.0	+1.0	2.9	2.9	0.0	184.2	181.5	-2.7	-1.5%
Pool 3 T-4	13	67.0	60.0	-7.0	2.1	1.9	-0.2	138.6	107.4	-31.2	-22.5%
Overall		**70.8**	**68.1**	**-2.7**	**2.5**	**2.4**	**-0.1**	**165.4**	**150.7**	**-14.7**	**-8.9%**

Appendix H-11. Average widths, depths and cross sectional areas for Riffle Transects measured in the Geyserville Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)	Width			Depth			Cross section			
		Pre (ft)	Post (ft)	Difference (ft)	Pre (ft)	Post (ft)	Difference (ft)	Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
Riffle 1 T-1	13	47	42	-5	0.9	0.7	-0.2	39.3	27	-12.3	-31.3%
Riffle 1 T-2	13	53	49	-4	1.0	0.8	-0.2	53.1	39.6	-13.5	-25.4%
Riffle 1 T-3	13	48	47	-1	1.4	0.9	-0.5	66.9	42.3	-24.6	-36.8%
Riffle 2 T-1	13	94	89	-5	0.6	0.5	-0.1	58.5	42.3	-16.2	-27.7%
Riffle 2 T-3	13	55	47	-8	0.9	0.8	-0.1	49.5	32.1	-17.4	-35.2%
Riffle 3 T-1	13	50	40	-10	0.8	0.7	-0.1	36.6	28.2	-8.4	-23.0%
Riffle 3 T-2	13	42	36	-6	1.3	1.1	-0.2	49.2	35.1	-14.1	-28.7%
Riffle 3 T-3	13	43	37	-6	1.3	1.2	-0.1	54	41.7	-12.3	-22.8%
Overall		**54.0**	**48.4**	**-5.6**	**1.0**	**0.8**	**-0.2**	**50.9**	**36.0**	**-14.9**	**-29.2%**

Appendix H-12. Average widths, depths and cross sectional areas for Flatwater Transects measured in the Geyserville Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)	Width			Depth			Cross section			
		Pre (ft)	Post (ft)	Difference (ft)	Pre (ft)	Post (ft)	Difference (ft)	Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
FW 1 T-1	13	55	49	-6.0	2.4	2.0	-0.4	127.5	100.5	-27.0	-21.2%
FW 1 T-2	13	68	61	-7.0	1.7	1.4	-0.3	149.1	96.9	-52.2	-35.0%
FW 1 T-3	13	59	57	-2.0	1.7	1.4	-0.3	89.4	81.3	-8.1	-9.1%
FW 2 T-1	13	59	59	0.0	1.5	1.2	-0.3	75.9	66.9	-9.0	-11.9%
FW 2 T-2	13	63	63	0.0	2.0	1.8	-0.2	119.7	106.2	-13.5	-11.3%
FW 2 T-3	13	64	62	-2.0	2.0	1.8	-0.2	114.9	109.2	-5.7	-5.0%
FW 3 T-1	13	63.5	52	-11.5	1.4	1.6	+0.2	87.3	75.9	-11.4	-13.1%
Overall		**61.6**	**57.6**	**-4.0**	**1.8**	**1.6**	**-0.2**	**109.1**	**91.0**	**-18.1**	**-16.6%**

Appendix H-13. Average widths, depths and cross sectional areas for Pool Transects measured in the Diggers Bend Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)	Width			Depth			Cross section			
		Pre (ft)	Post (ft)	Difference (ft)	Pre (ft)	Post (ft)	Difference (ft)	Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
Pool 1 T-1	74	54	54	0	2.5	2.5	-0.0	112.5	114.0	+1.5	+1.3%
Pool 1 T-2	74	68	66	-2	4.6	4.2	-0.4	261.0	223.2	-37.8	-14.5%
Pool 1 T-3	74	61	58	-3	4.9	4.6	-0.3	251.1	234.6	-16.5	-6.6%
Pool 1 T-4	74	73	67	-6	1.7	1.8	+0.1	125.1	121.8	-3.3	-2.6%
Pool 2 T-1	74	142	138	-4	6.0	6.0	-0.0	831.9	823.5	-8.4	-1.0%
Pool 2 T-2	74	143	139	-4	4.5	4.3	-0.2	607.8	594.6	-13.2	-2.2%
Pool 2 T-3	74	122	126	+4	8.7	8.8	+0.1	915.3	944.4	+29.1	+3.2%
Pool 3 T-1	74	75	68	-7	3.1	3.1	-0.0	229.2	184.5	-44.7	-19.5%
Pool 3 T-2	74	69	69	0	3.3	3.6	+0.3	189.9	200.4	+10.5	+5.5%
Pool 3 T-3	74	78	75	-3	3.6	2.9	-0.7	213.0	180.0	-33.0	-15.5%
Pool 3 T-4	74	85	89	+4	2.4	1.9	-0.5	194.4	164.7	-29.7	-15.3%
Overall		**88.2**	**86.3**	**-1.9**	**4.1**	**4.0**	**-0.1**	**357.4**	**344.2**	**-13.2**	**-6.1%**

Appendix H-14 Average widths, depths and cross sectional areas for Riffle Transects measured in the Diggers Bend Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)	Width			Depth			Cross section			
		Pre (ft)	Post (ft)	Difference (ft)	Pre (ft)	Post (ft)	Difference (ft)	Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
Riffle 1 T-1	74	140.0	125.0	-15.0	0.6	0.4	-0.2	89.4	49.8	-39.6	-44.3%
Riffle 1 T-2	74	129.0	117.0	-12.0	0.8	0.5	-0.3	76.5	43.5	-33.0	-43.1%
Riffle 2 T-1	74	91.0	91.0	0.0	1.1	0.7	-0.4	95.7	63.3	-32.4	-33.9%
Riffle 2 T-2	74	106.0	92.0	-14.0	0.9	0.6	-0.3	94.8	59.1	-35.7	-37.7%
Riffle 2 T-3	74	94.0	87.0	-7.0	0.8	0.5	-0.3	78.0	40.8	-37.2	-47.7%
Riffle 3 T-1	74	55.0	47.5	-7.5	1.1	0.7	-0.4	51.6	29.7	-21.9	-42.4%
Riffle 3 T-2	74	56.0	53.0	-3.0	1.1	0.8	-0.3	60.9	40.8	-20.1	-33.0%
Riffle 3 T-3	74	59.0	56.0	-3.0	1.1	0.7	-0.4	60.0	39.3	-20.7	-34.5%
Overall		**91.3**	**83.6**	**-7.7**	**0.9**	**0.6**	**-0.3**	**75.9**	**45.8**	**-30.1**	**-39.6%**

Appendix H-15. Average widths, depths and cross sectional areas for Flatwater Transects measured in the Diggers Bend Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)	Width			Depth			Cross section			
		Pre (ft)	Post (ft)	Difference (ft)	Pre (ft)	Post (ft)	Difference (ft)	Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
FW 1 T-1	74	58	51	-7.0	2	1.7	-0.3	111.3	86.4	-24.9	-22.4%
FW 1 T-2	74	58	52.5	-5.5	1.6	1.5	-0.1	92.7	78.9	-13.8	-14.9%
FW 1 T-3	74	68	62	-6.0	1.3	1.0	-0.3	88.8	61.8	-27.0	-30.4%
FW 2 T-1	74	79	78	-1.0	1.9	1.7	-0.2	150.6	124.2	-26.4	-17.5%
FW 2 T-2	74	65	62	-3.0	2.7	2.4	-0.3	169.2	146.4	-22.8	-13.5%
FW 2 T-3	74	75	72	-3.0	2.6	2.4	-0.2	188.4	162.9	-25.5	-13.5%
FW 3 T-1	74	113	113	0.0	2.2	1.9	-0.3	247.2	210.0	-37.2	-15.0%
FW 3 T-2	74	120	107	-13.0	1.9	1.7	-0.2	212.7	174.9	-37.8	-17.8%
FW 3 T-3	74	95	91	-4.0	2.0	1.7	-0.3	188.7	154.8	-33.9	-18.0%
Overall		**81.2**	**76.5**	**-4.7**	**2.0**	**1.8**	**-0.2**	**161.1**	**133.4**	**-27.7**	**-17.2%**

Appendix H-16. Average widths, depths and cross sectional areas for Pool Transects measured in the Healdsburg Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)	Width			Depth			Cross section			
		Pre (ft)	Post (ft)	Difference (ft)	Pre (ft)	Post (ft)	Difference (ft)	Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
Pool 1 T-1	69	86	84	-2	2.8	2.1	-0.7	219.3	172.5	46.8	-21.3%
Pool 1 T-2	69	117	109	-8	3.5	3.4	-0.1	396.6	361.8	34.8	-8.8%
Pool 1 T-3	69	91	92	1	6.1	6.0	-0.1	534.0	536.1	2.1	0.4%
Pool 1 T-4	69	120	115	-5	2.9	2.6	-0.3	336.3	297.0	39.3	-11.7%
Pool 2 T-3	69	78	79.5	1.5	3.8	3.3	-0.5	282.9	253.5	29.4	-10.4%
Pool 2 T-4	69	79	78	-1	2.3	1.9	-0.4	175.5	144.3	31.2	-17.8%
Pool 3 T-1	69	134	124	-10	1.6	1.4	-0.2	206.4	172.2	34.2	-16.6%
Pool 3 T-2	69	105	96	-9	2.0	1.7	-0.3	227.4	160.8	66.6	-29.3%
Pool 3 T-3	69	94	90	-4	2.0	1.9	-0.1	190.5	173.7	16.8	-8.8%
Pool 3 T-4	69	125	114	-11	1.7	1.7	0.0	211.8	195.9	15.9	-7.5%
Overall		**102.9**	**98.2**	**-4.8**	**2.9**	**2.6**	**-0.3**	**278.1**	**246.8**	**31.3**	**-13.2%**

Appendix H-17. Average widths, depths and cross sectional areas for Riffle Transects measured in the Healdsburg Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)		Width				Depth				Cross section			
			Pre (ft)	Post (ft)	Difference (ft)		Pre (ft)	Post (ft)	Difference (ft)		Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
Riffle 1 T-1	69		46	40	-6		1.3	1.0	-0.3		58.5	32.4	-26.1	-44.6%
Riffle 1 T-2	69		42	41	-1		1.1	1.1	-0.1		51.6	41.7	-9.9	-19.2%
Riffle 1 T-3	69		50	43	-7		1.1	0.8	-0.3		51.6	33.6	-18	-34.9%
Riffle 2 T-1	69		50	49	-1		1.1	0.7	-0.4		54.0	32.7	-21.3	-39.4%
Riffle 2 T-2	69		48	42	-6		1.2	0.9	-0.4		60.0	36.0	-24	-40.0%
Overall			**47.2**	**43**	**-4.2**		**1.2**	**0.9**	**-0.3**		**55.1**	**35.3**	**-19.9**	**-36.0%**

Appendix H-18. Average widths, depths and cross sectional areas for Flatwater Transects measured in the Healdsburg Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)		Width				Depth				Cross section			
			Pre (ft)	Post (ft)	Difference (ft)		Pre (ft)	Post (ft)	Difference (ft)		Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
FW 1 T-1	69		73	72	-1		1.5	1.1	-0.4		108.0	77.4	-30.6	-28.3%
FW 1 T-2	69		73	68	-5		1.5	1.0	-0.5		94.5	63.3	-31.2	-33.0%
FW 1 T-3	69		89	87	-2		1.1	0.8	-0.3		111.0	72.9	-38.1	-34.3%
FW 2 T-1	69		106	106	0		0.9	0.6	-0.2		92.4	66.3	-26.1	-28.2%
FW 2 T-2	69		78	69	-9		1.1	0.8	-0.3		138.0	104.4	-33.6	-24.3%
FW 3 T-1	69		64	65	+1		1.3	1.3	0.0		79.2	82.8	+3.6	+4.5%
FW 3 T-2	69		55	53	-2		1.3	1.0	-0.3		69.3	51.3	-18.0	-26.0%
FW 3 T-3	69		53	48	-5		1.2	1.0	-0.2		63.0	45.9	-17.1	-27.1%
Overall			**73.9**	**71.0**	**-2.9**		**1.2**	**0.9**	**-0.3**		**94.4**	**70.5**	**-23.9**	**-24.6%**

Appendix H-19. Average widths, depths and cross sectional areas for Pool Transects measured in the Below Dry Creek Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs) Before		Width				Depth				Cross section			
			Pre (ft)	Post (ft)	Difference (ft)		Pre (ft)	Post (ft)	Difference (ft)		Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
Pool 1 T-1	41		55	51	-4		3.1	3.3	+0.2		157	158	+1.0	+0.6%
Pool 1 T-2	41		67	60	-7		5.1	4.8	-0.3		289	276	-13.0	-4.5%
Pool 1 T-3	41		66	66	0		3.7	3.3	-0.4		244	217	-27.0	-11.1%
Pool 2 T-1	52		72	63	-9		2.1	2.4	+0.3		124	153	+29.0	+23.4%
Pool 2 T-2	52		72	72	0		2.7	2.5	-0.2		185	171	-14	-7.6%
Pool 2 T-3	52		67	69	+2		4.0	3.6	-0.4		264	250	-14	-5.3%
Pool 2 T-4	52		75	70	-5		2.1	2.1	0.0		156	148.0	-8.0	-5.1%
Pool 3 T-1	52		80	82	+2		3.3	3.4	+0.1		239	260	+21	+8.8%
Pool 3 T-2	52		96	94	-2		4.6	4.5	-0.1		375	365	-10	-2.7%
Overall			**71.9**	**69.6**	**-2.3**		**3.6**	**3.5**	**-0.1**		**234.6**	**231.3**	**-3.4**	**-0.2%**

Appendix H-20. Average widths, depths and cross sectional areas for Riffle Transects measured in the Below Dry Creek Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)		Width				Depth				Cross section			
	Before		Pre (ft)	Post (ft)	Difference (ft)		Pre (ft)	Post (ft)	Difference (ft)		Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
R1, T-1	72		72	67	-5		1.2	0.9	-0.3		85.0	59.0	-26	-30.6%
R1, T-2	72		75	71	-4		1.1	0.9	-0.2		80.4	63.6	-16.8	-20.9%
R1, T-3	72		77	73	-4		1.3	1.1	-0.2		90.0	80.0	-10.0	-11.1%
R2, T-2	36		86	80	-6		0.9	0.9	0.0		76.0	72.0	-4.0	-5.3%
R3, T-2	5		83	64	-19		0.8	1.0	+0.2		66.0	61.0	-5.0	-7.6%
R3, T-3	5		82	79	-3		0.9	0.9	0.0		74.0	67.0	-7.0	-9.5%
Overall[1]			**74.7**	**70.3**	**-4.3**		**1.2**	**1.0**	**-0.2**		**85.1**	**67.5**	**-17.6**	**-20.7%**

[1]Includes data from Riffle 1, only

Appendix H-21. Average widths, depths and cross sectional areas for Flatwater Transects measured in the Below Dry Creek Reach. Shaded areas represent transects where the average width, depth, or cross sectional area increased between the Pre and Post surveys.

Transect	Change in flow (cfs)		Width				Depth				Cross section			
	Before		Pre (ft)	Post (ft)	Difference (ft)		Pre (ft)	Post (ft)	Difference (ft)		Pre (ft^2)	Post (ft^2)	Difference (ft^2)	% Change
FW 1, T-1	72		92	85	-7		1.1	0.9	-0.2		99.0	78.0	-21.0	-21.2%
FW 1, T-2	72		117	108	-9		1.4	1.2	-0.2		162.0	138.0	-24.0	-14.8%
FW 1, T-3	72		82	81	-1		2.3	2.1	-0.2		187.0	167.0	-20.0	-10.7%
FW 2, T-1	72		72	68	-4		2.0	1.8	-0.2		131.0	122.0	-9.0	-6.9%
FW 2, T-2	72		71	68	-3		2.3	2.2	-0.1		162.0	145.0	-17.0	-10.5%
FW 2, T-3	72		71	69	-2		1.8	1.8	0.0		125.0	121.0	-4.0	-3.2%
FW 3, T-1	5		48	46	-2		2.1	1.9	-0.2		95.4	90.6	-4.8	-5.0%
FW 3, T-2	5		62	56	-6		1.8	1.7	-0.1		108.0	94.0	-14.0	-13.0%
FW 3, T-3	5		68	60	-8		2.0	1.7	-0.3		129.0	104.0	-25.0	-19.4%
Overall[1]			**84.2**	**79.8**	**-4.4**		**1.8**	**1.7**	**-0.1**		**144.3**	**128.5**	**-15.8**	**-11.0%**

[1]Includes data from Flatwater 1 and 2, only

Appendix I. List of transects excluded from analysis[1].

Reach	Transect excluded
Ukiah	Pool 2 – Transect 1 Pool 3 – Transect 1 Riffle 1 Transect 1 Riffle 1 Transect 2 Flatwater 1 Transect 1 Flatwater 1 – Transect 2
Comminsky Station	Pool 2 – Transect 1 Pool 2 – Transect 3 Flatwater 1 Transect 3
Cloverdale	Riffle 2 – Transect 2 Riffle 3 – Transect 1
Geyserville	Pool 3 – Transect 1 Riffle 2 – Transect 2 Flatwater 3 – Transect 2 Flatwater 3 – Transect 3
Diggers Bend	All used
Healdsburg	Pool 2 – Transect 1 Pool 2 – Transect 2 Riffle 1 – Transect 1 Riffle 1 – Transect 2 Riffle 1 – Transect 3 Flatwater 2 – Transect 3
Below Dry Creek	Pool 3 – Transect 3 Pool 3 Transect 4 Riffle 2 – Transect 1 Riffle 3 – Transect 1

[1]Physical habitat variables measured at each transect during the Pre and Post flow reduction surveys were compared. In cases where the contours (cross sections) clearly did not match, we excluded the data from the analysis. As stated in the report, GPS coordinates were collected at each transect, and each transect was marked with flagging. However, at some stations, the flagging was removed, and at other stations GPS coordinates were insufficient to exactly replicate some transects.