STREAM MITIGATION
AS-BUILT REPORT

Beaver Creek
Surry County, North Carolina

N.C. Wetlands Restoration Program
_____NCDENR_DWQ

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1.0 INTRODUCTION

The North Carolina Wetlands Restoration Program (WRP) requested that Earth Tech conduct an as-built study on the Beaver Creek Restoration in Wilkes County, North Carolina.

The objective of this study was to conduct a post-construction assessment of site conditions, to establish permanent reference points for future monitoring, and compile a photographic log of current stream and site conditions.

This report is broken into five main components:

1) Detailed establishment of study plots and monument points
2) Assessment of the stream channel and structures
3) Assessment of the vegetation in the riparian buffer
4) Development of a baseline photographic log showing post-construction conditions
5) A summary of findings

1.1 Project Description

Beaver Creek project site consists of 4,670 linear feet of stream restoration. A tributary to the Fisher River, Beaver Creek (NCDWQ Stream Index Number – 12-63-12) is located on agricultural land southeast of the town of Dobson in Surry County, North Carolina (Figure 1). The watershed area for this project is 5.9 square miles. The project is fully contained within the property of five landowners.

The Surry County Soil and Water Conservation District (SCSWCD) staff first identified Beaver Creek as a potential restoration site after landowners complained about active erosion and flooding adjacent to the stream. The stream was actively eroding along a tight meander located within property owned by Mr. Mike Jones. The meander eroded to the point where the radius was so tight that water was overtopping the bank and flooding the adjacent landowners (Mr. Wayne Draughn) field during storm events.

Beyond the above stated problem area, Beaver Creek had other areas of significant active bank erosion throughout the proposed project limits. There is evidence of historic straightening and degradation resulting from this straightening. Thinning and removal of riparian vegetation had also accelerated the degradation process. The incised condition of the channel had accelerating the erosion process by forcing the channel to contain larger than bankfull storm events. One of the three tributaries, within the project limits, had also been straightened.

The restoration site is located entirely within undeveloped land consisting of agricultural land predominantly being used for hay production, woodland, and sparse crop production. There are no utilities within the project limits. All of these characteristics combined to make Beaver Creek an excellent restoration site. The project had the following goals and objectives:

1. Restore 4,670 linear feet of Beaver Creek (as measured along the thalweg).
2. Provide a stable stream channel that neither aggrades nor degrades while maintaining its dimension, pattern, and profile with the capacity to transport its watershed's water and sediment load.
3. Improve water quality and reduce further property loss by stabilizing eroding stream banks.
4. Reconnect the stream to its floodplain or establish a new floodplain at a lower elevation.
5. Improve aquatic habitat with the use of natural material stabilization structures such as root wads, rock vanes, woody debris and a riparian buffer.
6. Provide aesthetic value, wildlife habitat and bank stability through the creation or enhancement of a riparian zone.

The Priority I restoration involved converting the 4,670 ft impaired channel into a sinuous channel that meanders for a total of 4,210 ft as measured along the centerline or 4,266 along the thalweg (Appendix A). Rock and log cross-vanes and rootwads were incorporated for aquatic habitat enhancement and bed and bank stability. A 50-foot riparian buffer on either side of the stream was planted with native vegetation.

Figure 1. Vicintiy Map

Table 1 contains a schedule of events for the construction of Beaver Creek Restoration Site.

Table 1. Schedule of Construction Events

Construction Event	Date
Channel construction	June-August, 2002
Temporary and Permanent Seeding	June-August, 2002
As-built Stream Survey	October 29, 2002
As-built Longitudinal and Cross-Sections	January 9-10, 2003
Planting of bare-root stock	January 2003

1.2 Methodology

Post-construction monitoring of geomorphic and vegetative conditions was performed on the Beaver Creek Restoration project. Methodologies used are detailed in the following sections.

1.2.1 Reference Point Establishment

The establishment of permanent markers are needed to document post-construction conditions and for future evaluation of any changes in the site. Documentation is necessary to evaluate any changes and determine the success of this stream restoration project. Benchmark elevation points have been established at five locations along the project. Table 2 contains the benchmark locations by Northing and Easting coordinates and the elevations of the pins. The as-built plan in Figure 2 also depicts the locations of the benchmarks with relation to the restoration.

Table 2. Benchmark Locations and Elevations

Description	Northing	Easting	Elevation
½” Rebar	954802.27	1506819.62	945.28’
½” Rebar	954557.28	1507021.17	945.13’
½” Rebar	954679.35	1507502.31	949.24’
½” Rebar	954988.00	1507842.16	951.85’
½” Rebar	955401.58	1508446.07	971.30’

Figure 2. Site Plan

Figure 2. Site Plan (con't)

Figure 2. Site Plan (con't)

Six cross-sections were established along the stream to document channel conditions. Permanent markers were installed to locate the ends of the cross-section. The permanent

markers are metal pins consisting of approximately 2-foot lengths of re-bar driven flush with the ground surface. Wooden stakes were driven in the ground at each rebar pin and marked with the cross-section identifier.

Vegetation plots have not been established on this project. Appendix B contains a list of the species and quantities of vegetation planted.

1.2.2 Longitudinal Profile

A longitudinal profile of the restored stream was conducted. The profile began at the waterfall, which is the upstream most location of restoration and ended at the tie in with the Fisher River. Standard differential leveling techniques and equipment were employed to measure the elevations of thalweg, water surface, and bankfull. These measurements were taken at the head of each riffle, top of pool, max pool, and at each structure. In addition, the maximum scour pool depth and the end of the scour pool were taken below each cross-vane to monitor the change in the scour pool depth.

1.2.3 Cross-Sections

Six cross-sections were surveyed to establish the dimensions of the channel using standard differential leveling techniques and equipment (Figure 2). These cross-sections were tied to the longitudinal profile and the as-built survey and were assigned station identification numbers based on the as-built survey. Of the six cross-sections, three were riffles and three were pools. The cross-sections varied in length from 75 to 100 feet long with wooden stake on each side of the channel and a rebar stake adjacent to the stake on the right bank. Data was analyzed using the methods recommended by Dave Rosgen (1996). From the field data, the bankfull cross-sectional area, width, depth, and entrenchment ratio were determined. Appendix A contains the data for each cross-section including pictures of each cross-section.

1.2.4 Pebble Count

A pebble count was taken at each cross-section to determine the size distribution of the channel materials. The Modified Wolman Pebble Count was used to account for both bed and bank materials. One hundred counts were randomly taken beginning at the left bankfull station and proceeding down the bank into the bed and back up to the right bankfull station. The data was analyzed using methods recommended by Dave Rosgen (1996). A spreadsheet was developed to calculate the cumulative percent by particle size class. These values were plotted on log-normal scale. Due to the fineness of the samples, the D50 and the D84 particle sizes were calculated from the data and not the graph. These values are listed on the graphs contained in Appendix A.

1.2.5 Vegetation

Vegetative belt transects were not established on this project due to storm damage that occurred prior to vegetation monitoring. Vegetation plots will be established during the Year 1 monitoring period in Winter 2003 after vegetation has been replanted.

1.2.6 Photograph Log

Photographs were taken to depict existing conditions for the stream channel, cross-sections, structures, and vegetation. To document channel conditions, four photographs were taken at each cross-section: looking upstream, downstream, towards the left bank, and towards the right bank. Additional photographs were taken at areas of concern that included a couple of cross-vanes. The stream channel photo log is included in Appendix C. To document existing vegetative conditions, a photograph was taken looking upstream and downstream to show the bench zone and looking toward right bank and toward left bank, to show the buffer zone. The vegetation photo log is included in Appendix C.

1.3 Project Contacts

WRP Project Manager:	Jeff Jurek 1619 Mail Service Center Raleigh, NC 27699-1619 Phone: (919)733-5316
Design Firm:	Earth Tech of North Carolina, INC. 701 Corporate Center Drive, Suite 475 Raleigh, NC 27607 Phone: (919)854-6200
Contractor:	Tom Jones West Contracting, Inc. 2608 Airport Road (PO Box 310) Marble, NC 28905 Phone: (828)837-2280

2.0 SUCCESS CRITERIA

The following success criteria are recommended for the Beaver Creek Stream Restoration Project. These criteria are suggested based on past projects and guidance from NCWRP.

2.1 Dimension, Pattern and Profile

The dimension, pattern, and profile of the stream should show no radical change during the 5-year monitoring period. To determine this, the longitudinal profile and cross-sections should be re-surveyed annually as described in Section 1.2. Cross-sections

should be overlaid to verify no significant change in the dimension from year to year. Similarly, the longitudinal profile should be overlaid to confirm a stable bed profile. Due to the number of rootwads located in the majority of the meanders, the pattern should be confirmed through visual observation. If a rootwad has washed out or there are signs of erosion, the radius of curvature should be measured and compared to the as-built mapping.

2.2 Materials

A Modified Wolman Pebble Count should be taken at each cross-section to determine the change in the surface material below bankfull as described in Section 1.2. The pools should contain a finer material than the riffles, which should show coarsening over the 5-year monitoring period. The pebble count should be taken once a year during the annual monitoring period. The consecutive pebble counts should be plotted on the same graph. In addition, the D50 and D84 should be compared to determine changes in the surface material of the cross-section.

2.3 Photograph Points

Photographs should be taken as described in Section 1.2 and compared to the as-built photos. A qualitative assessment should be made with regard to the vegetation, cross-vanes, and the general stability of the reach. Any significant changes should be discussed and highlighted in the report.

2.4 Vegetation

The success criteria for tree seedlings in the riparian buffer zones are defined by the Division of Water Quality to be 320 stems/acre after five years. Vegetation should be monitored annually.

3.0 MONITORING

Future monitoring of the site is necessary to determine if the success criteria for mitigation have been met. The monitoring shall fulfill the requirements of the NC Division of Water Quality. The duration of the monitoring shall be 5 years from the end of construction, which includes channel modifications and vegetation planting. On this project, the channel construction was completed in August 2002. However, due to weather conditions, the vegetation planting was not completed until January 2003. The annual monitoring of the site should be conducted during the late fall or early winter of each year beginning in 2003 as indicated by Table 3. Earth Tech has provided the as-built conditions as outlined in this report and will provide the Year 1 monitoring. A separate firm, to be announced at a later date, will monitor the site during Years 2-5.

Table 3. 5-Year Monitoring Schedule

Monitoring Year	Monitoring Date	Monitoring Firm
Year 1*	Late Fall/Early Winter 2003	Earth Tech
Year 2	Late Fall/Early Winter 2004	TBA
Year 3*	Late Fall/Early Winter 2005	TBA
Year 4	Late Fall/Early Winter 2006	TBA
Year 5*	Late Fall/Early Winter 2007	TBA

*These monitoring reports should be sent to USACOE and NCDWQ, 401-Wetlands Unit at the end of the yearly monitoring period.

This monitoring will be conducted using the methodologies described in Section 1.2 for longitudinal profile, cross-sections, pebble counts, vegetation monitoring, and photo reference points.

4.0 MITIGATION

This project consisted of restoring 4,670 linear foot of channelized rural stream and converting it into 4,210 linear feet of Priority I stream restoration (Rosgen, 1997) as measured along the centerline, or 4,266 feet along the thalweg. Included in this restoration was the installation of 28 cross-vanes, 50 rootwads, 10 j-hook vanes, and 6 double wing deflectors. A 50-ft riparian buffer was established along either side of the stream channel for the entire length of channel. A dedicated easement will contain the vegetative buffer and stream channel.

The plan sheets in Appendix D contain the As-Built Plans for the project. These plans depict the stream restoration in plan view along the centerline of the project post-construction.

5.0 MAINTENANCE AND CONTINGENCY PLANS

6.0 REFERENCES

Radford, A.E., H.E. Ahles and G.R. Bell. 1968. *Manual of the Vascular Flora of the Carolinas.* The University of North Carolina Press, Chapel Hill, North Carolina.

Rosgen, D. L. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

Rosgen, D. L. 1997. "A Geomorphological Approach to Restoration of Incised Rivers." Proceedings of the Conference on Management of Landscapes Disturbed by Channel Incision. Edited by S. S. Y. Wang, E. J. Langendoen, and F. D. Shields, Jr.

Schafale, M.P. and A.S. Weakley. 1990. *Classification of the Natural Communities of North Carolina, Third Approximation*. North Carolina Natural Heritage Program, Division of Parks and Recreation, NCDENR, Raleigh, NC.

Smith, C. L. 2001. "Guidelines for Riparian Buffer Restoration." Prepared for the Department of Environment and Natural Resources, Division of Water Quality, Wetlands Restoration Program. Raleigh, North Carolina.

APPENDICES

APPENDIX A
AS-BUILT STREAM CONDITIONS

Profile

The longitudinal profile was modified from the design during construction due to cut and fill requirements. The bed was dropped in two-½ foot increments at stations 39+00 and 38+00 using two cross-vanes. The cross-vane at 38+00 was added during construction since it was not shown on the plans. The longitudinal profile reflects these two drops.

The design profile was not plotted over the as-built longitudinal profile since the design profile was based on centerline lengths while the as-built profile was measured along the thalweg of the channel. A direct overlay of the 1st year monitoring profile on the as-built profile will better depict changes in the bed. Successive overlays in the 5-year monitoring period are recommended.

Cross-Sections

The channel cross-sectional area that was designed was based on an E-type channel with an 11.2 width-to-depth ratio. The channel that was constructed had a width-to-depth ratio that ranged from 9.8 to 10.8. The cross-sectional area for two of the as-built riffles was larger than the pools and the design riffle. However, the pools were built with a smaller cross-sectional area than the design pool.

The following table (Table 1) contains a summary of the design and as-built cross-sectional information for comparison. The complete set of as-built data including photographs and graphs follows this write-up.

Table 1. Summary of Cross-Section Data

	Riffle Cross-Sections				Pool Cross-Sections			
	Design	51+10	41+10	18+50	Design	47+12	28+50	16+10
Bankfull Area (sq. ft.)	70.0	104.6	103.8	67.4	85.0	75.2	55.1	66.0
Bankfull Width (ft.)	28.0	33.6	33.0	25.7	30.0	27.4	21.9	22.0
Bankfull Max Depth (ft.)	4.2	4.6	4.8	4.3	5.5	4.8	5.0	5.2
Bankfull Mean Depth (ft.)	2.5	3.1	3.1	2.6	n/a	2.7	2.5	3.0
Bankfull Width/Depth	11.2	10.8	10.5	9.8	n/a	n/a	n/a	n/a

Pebble Count

Table 2 summarizes the pebble count data for the as-built conditions. The complete as-built pebble count data follows this write-up.

Table 2. Pebble Count Summary Data

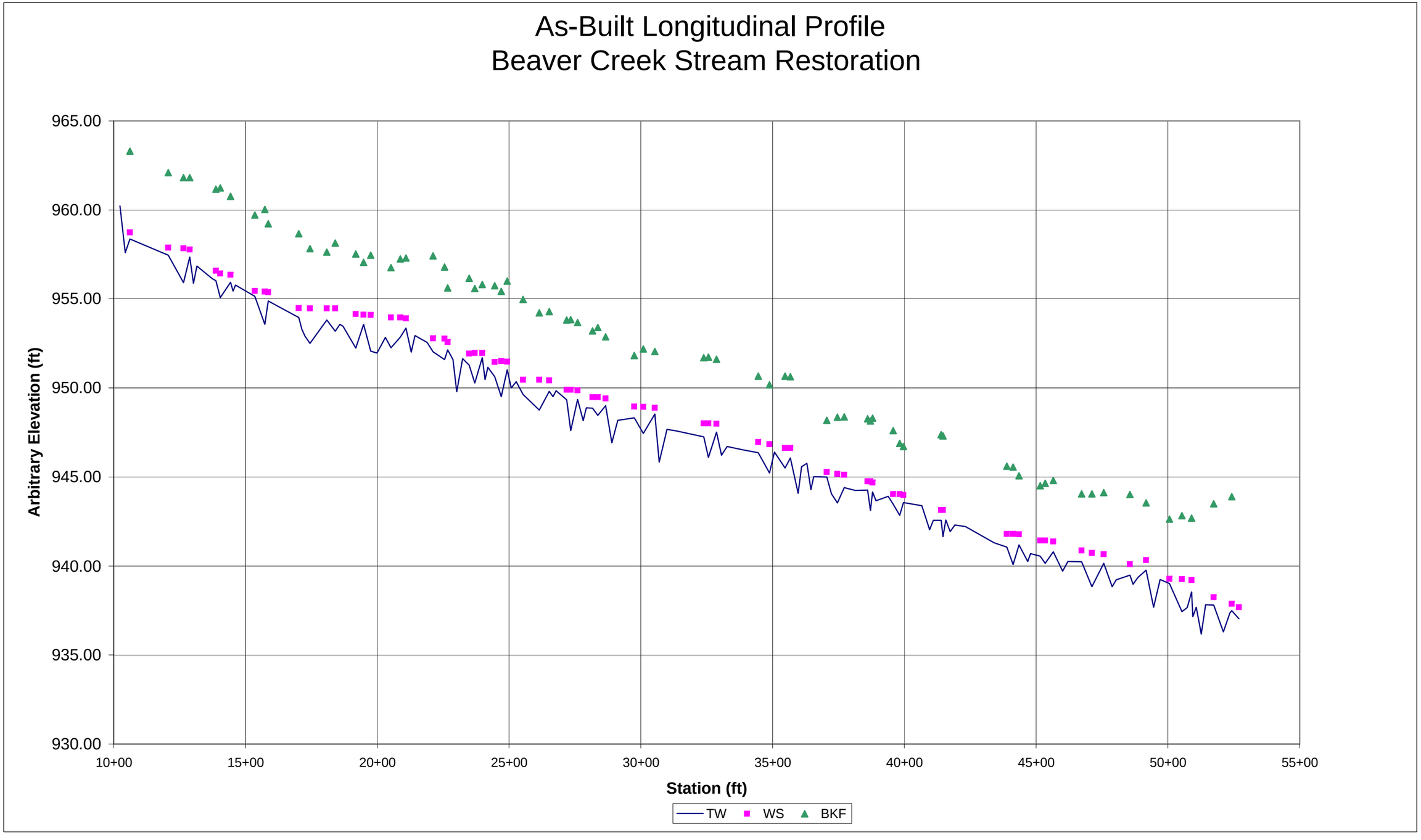
Cross-Section	**D50**	**D84**
CS 51+10-Riffle	Fine Gravel	Small Cobble
CS 47+12-Pool	Fine Sand	Coarse Gravel
CS 41+10-Riffle	Medium Gravel	Very Coarse Gravel
CS 28+50-Pool	Very Coarse Sand	Coarse Gravel
CS 18+50-Riffle	Fine Sand	Medium Sand
CS 16+10-Pool	V. Fine Sand	Coarse Sand

Field Crew:	Dan Clinton, Jan Patterson
River Basin:	Yadkin-Pee Dee
Watershed:	**Fisher River**
Stream Reach:	Beaver Creek
Draiange Area:	5.9 sq. mi.
Date:	1/9/2003
Description:	LONGITUDINAL PROFILE

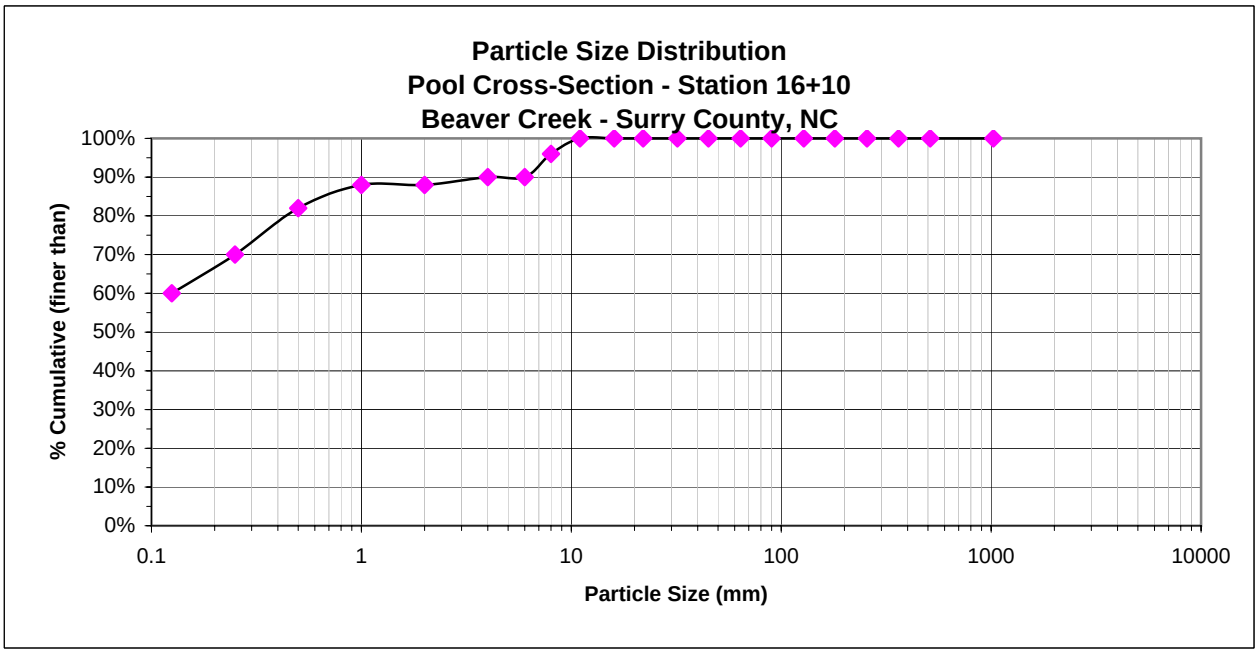
Station	TW (FS)	TW	WS (FS)	WS	BKF (FS)	BKF	Notes	HI
10+24.0	7.09	960.22					Top Bedrock	967.31
10+44.0	9.72	957.59					pool below	967.31
10+62.0	8.95	958.36	8.57	958.74	4.00	963.31	Top Riffle	967.31
12+07.0	9.85	957.46	9.44	957.87	5.22	962.09	XVANE-Top Pool	967.31
12+65.0	11.40	955.91	9.46	957.85	5.50	961.81	Max Pool	967.31
12+89.0	9.96	957.35	9.54	957.77	5.49	961.82	XVANE-Top Riffle	967.31
13+03.0	11.42	955.89					XVANE-Scour Pool	967.31
13+16.0	10.46	956.85					End Scour Pool	967.31
13+73.0	11.16	956.15					Log Vane	967.31
13+88.0	11.28	956.03	10.72	956.59	6.15	961.16	Top Pool	967.31
14+04.0	12.24	955.07	10.88	956.43	6.08	961.23	Max Pool	967.31
14+43.0	11.38	955.93	10.95	956.36	6.55	960.76	XVANE-Top Riffle	967.31
14+53.0	11.86	955.45					XVANE-Scour Pool	967.31
14+62.0	11.53	955.78					End Scour Pool	967.31
15+36.0	12.17	955.14	11.86	955.45	7.60	959.71	Top Pool	967.31
15+73.0	13.73	953.58	11.90	955.41	7.28	960.03	Max Pool	967.31
15+86.0	12.43	954.88	11.93	955.38	8.09	959.22	Top Riffle	967.31
17+02.0	8.91	953.96	8.38	954.49	4.20	958.67	Log XVANE	962.87
17+14.0	9.58	953.29					XVANE-Scour Pool	962.87
17+26.0	9.27	952.90					End Scour Pool	962.87
17+45.0	10.36	952.51	8.40	954.47	5.04	957.83	Top Pool	962.87
18+08.0	9.06	953.81	8.40	954.47	5.23	957.64	Max Pool	962.87
18+40.0	9.68	953.19	8.40	954.47	4.73	958.14	XVANE-Top Riffle	962.87
18+58.0	9.30	953.57					XVANE-Scour Pool	962.87
18+70.0	9.41	953.46					End Scour Pool	962.87
19+19.0	10.62	952.25	8.72	954.15	5.35	957.52	J-Hook/Top Pool/XSEC	962.87
19+48.0	9.29	953.58	8.76	954.11	5.82	957.05	Max Pool	962.87
19+75.0	10.80	952.07	8.78	954.09	5.42	957.45	XVANE-Top Riffle	962.87
19+99.0	10.90	951.97					XVANE-Scour Pool	962.87
20+31.0	10.04	952.83					Intermediate Point	962.87
20+52.0	10.61	952.26	8.92	953.95	6.12	956.75	Top Pool	962.87
20+88.0	10.02	952.85	8.92	953.95	5.63	957.24	Max Pool	962.87
21+09.0	7.71	953.37	7.17	953.91	3.78	957.30	XVANE-Top Riffle	961.08
21+29.0	9.07	952.01					XVANE-Scour Pool	961.08
21+43.0	8.14	952.94					End Scour Pool	961.08
21+89.0	8.52	952.56					DBL Wing Deflector	961.08
22+11.0	9.05	952.03	8.29	952.79	3.65	957.43	Top Pool	961.08
22+55.0	7.52	951.59	6.34	952.77	2.31	956.80	Max Pool	959.11
22+67.0	6.97	952.14	6.54	952.57	3.49	955.62	XVANE-Top Riffle	959.11
22+87.0	7.52	951.59					Intermediate Point	959.11
23+02.0	9.32	949.79					Problem	959.11
23+24.0	7.47	951.64					End Scour Pool/J-hook	959.11
23+49.0	7.83	951.28	7.18	951.93	2.94	956.17	Top Pool	959.11

23+70.0	8.83	950.28	7.15	951.96	3.52	955.59	Max Pool	959.11
23+98.0	7.41	951.7	7.14	951.97	3.29	955.82	XVANE-Problem	959.11
24+09.0	8.64	950.47					XVANE-Scour Pool	959.11
24+20.0	7.96	951.15					End Scour Pool	959.11
24+46.0	8.47	950.64	7.66	951.45	3.36	955.75	Top Pool/Tributray	959.11
24+71.0	9.6	949.51	7.6	951.51	3.68	955.43	Max Pool	959.11
24+93.0	8.09	951.02	7.63	951.48	3.1	956.01	XVANE-Top Riffle	959.11
25+08.0	9.1	950.01					XVANE-Scour Pool	959.11
25+27.0	8.76	950.35					End Scour Pool	959.11
25+53.0	9.47	949.64	8.65	950.46	4.14	954.97	Top Pool	959.11
26+15.0	10.35	948.76	8.66	950.45	4.89	954.22	Max Pool	959.11
26+52.0	9.3	949.81	8.69	950.42	4.82	954.29	XVANE-Top Riffle	959.11
26+67.0	9.59	949.52					XVANE-Scour Pool	959.11
26+79.0	9.27	949.84					End Scour Pool	959.11
27+19.0	9.77	949.34	9.22	949.89	5.3	953.81	Top Pool	959.11
27+34.0	11.5	947.61	9.22	949.89	5.27	953.84	Max Pool	959.11
27+60.0	9.75	949.36	9.25	949.86	5.43	953.68	Log XVANE-Top Riffle	959.11
27+81.0	10.94	948.17					XVANE-Scour Pool	959.11
27+93.0	10.22	948.89					End Scour Pool	959.11
28+17.0	10.24	948.87	9.63	949.48	5.91	953.20	Top Pool	959.11
28+37.0	10.64	948.47	9.63	949.48	5.71	953.40	Max Pool	959.11
28+67.0	10.1	949.01	9.71	949.40	6.23	952.88	XVANE-Top Riffle	959.11
28+90.0	12.18	946.93					XVANE-Scour Pool	959.11
29+13.0	10.93	948.18					End Scour Pool	959.11
29+75.0	8.41	948.33	7.78	948.96	4.92	951.82	Log vane-Top Pool	956.74
30+10.0	9.29	947.45	7.81	948.93	4.55	952.19	Max Pool	956.74
30+53.0	8.21	948.53	7.86	948.88	4.69	952.05	XVANE-Top Riffle	956.74
30+70.0	10.9	945.84					XVANE-Scour Pool	956.74
30+99.0	9.06	947.68					End Scour Pool	956.74
31+35.0	9.15	947.59					DBL Wing Deflector	956.74
32+39.0	9.48	947.26	8.74	948.00	5.04	951.70	Top Pool	956.74
32+56.0	10.64	946.10	8.74	948.00	5.00	951.74	Max Pool	956.74
32+87.0	9.22	947.52	8.75	947.99	5.12	951.62	XVANE-Top Riffle	956.74
33+06.0	10.52	946.22					XVANE-Scour Pool	956.74
33+27.0	10.03	946.71					End Scour Pool	956.74
33+89.0	10.22	946.52					DBL Wing Deflector	956.74
34+46.0	10.37	946.37	9.79	946.95	6.08	950.66	Log vane-Top Pool	956.74
34+88.0	11.51	945.23	9.91	946.83	6.57	950.17	Max Pool/XSEC	956.74
35+07.0	10.35	946.39					Rock Vane	956.74
35+47.0	11.23	945.51	10.12	946.62	6.07	950.67	Max Pool	956.74
35+67.0	10.68	946.06	10.12	946.62	6.11	950.63	XVANE-Top Riffle	956.74
35+97.0	10.42	944.09					XVANE-Scour Pool	954.51
36+10.0	8.94	945.57					End Scour Pool	954.51
36+30.0	8.75	945.76					XVANE	954.51
36+45.0	10.22	944.29					XVANE-Scour Pool	954.51
36+56.0	9.50	945.01					End Scour Pool	954.51
37+06.0	9.52	944.99	9.24	945.27	6.32	948.19	Top Pool	954.51
37+23.0	10.45	944.06					Log Vane	954.51
37+46.0	10.96	943.55	9.33	945.18	6.15	948.36	Max Pool	954.51
37+72.0	10.10	944.41	9.39	945.12	6.14	948.37	Top Riffle	954.51
38+13.0	10.27	944.24					Tributary	954.51
38+60.0	10.24	944.27	9.76	944.75	6.24	948.27	Top Pool	954.51

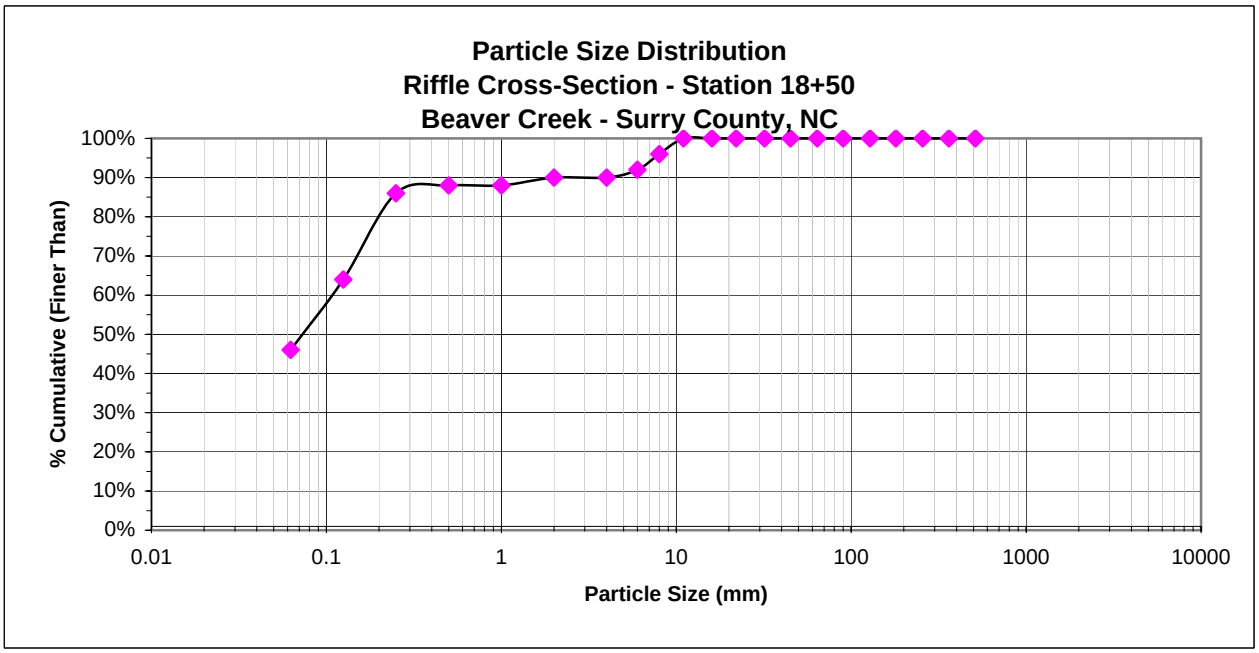
38+71.0	11.39	943.12	9.75	944.76	6.36	948.15	Max Pool	954.51
38+80.0	10.36	944.15	9.82	944.69	6.2	948.31	XVANE	954.51
38+93.0	10.84	943.67					XVANE-Scour Pool	954.51
39+13.0	10.74	943.77					End Scour Pool	954.51
39+38.0	10.60	943.91					Intermediate Point	954.51
39+57.0	11.03	943.48	10.48	944.03	6.9	947.61	Top Pool	954.51
39+82.0	11.67	942.84	10.48	944.03	7.62	946.89	Max Pool	954.51
39+96.0	10.94	943.57	10.53	943.98	7.79	946.72	Top Riffle	954.51
40+66.0	11.13	943.38					XVANE	954.51
40+96.0	12.47	942.04					XVANE-Scour Pool	954.51
41+10.0	11.94	942.57					End Scour Pool	954.51
41+39.0	11.94	942.57	11.37	943.14	7.13	947.38	Top Pool	954.51
41+47.0	12.86	941.65	11.36	943.15	7.21	947.30	Max Pool	954.51
41+57.0	11.93	942.58					XVANE-Top Riffle	954.51
41+74.0	12.57	941.94					XVANE-Scour Pool	954.51
41+92.0	12.20	942.31					End Scour Pool	954.51
42+32.0	7.76	942.21					XVANE	949.97
43+41.0	8.66	941.31					DBL Wing Deflector	949.97
43+89.0	8.91	941.06	8.18	941.79	4.36	945.61	Top Pool	949.97
44+13.0	9.89	940.08	8.18	941.79	4.42	945.55	Max Pool	949.97
44+35.0	8.78	941.19	8.2	941.77	4.9	945.07	XVANE-Top Riffle	949.97
44+68.0	9.71	940.26					XVANE-Scour Pool	949.97
44+79.0	9.27	940.70					End Scour Pool	949.97
45+15.0	9.41	940.56	8.54	941.43	5.47	944.50	Top Pool	949.97
45+34.0	9.82	940.15	8.54	941.43	5.33	944.64	Max Pool	949.97
45+65.0	9.17	940.80	8.6	941.37	5.16	944.81	XVANE-Top Riffle	949.97
46+00.0	10.26	939.71					XVANE-Scour Pool	949.97
46+20.0	9.71	940.26					End Scour Pool	949.97
46+72.0	9.74	940.23	9.11	940.86	5.91	944.06	Log vane-Top Pool	949.97
47+12.0	11.14	938.83	9.25	940.72	5.92	944.05	Max Pool-XSEC	949.97
47+56.0	9.82	940.15	9.31	940.66	5.85	944.12	XVANE-Top Riffle	949.97
47+88.0	11.13	938.84					XVANE-Scour Pool	949.97
48+04.0	10.74	939.23					End Scour Pool	949.97
48+56.0	10.49	939.48	9.87	940.10	5.96	944.01	XVANE	949.97
48+68.0	9.44	938.97					XVANE-Scour Pool	948.41
48+87.0	9.05	939.36					End Scour Pool	948.41
49+17.0	8.65	939.76	8.09	940.32	4.86	943.55	XVANE	948.41
49+46.0	10.73	937.68					XVANE-Scour Pool	948.41
49+70.0	9.17	939.24					End Scour Pool	948.41
50+06.0	9.4	939.01	9.13	939.28	5.78	942.63	Rock Vane-Top Pool	948.41
50+53.0	10.98	937.43	9.15	939.26	5.58	942.83	Max Pool	948.41
50+73.0	10.75	937.66					Intermediate Point	948.41
50+90.0	9.87	938.54	9.2	939.21	5.73	942.68	XVANE	948.41
50+94.0	11.25	937.16					XVANE-Scour Pool	948.41
51+07.0	10.72	937.69					End Scour Pool	948.41
51+27.0	12.23	936.18					Intermediate Point	948.41
51+43.0	10.58	937.83					Intermediate Point	948.41
51+74.0	10.61	937.80	10.17	938.24	4.92	943.49	XVANE	948.41
52+10.0	12.11	936.30					XVANE-Scour Pool	948.41
52+35.0	11.05	937.36					End Scour Pool	948.41
52+42.0	10.92	937.49	10.53	937.88	4.52	943.89	XVANE-Scour Pool	948.41
52+70.0	11.38	937.03	10.72	937.69			End Scour Pool	948.41


As-Built Longitudinal Profile
Beaver Creek Stream Restoration
965.00
960.00
955.00
950.00
945.00
940.00
935.00
930.00
Arbitrary Elevation (ft)
10+00
15+00
20+00
25+00
30+00
35+00
40+00
45+00
50+00
55+00
Station (ft)
TW
WS
BKF

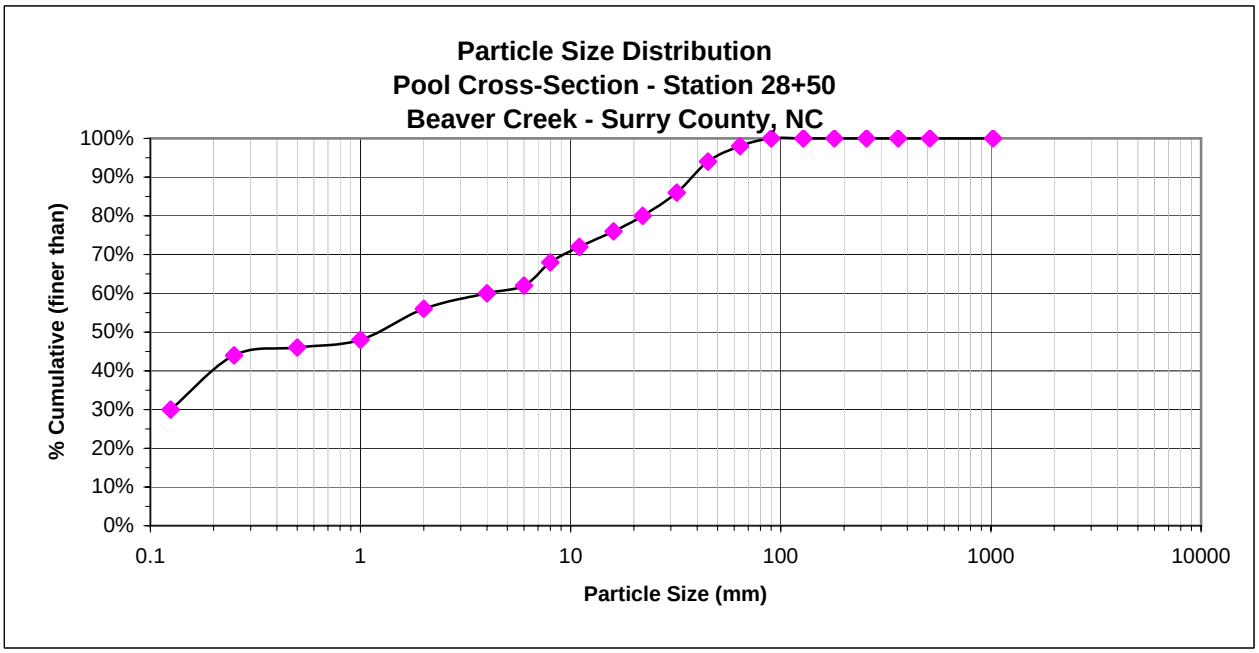
PEBBLE COUNT								
Site: Beaver Creek, Pool Station 16+10						10/29/2002		
Party: Ben Goetz, Dan Clinton						Reach: WRP Restoration		
Particle Counts								
Inches	Particle	Millimeter		Pool #3		Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	**S/C**	38		38	38%	38%
	Very Fine	.062 - .125	**S**	22		22	22%	60%
	Fine	.125 - .25	**A**	10		10	10%	70%
	Medium	.25 - .50	**N**	12		12	12%	82%
	Coarse	.50 - 1.0	**D**	6		6	6%	88%
.04 -.08	Very Coarse	1.0 - 2.0	**S**	0		0	0%	88%
.08 - .16	Very Fine	2.0 - 4.0		2		2	2%	90%
.16 - .22	Fine	4.0 - 5.7	**G**	0		0	0%	90%
.22 - .31	Fine	5.7 - 8.0	**R**	6		6	6%	96%
.31 - .44	Medium	8.0 - 11.3	**A**	4		4	4%	100%
.44 - .63	Medium	11.3 - 16.0	**V**	0		0	0%	100%
.63 - .89	Coarse	16.0 - 22.6	**E**	0		0	0%	100%
.89 - 1.26	Coarse	22.6 - 32.0	**L**	0		0	0%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0	**S**	0		0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0		0		0	0%	100%
2.5 - 3.5	Small	64 - 90	**C**	0		0	0%	100%
3.5 - 5.0	Small	90 - 128	**O**	0		0	0%	100%
5.0 - 7.1	Large	128 - 180	**B**	0		0	0%	100%
7.1 - 10.1	Large	180 - 256	**L**	0		0	0%	100%
10.1 - 14.3	Small	256 - 362	**B**	0		0	0%	100%
14.3 - 20	Small	362 - 512	**L**	0		0	0%	100%
20 - 40	Medium	512 - 1024	**D**	0		0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	**R**	0		0	0%	100%
	Bedrock		**BDRK**	0		0	0%	100%
			Totals	**100**		**100**	**100%**	**100%**



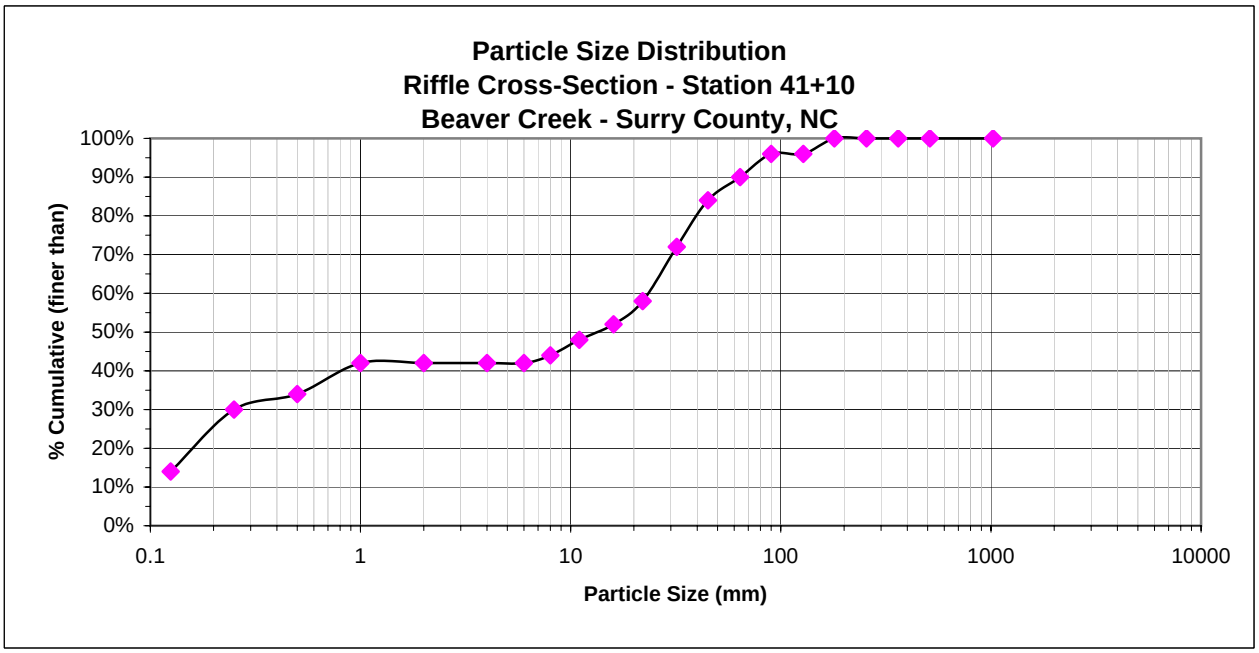
PEBBLE COUNT								
Site: Beaver Creek, Riffle Station 18+50						10/29/2002		
Party: Ben Goetz, Dan Clinton						Reach: WRP Restoration		
Particle Counts								
Inches	Particle	Millimeter		Bank	Bed	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	**S/C**	14	10	24	24%	24%
	Very Fine	.062 - .125	**S**	14	8	22	22%	46%
	Fine	.125 - .25	**A**	6	12	18	18%	64%
	Medium	.25 - .50	**N**	10	12	22	22%	86%
	Coarse	.50 - 1.0	**D**	0	2	2	2%	88%
.04 -.08	Very Coarse	1.0 - 2.0	**S**	0	0	0	0%	88%
.08 - .16	Very Fine	2.0 - 4.0		0	2	2	2%	90%
.16 - .22	Fine	4.0 - 5.7	**G**	0	0	0	0%	90%
.22 - .31	Fine	5.7 - 8.0	**R**	0	2	2	2%	92%
.31 - .44	Medium	8.0 - 11.3	**A**	0	4	4	4%	96%
.44 - .63	Medium	11.3 - 16.0	**V**	0	4	4	4%	100%
.63 - .89	Coarse	16.0 - 22.6	**E**	0	0	0	0%	100%
.89 - 1.26	Coarse	22.6 - 32.0	**L**	0	0	0	0%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0	**S**	0	0	0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0		0	0	0	0%	100%
2.5 - 3.5	Small	64 - 90	**C**	0	0	0	0%	100%
3.5 - 5.0	Small	90 - 128	**O**	0	0	0	0%	100%
5.0 - 7.1	Large	128 - 180	**B**	0	0	0	0%	100%
7.1 - 10.1	Large	180 - 256	**L**	0	0	0	0%	100%
10.1 - 14.3	Small	256 - 362	**B**	0	0	0	0%	100%
14.3 - 20	Small	362 - 512	**L**	0	0	0	0%	100%
20 - 40	Medium	512 - 1024	**D**	0	0	0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	**R**	0	0	0	0%	100%
	Bedrock		**BDRK**	0	0	0	0%	100%
			Totals	**44**	**56**	**100**	**100%**	**100%**



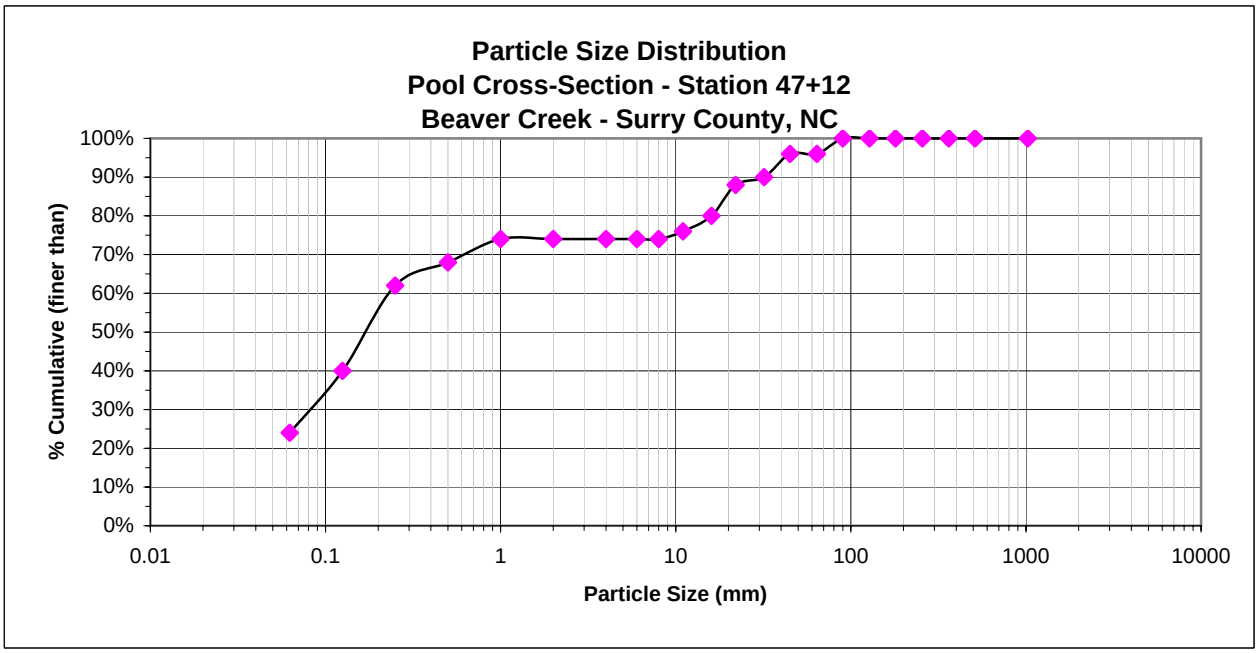
PEBBLE COUNT								
Site: Beaver Creek, Pool 28+50						10/29/2002		
Party: Ben Goetz, Dan Clinton						Reach: WRP Restoration		
Particle Counts								
Inches	Particle	Millimeter		Pool #2		Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	**S/C**	16		16	16%	16%
	Very Fine	.062 - .125	**S**	14		14	14%	30%
	Fine	.125 - .25	**A**	14		14	14%	44%
	Medium	.25 - .50	**N**	2		2	2%	46%
	Coarse	.50 - 1.0	**D**	2		2	2%	48%
.04 -.08	Very Coarse	1.0 - 2.0	**S**	8		8	8%	56%
.08 - .16	Very Fine	2.0 - 4.0		4		4	4%	60%
.16 - .22	Fine	4.0 - 5.7	**G**	2		2	2%	62%
.22 - .31	Fine	5.7 - 8.0	**R**	6		6	6%	68%
.31 - .44	Medium	8.0 - 11.3	**A**	4		4	4%	72%
.44 - .63	Medium	11.3 - 16.0	**V**	4		4	4%	76%
.63 - .89	Coarse	16.0 - 22.6	**E**	4		4	4%	80%
.89 - 1.26	Coarse	22.6 - 32.0	**L**	6		6	6%	86%
1.26 - 1.77	Very Coarse	32.0 - 45.0	**S**	8		8	8%	94%
1.77 - 2.5	Very Coarse	45.0 - 64.0		4		4	4%	98%
2.5 - 3.5	Small	64 - 90	**C**	2		2	2%	100%
3.5 - 5.0	Small	90 - 128	**O**	0		0	0%	100%
5.0 - 7.1	Large	128 - 180	**B**	0		0	0%	100%
7.1 - 10.1	Large	180 - 256	**L**	0		0	0%	100%
10.1 - 14.3	Small	256 - 362	**B**	0		0	0%	100%
14.3 - 20	Small	362 - 512	**L**	0		0	0%	100%
20 - 40	Medium	512 - 1024	**D**	0		0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	**R**	0		0	0%	100%
	Bedrock		**BDRK**	0		0	0%	100%
			Totals	**100**		**100**	**100%**	**100%**



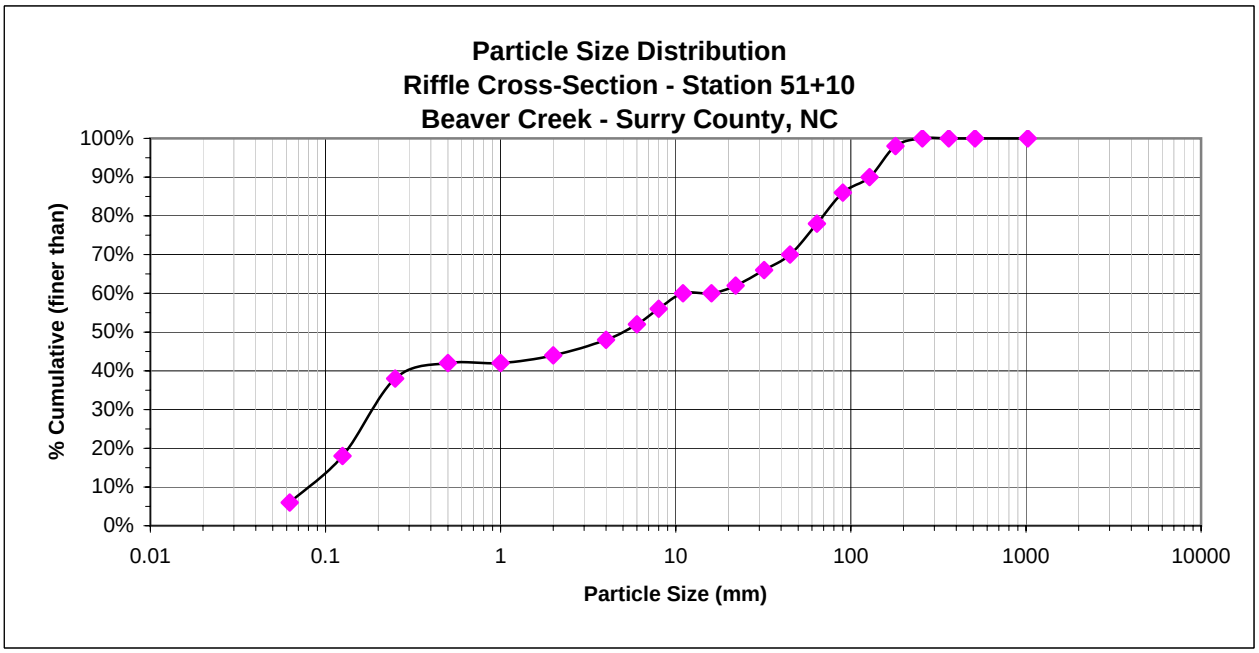
PEBBLE COUNT								
Site: Beaver Creek, Riffle Station 41+10						10/29/2002		
Party: Ben Goetz, Dan Clinton						Reach: WRP Restoration		
Particle Counts								
Inches	Particle	Millimeter		Riffle #2		Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	**S/C**	6		6	6%	6%
	Very Fine	.062 - .125	**S**	8		8	8%	14%
	Fine	.125 - .25	**A**	16		16	16%	30%
	Medium	.25 - .50	**N**	4		4	4%	34%
	Coarse	.50 - 1.0	**D**	8		8	8%	42%
.04 -.08	Very Coarse	1.0 - 2.0	**S**	0		0	0%	42%
.08 - .16	Very Fine	2.0 - 4.0		0		0	0%	42%
.16 - .22	Fine	4.0 - 5.7	**G**	0		0	0%	42%
.22 - .31	Fine	5.7 - 8.0	**R**	2		2	2%	44%
.31 - .44	Medium	8.0 - 11.3	**A**	4		4	4%	48%
.44 - .63	Medium	11.3 - 16.0	**V**	4		4	4%	52%
.63 - .89	Coarse	16.0 - 22.6	**E**	6		6	6%	58%
.89 - 1.26	Coarse	22.6 - 32.0	**L**	14		14	14%	72%
1.26 - 1.77	Very Coarse	32.0 - 45.0	**S**	12		12	12%	84%
1.77 - 2.5	Very Coarse	45.0 - 64.0		6		6	6%	90%
2.5 - 3.5	Small	64 - 90	**C**	6		6	6%	96%
3.5 - 5.0	Small	90 - 128	**O**	0		0	0%	96%
5.0 - 7.1	Large	128 - 180	**B**	4		4	4%	100%
7.1 - 10.1	Large	180 - 256	**L**	0		0	0%	100%
10.1 - 14.3	Small	256 - 362	**B**	0		0	0%	100%
14.3 - 20	Small	362 - 512	**L**	0		0	0%	100%
20 - 40	Medium	512 - 1024	**D**	0		0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	**R**	0		0	0%	100%
	Bedrock		**BDRK**	0		0	0%	100%
			Totals	**100**		**100**	**100%**	**100%**



PEBBLE COUNT								
Site: Beaver Creek, Pool Station 47+12						10/29/2002		
Party: Ben Goetz, Dan Clinton						Reach: WRP Restoration		
Particle Counts								
Inches	Particle	Millimeter		Pool #1		Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	**S/C**	24		24	24%	24%
	Very Fine	.062 - .125	**S**	16		16	16%	40%
	Fine	.125 - .25	**A**	22		22	22%	62%
	Medium	.25 - .50	**N**	6		6	6%	68%
	Coarse	.50 - 1.0	**D**	6		6	6%	74%
.04 -.08	Very Coarse	1.0 - 2.0	**S**	0		0	0%	74%
.08 - .16	Very Fine	2.0 - 4.0		0		0	0%	74%
.16 - .22	Fine	4.0 - 5.7	**G**	0		0	0%	74%
.22 - .31	Fine	5.7 - 8.0	**R**	0		0	0%	74%
.31 - .44	Medium	8.0 - 11.3	**A**	2		2	2%	76%
.44 - .63	Medium	11.3 - 16.0	**V**	4		4	4%	80%
.63 - .89	Coarse	16.0 - 22.6	**E**	8		8	8%	88%
.89 - 1.26	Coarse	22.6 - 32.0	**L**	2		2	2%	90%
1.26 - 1.77	Very Coarse	32.0 - 45.0	**S**	6		6	6%	96%
1.77 - 2.5	Very Coarse	45.0 - 64.0		0		0	0%	96%
2.5 - 3.5	Small	64 - 90	**C**	4		4	4%	100%
3.5 - 5.0	Small	90 - 128	**O**	0		0	0%	100%
5.0 - 7.1	Large	128 - 180	**B**	0		0	0%	100%
7.1 - 10.1	Large	180 - 256	**L**	0		0	0%	100%
10.1 - 14.3	Small	256 - 362	**B**	0		0	0%	100%
14.3 - 20	Small	362 - 512	**L**	0		0	0%	100%
20 - 40	Medium	512 - 1024	**D**	0		0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	**R**	0		0	0%	100%
	Bedrock		**BDRK**	0		0	0%	100%
			Totals	**100**		**100**	**100%**	**100%**



PEBBLE COUNT								
Site: Beaver Creek, Riffle Station 51+10						10/29/2002		
Party: Ben Goetz, Dan Clinton						Reach: WRP Restoration		
Particle Counts								
Inches	Particle	Millimeter		Riffle #1		Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	**S/C**	6		6	6%	6%
	Very Fine	.062 - .125	**S**	12		12	12%	18%
	Fine	.125 - .25	**A**	20		20	20%	38%
	Medium	.25 - .50	**N**	4		4	4%	42%
	Coarse	.50 - 1.0	**D**	0		0	0%	42%
.04 -.08	Very Coarse	1.0 - 2.0	**S**	2		2	2%	44%
.08 - .16	Very Fine	2.0 - 4.0		4		4	4%	48%
.16 - .22	Fine	4.0 - 5.7	**G**	4		4	4%	52%
.22 - .31	Fine	5.7 - 8.0	**R**	4		4	4%	56%
.31 - .44	Medium	8.0 - 11.3	**A**	4		4	4%	60%
.44 - .63	Medium	11.3 - 16.0	**V**	0		0	0%	60%
.63 - .89	Coarse	16.0 - 22.6	**E**	2		2	2%	62%
.89 - 1.26	Coarse	22.6 - 32.0	**L**	4		4	4%	66%
1.26 - 1.77	Very Coarse	32.0 - 45.0	**S**	4		4	4%	70%
1.77 - 2.5	Very Coarse	45.0 - 64.0		8		8	8%	78%
2.5 - 3.5	Small	64 - 90	**C**	8		8	8%	86%
3.5 - 5.0	Small	90 - 128	**O**	4		4	4%	90%
5.0 - 7.1	Large	128 - 180	**B**	8		8	8%	98%
7.1 - 10.1	Large	180 - 256	**L**	2		2	2%	100%
10.1 - 14.3	Small	256 - 362	**B**	0		0	0%	100%
14.3 - 20	Small	362 - 512	**L**	0		0	0%	100%
20 - 40	Medium	512 - 1024	**D**	0		0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	**R**	0		0	0%	100%
	Bedrock		**BDRK**	0		0	0%	100%
			Totals	**100**		**100**	**100%**	**100%**



Field Crew:	Dan Clinton, Jan Patterson
River Basin:	Yadkin-Pee Dee
Watershed:	**Fisher River**
Stream Reach:	Beaver Creek
Date:	1/9/2003
Feature:	Pool, Station 16+10

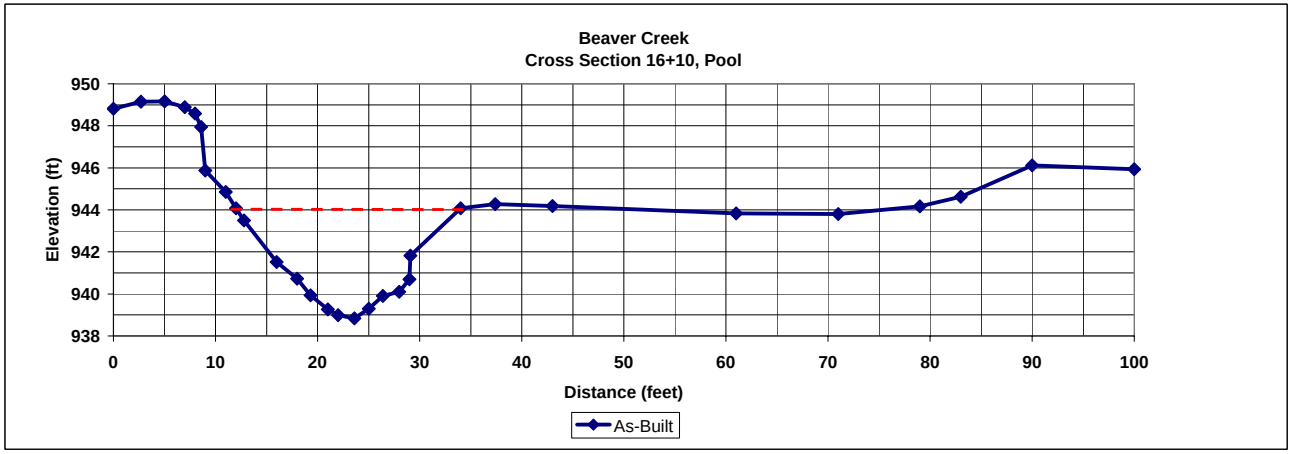
STATION (Feet)	HI (Feet)	FS (Feet)	ELEVATION (Feet)	NOTES
0+00.0	949.97	1.16	948.81	
0+02.7	949.97	0.82	949.15	Wood Stake Grd
0+05.0	949.97	0.80	949.17	
0+07.0	949.97	1.08	948.89	
0+08.0	949.97	1.39	948.58	
0+08.6	949.97	2.02	947.95	
0+09.0	949.97	4.10	945.87	
0+11.0	949.97	5.11	944.86	LBKF
0+12.0	949.97	5.90	944.07	LBKF-calc
0+12.8	949.97	6.48	943.49	
0+16.0	949.97	8.45	941.52	
0+18.0	949.97	9.25	940.72	LEW/WS
0+19.3	949.97	10.04	939.93	
0+21.0	949.97	10.70	939.27	
0+22.0	949.97	10.98	938.99	
0+23.6	949.97	11.14	938.83	TW
0+25.0	949.97	10.67	939.30	
0+26.4	949.97	10.07	939.90	
0+28.0	949.97	9.87	940.10	
0+29.0	949.97	9.27	940.70	REW/WS
0+29.1	949.97	8.15	941.82	
0+34.0	949.97	5.90	944.07	RBKF
0+37.4	949.97	5.70	944.27	RPIN Grd
0+43.0	949.97	5.78	944.19	Ponded Water
0+61.0	949.97	6.14	943.83	Ponded Water
0+71.0	949.97	6.17	943.80	Ponded Water
0+79.0	949.97	5.81	944.16	Ponded Water
0+83.0	949.97	5.34	944.63	Toe Terrace
0+90.0	949.97	3.86	946.11	Top Terrace
1+00.0	949.97	4.03	945.94	
0+37.4	949.97	4.87	945.10	Top RPIN

BANKFULL
Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	0.8	0.6	0.2
	3.2	2.6	5.0
	2.0	3.4	5.9
	1.3	4.1	4.9
	1.7	4.8	7.6
	1.0	5.1	4.9
	1.6	5.2	8.3
	1.4	4.8	7.0
	1.4	4.2	6.3
	1.6	4.0	6.5
	1.0	3.4	3.7
	0.1	2.3	0.3
	4.9	0.0	5.5
TOTALS	22.0		66.0

SUMMARY DATA (TOB)	
A(BKF)	66.0
W(BKF)	22.0
Max d	5.2
Mean d	3.0

Pool Cross-Section (16+10)



Field Crew:	Dan Clinton, Jan Patterson
River Basin:	Yadkin-Pee Dee
Watershed:	**Fisher River**
Stream Reach:	Beaver Creek
Date:	1/9/2003
Feature:	Riffle, Station 18+50

STATION (Feet)	HI (Feet)	FS (Feet)	ELEVATION (Feet)	NOTES
0+00.0	949.97	1.76	948.21	
0+00.8	949.97	1.77	948.20	Wooden Stake Grd
0+02.0	949.97	2.00	947.97	
0+03.4	949.97	2.33	947.64	LTOB
0+05.5	949.97	4.03	945.94	
0+07.3	949.97	4.71	945.26	LBKF
0+08.3	949.97	5.06	944.91	LBKF-Calc
0+09.2	949.97	5.71	944.26	
0+10.3	949.97	5.81	944.16	
0+12.3	949.97	7.01	942.96	
0+14.0	949.97	7.21	942.76	
0+14.8	949.97	7.75	942.22	
0+15.8	949.97	7.95	942.02	
0+17.2	949.97	7.93	942.04	
0+18.6	949.97	8.27	941.70	
0+18.8	949.97	8.5	941.47	LEW/WS
0+18.9	949.97	9.29	940.68	
0+20.0	949.97	9.36	940.61	TW
0+22.0	949.97	9.10	940.87	
0+24.0	949.97	9.23	940.74	
0+25.5	949.97	9.27	940.70	
0+26.5	949.97	8.52	941.45	REW/WS
0+26.6	949.97	8.21	941.76	
0+28.3	949.97	7.7	942.27	
0+30.0	949.97	7.59	942.38	
0+34.0	949.97	5.06	944.91	RBKF
0+41.8	949.97	5.04	944.93	Wooden Stake Grd
0+57.0	949.97	4.93	945.04	
0+71.0	949.97	4.91	945.06	
0+74.0	949.97	4.62	945.35	
0+79.0	949.97	3.67	946.30	
0+85.0	949.97	3.46	946.51	
0+41.8	949.97	4.97	945.00	Top RPIN

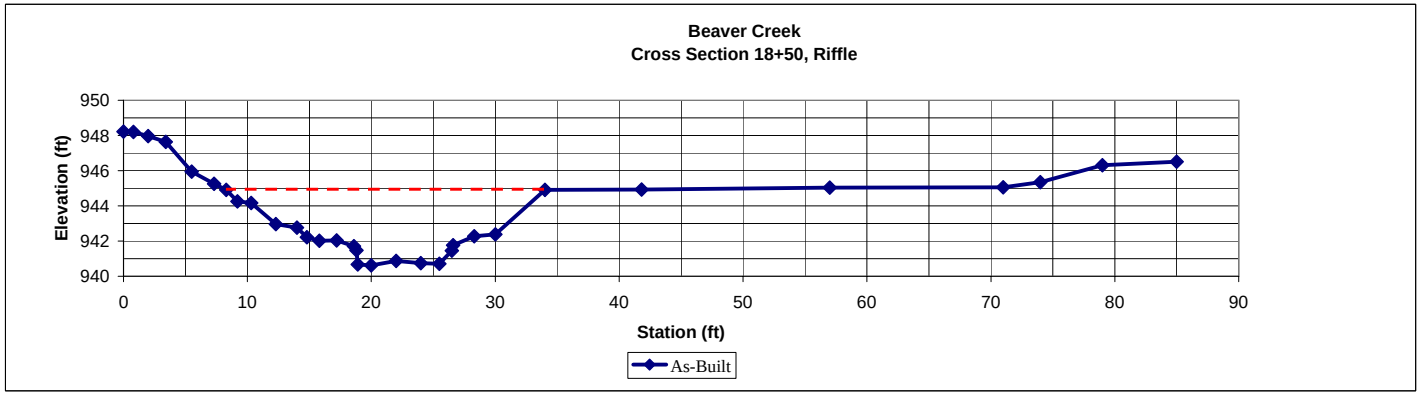
BANKFULL Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0	0	0
	0.9	0.7	0.3
	1.1	0.8	0.8
	2.0	2.0	2.7
	1.7	2.2	3.5
	0.8	2.7	1.9
	1.0	2.9	2.8
	1.4	2.9	4.0
	1.4	3.2	4.3
	0.2	3.4	0.7
	0.1	4.2	0.4
	1.1	4.3	4.7
	2.0	4.0	8.3
	2.0	4.2	8.2
	1.5	4.2	6.3
	1.0	3.5	3.8
	0.1	3.2	0.3
	1.7	2.6	4.9
	1.7	2.5	4.4
	4.0	0.0	5.1
TOTALS	25.7		67.4

SUMMARY DATA (BANKFULL)

A(BKF)	67.4	
W(BKF)	25.7	Area= A
Max d	4.3	Width= W
Mean d	2.6	Depth= D
W/D	9.8	Bankfull= BKF

Riffle Cross-Section (18+50)



Field Crew:	Dan Clinton, Jan Patterson
River Basin:	Yadkin-Pee Dee
Watershed:	**Fisher River**
Stream Reach:	Beaver Creek
Date:	1/9/2003
Feature:	Pool, Station 28+50

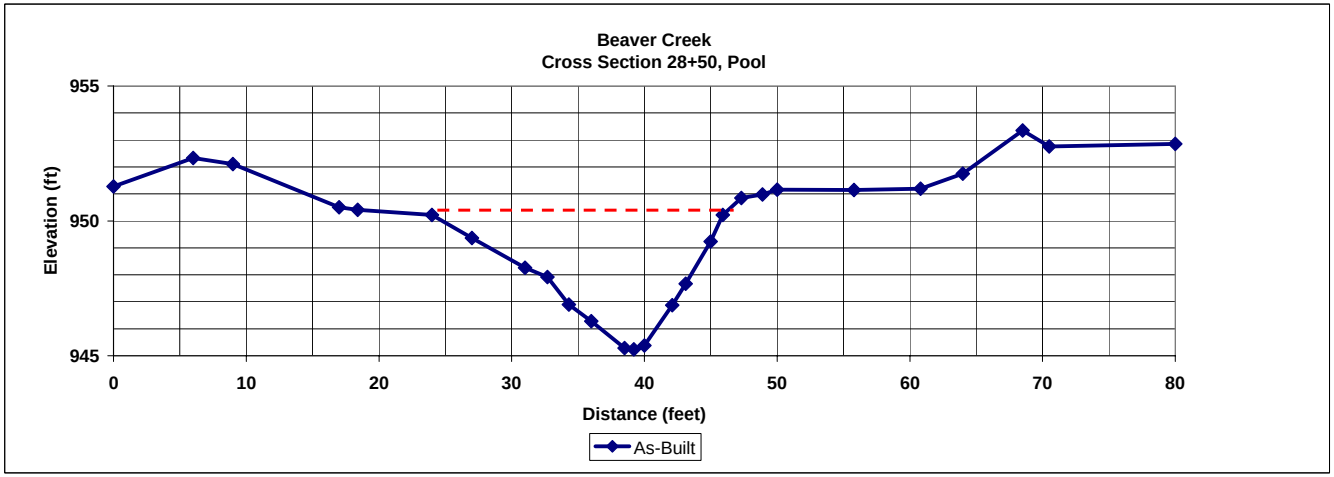
STATION (Feet)	HI (Feet)	FS (Feet)	ELEVATION (Feet)	NOTES
0+00.0	955.30	4.03	951.27	
0+06.0	955.30	2.97	952.33	
0+09.0	955.30	3.19	952.11	
0+17.0	955.30	4.79	950.51	
0+18.4	955.30	4.89	950.41	Left Stake-No Iron Pin
0+24.0	955.30	5.08	950.22	LBKF
0+27.0	955.30	5.94	949.36	
0+31.0	955.30	7.04	948.26	
0+32.7	955.30	7.38	947.92	
0+34.3	955.30	8.40	946.90	LEW/WS
0+36.0	955.30	9.02	946.28	
0+38.5	955.30	10.02	945.28	
0+39.2	955.30	10.06	945.24	TW
0+40.0	955.30	9.92	945.38	
0+42.1	955.30	8.42	946.88	REW/WS
0+43.1	955.30	7.63	947.67	
0+45.0	955.30	6.07	949.23	
0+45.9	955.30	5.08	950.22	RBKF-calc
0+47.3	955.30	4.45	950.85	RBKF
0+48.9	955.30	4.32	950.98	Grd @ RPIN
0+50.0	955.30	4.14	951.16	
0+55.8	955.30	4.15	951.15	Wooden Stake Grd
0+60.8	955.30	4.11	951.19	
0+64.0	955.30	3.55	951.75	
0+68.5	955.30	1.95	953.35	
0+70.5	955.30	2.54	952.76	
0+80.0	955.30	2.45	952.85	
0+48.9	955.30	3.43	951.87	Top RPIN

BANKFULL
Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	3.0	0.9	1.3
	4.0	2.0	5.6
	1.7	2.3	3.6
	1.6	3.3	4.5
	1.7	3.9	6.2
	2.5	4.9	11.1
	0.7	5.0	3.5
	0.8	4.8	3.9
	2.1	3.3	8.6
	1.0	2.5	2.9
	1.9	1.0	3.4
	0.9	0.0	0.4
TOTALS	21.9		55.1

SUMMARY DATA (TOB)	
A(BKF)	55.1
W(BKF)	21.9
Max d	5.0
Mean d	2.5

Pool Cross-Section (28+50)



Field Crew:	Dan Clinton, Jan Patterson
River Basin:	Yadkin-Pee Dee
Watershed:	**Fisher River**
Stream Reach:	Beaver Creek
Date:	1/9/2003
Feature:	Riffle, Station 41+10

STATION (Feet)	HI (Feet)	FS (Feet)	ELEVATION (Feet)	NOTES
0+00.0	961.86	3.69	958.17	
0+07.6	961.86	3.53	958.33	Wooden Stake
0+12.0	961.86	3.65	958.21	
0+13.2	961.86	3.88	957.98	LBKF
0+14.0	961.86	4.37	957.49	LBKF-Calc
0+16.0	961.86	5.52	956.34	
0+19.0	961.86	7.32	954.54	
0+21.0	961.86	7.71	954.15	
0+23.0	961.86	7.97	953.89	
0+24.3	961.86	8.59	953.27	
0+26.2	961.86	8.60	953.26	
0+27.0	961.86	8.70	953.16	LEW/WS
0+28.6	961.86	9.09	952.77	
0+29.4	961.86	9.15	952.71	TW
0+31.5	961.86	9.09	952.77	
0+33.3	961.86	9.08	952.78	
0+35.5	961.86	8.69	953.17	REW/WS
0+37.0	961.86	8.08	953.78	
0+38.6	961.86	7.71	954.15	
0+40.1	961.86	7.43	954.43	
0+42.7	961.86	6.35	955.51	
0+45.2	961.86	5.11	956.75	
0+46.3	961.86	4.88	956.98	
0+47.0	961.86	4.37	957.49	RBKF
0+48.0	961.86	4.61	957.25	
0+52.0	961.86	4.31	957.55	
0+57.0	961.86	4.28	957.58	RPIN Grd
0+66.0	961.86	4.22	957.64	
0+75.0	961.86	4.39	957.47	
0+57.0	961.86	4.22	957.64	Top RPIN

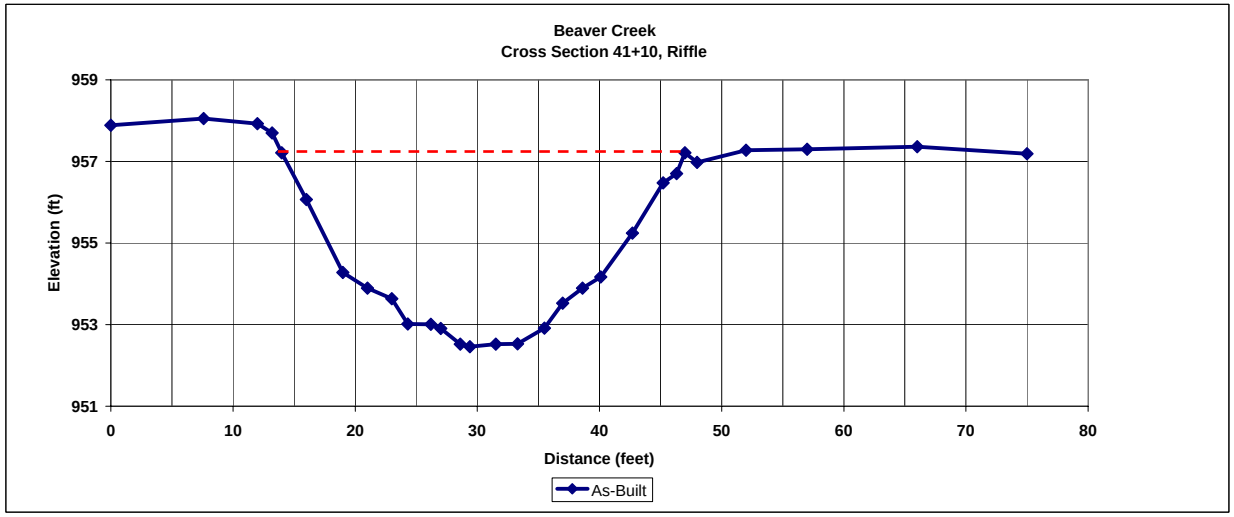
BANKFULL
Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	2.0	1.1	1.1
	3.0	3.0	6.2
	2.0	3.3	6.3
	2.0	3.6	6.9
	1.3	4.2	5.1
	1.9	4.2	8.0
	0.8	4.3	3.4
	1.6	4.7	7.2
	0.8	4.8	3.8
	2.1	4.7	10.0
	1.8	4.7	8.5
	2.2	4.3	9.9
	1.5	3.7	6.0
	1.6	3.3	5.6
	1.5	3.1	4.8
	2.6	2.0	6.6
	2.5	0.7	3.4
	1.1	0.5	0.7
	0.7	0.0	0.2
TOTALS	33.0		103.8

SUMMARY DATA (BANKFULL)

A(BKF)	103.8	
W(BKF)	33.0	Area= A
Max d	4.8	Width= W
Mean d	3.1	Depth= D
W/D	10.5	Bankfull= BKF

Riffle Cross-Section (41+10)



Field Crew:	Dan Clinton, Jan Patterson
River Basin:	Yadkin-Pee Dee
Watershed:	**Fisher River**
Stream Reach:	Beaver Creek
Date:	1/9/2003
Feature:	Pool, Station 47+12

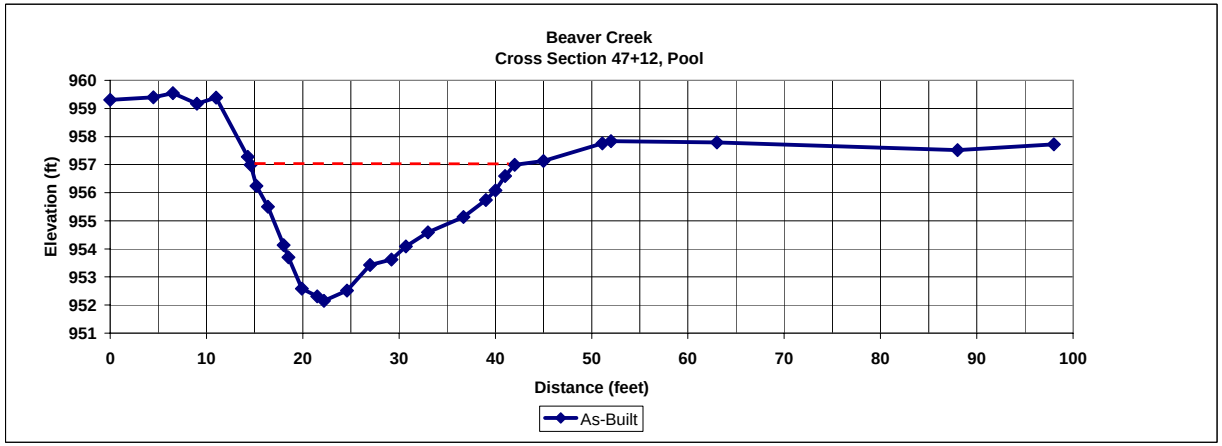
STATION (Feet)	HI (Feet)	FS (Feet)	ELEVATION (Feet)	NOTES
0+00.0	964.34	5.04	959.30	
0+04.5	964.34	4.94	959.40	Wood Stake Grd
0+06.5	964.34	4.80	959.54	
0+09.0	964.34	5.17	959.17	
0+11.0	964.34	4.95	959.39	
0+14.3	964.34	7.06	957.28	
0+14.6	964.34	7.35	956.99	LBKF-calc
0+15.2	964.34	8.10	956.24	
0+16.4	964.34	8.84	955.50	
0+18.0	964.34	10.21	954.13	LEW/WS
0+18.5	964.34	10.64	953.70	
0+19.9	964.34	11.76	952.58	
0+21.5	964.34	12.03	952.31	
0+22.2	964.34	12.19	952.15	TW
0+24.6	964.34	11.83	952.51	
0+27.0	964.34	10.91	953.43	
0+29.2	964.34	10.72	953.62	
0+30.7	964.34	10.25	954.09	REW/WS
0+33.0	964.34	9.75	954.59	
0+36.7	964.34	9.20	955.14	
0+39.0	964.34	8.60	955.74	
0+40.0	964.34	8.26	956.08	
0+41.0	964.34	7.75	956.59	
0+42.0	964.34	7.35	956.99	RBKF
0+45.0	964.34	7.21	957.13	
0+51.1	964.34	6.58	957.76	RPIN Grd
0+52.0	964.34	6.50	957.84	
0+63.0	964.34	6.55	957.79	
0+88.0	964.34	6.82	957.52	
0+98.0	964.34	6.62	957.72	
0+51.1	964.34	6.53	957.81	Top RPIN

BANKFULL Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	0.6	0.8	0.2
	1.2	1.5	1.3
	1.6	2.9	3.5
	0.5	3.3	1.5
	1.4	4.4	5.4
	1.6	4.7	7.3
	0.7	4.8	3.3
	2.4	4.5	11.2
	2.4	3.6	9.6
	2.2	3.4	7.6
	1.5	2.9	4.7
	2.3	2.4	6.1
	3.7	1.9	7.9
	2.3	1.3	3.6
	1.0	0.9	1.1
	1.0	0.4	0.7
	1.0	0.0	0.2
TOTALS	27.4		75.2

SUMMARY DATA (TOB)	
A(BKF)	75.2
W(BKF)	27.4
Max d	4.8
Mean d	2.7

Pool Cross-Section (47+12)



Field Crew:	Dan Clinton, Jan Patterson
River Basin:	Yadkin-Pee Dee
Watershed:	**Fisher River**
Stream Reach:	Beaver Creek
Date:	1/9/2003
Feature:	Riffle, Station 51+10

STATION (Feet)	HI (Feet)	FS (Feet)	ELEVATION (Feet)	NOTES
0+02.0	967.31	2.84	964.47	Ex. Bank
0+04.0	967.31	3.08	964.23	Ex. Bank
0+07.0	967.31	3.72	963.59	LTOB/Ex. Bank
0+09.0	967.31	4.77	962.54	Ex. Bank
0+09.9	967.31	5.32	961.99	LBKF-Calc/ Ex. Bank
0+11.5	967.31	6.27	961.04	Ex. Bank
0+13.0	967.31	7.34	959.97	Ex. Bank
0+14.0	967.31	7.83	959.48	
0+15.0	967.31	8.96	958.35	
0+15.5	967.31	9.13	958.18	LEW/WS
0+16.2	967.31	9.40	957.91	
0+17.8	967.31	9.51	957.80	
0+21.0	967.31	9.59	957.72	
0+22.7	967.31	9.89	957.42	TW
0+25.7	967.31	9.65	957.66	
0+27.3	967.31	9.27	958.04	
0+27.9	967.31	9.15	958.16	REW/WS
0+29.0	967.31	8.98	958.33	
0+30.4	967.31	9.18	958.13	
0+31.8	967.31	8.64	958.67	
0+36.3	967.31	8.46	958.85	
0+38.0	967.31	8.00	959.31	
0+39.5	967.31	7.42	959.89	
0+43.5	967.31	5.32	961.99	RBKF
0+46.3	967.31	5.13	962.18	
0+52.3	967.31	4.81	962.50	RPIN Grd
0+58.0	967.31	4.62	962.69	
0+65.0	967.31	4.56	962.75	Toe Slope
0+73.0	967.31	2.38	964.93	Top Terrace
0+80.0	967.31	1.25	966.06	
0+52.3	967.31	4.62	962.69	Top RPIN

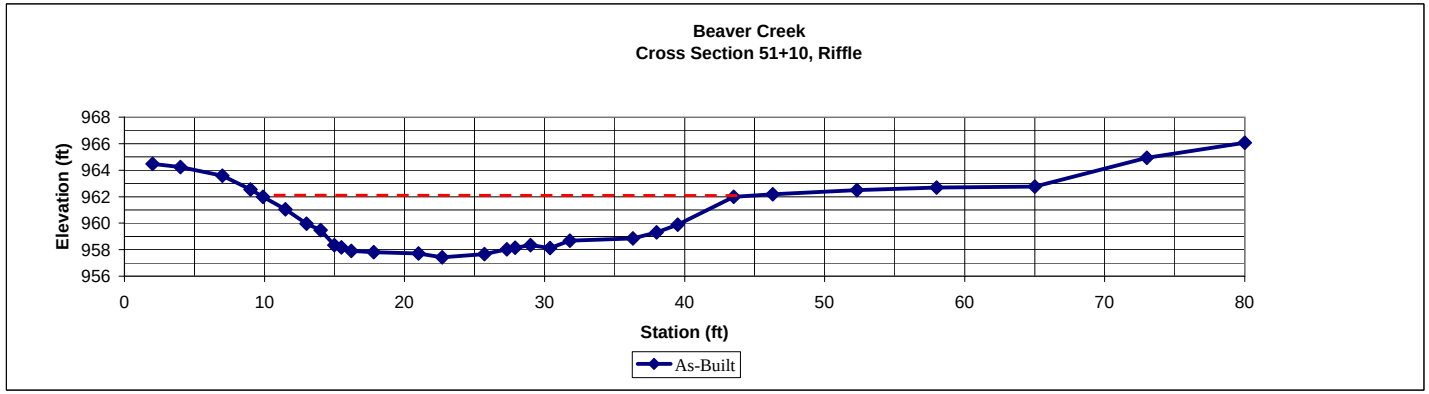
BANKFULL
Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0	0	0
	1.6	0.9	0.8
	1.5	2.0	2.2
	1.0	2.5	2.3
	1.0	3.6	3.1
	0.5	3.8	1.9
	0.7	4.1	2.8
	1.6	4.2	6.6
	3.2	4.3	13.5
	1.7	4.6	7.5
	3.0	4.3	13.3
	1.6	3.9	6.6
	0.6	3.8	2.3
	1.1	3.7	4.1
	1.4	3.9	5.3
	1.4	3.3	5.0
	4.5	3.1	14.5
	1.7	2.7	4.9
	1.5	2.1	3.6
	4.0	0.0	4.2
TOTALS	33.6		104.6

SUMMARY DATA (BANKFULL)

A(BKF)	104.6		
W(BKF)	33.6	Area=	A
Max d	4.6	Width=	W
Mean d	3.1	Depth=	D
W/D	10.8	Bankfull=	BKF

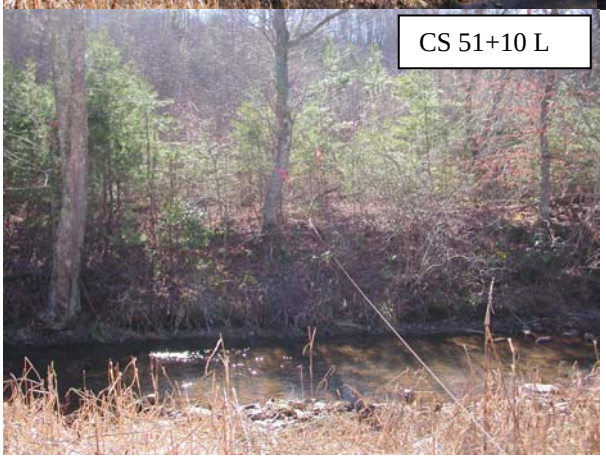
Riffle Cross-Section (51+10)



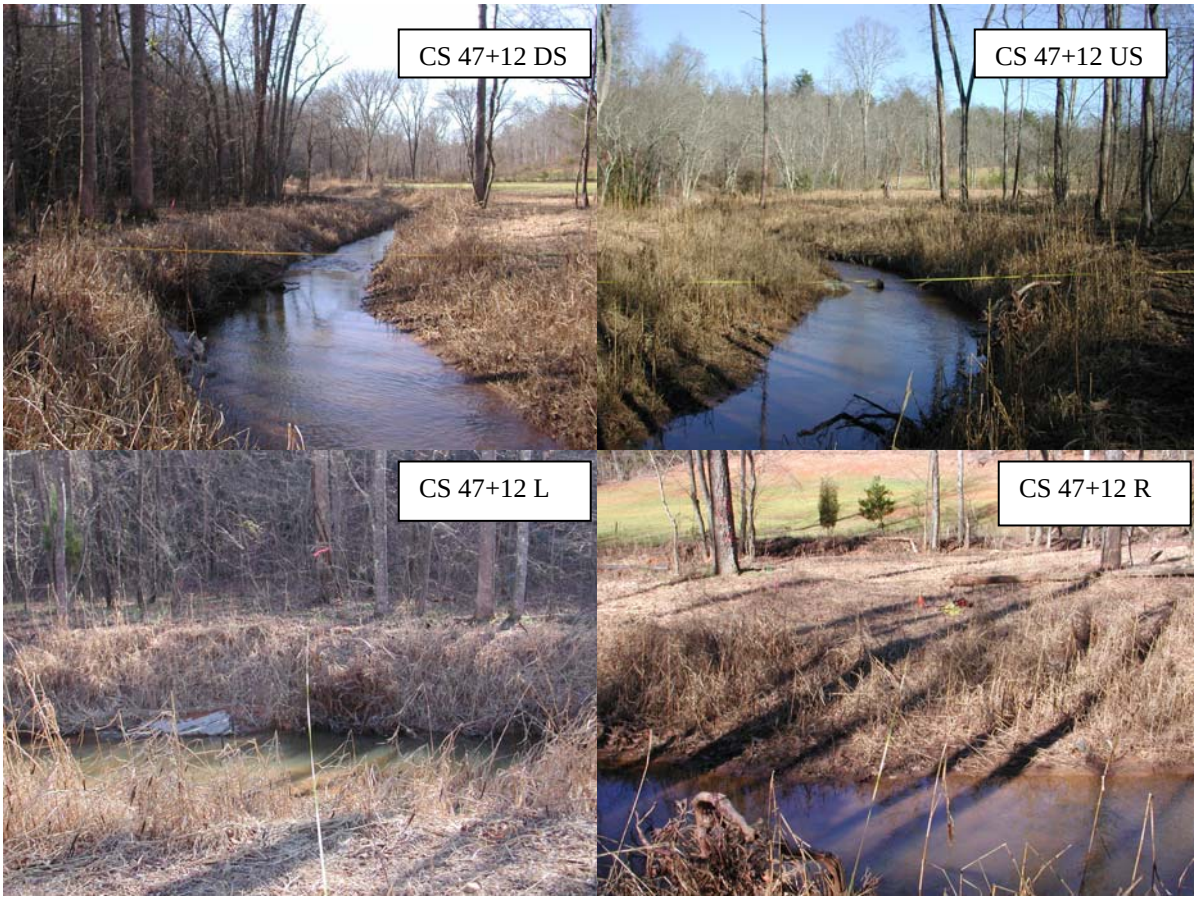
APPENDIX B
AS-BUILT VEGETATION CONDITIONS

Photo Reference Points

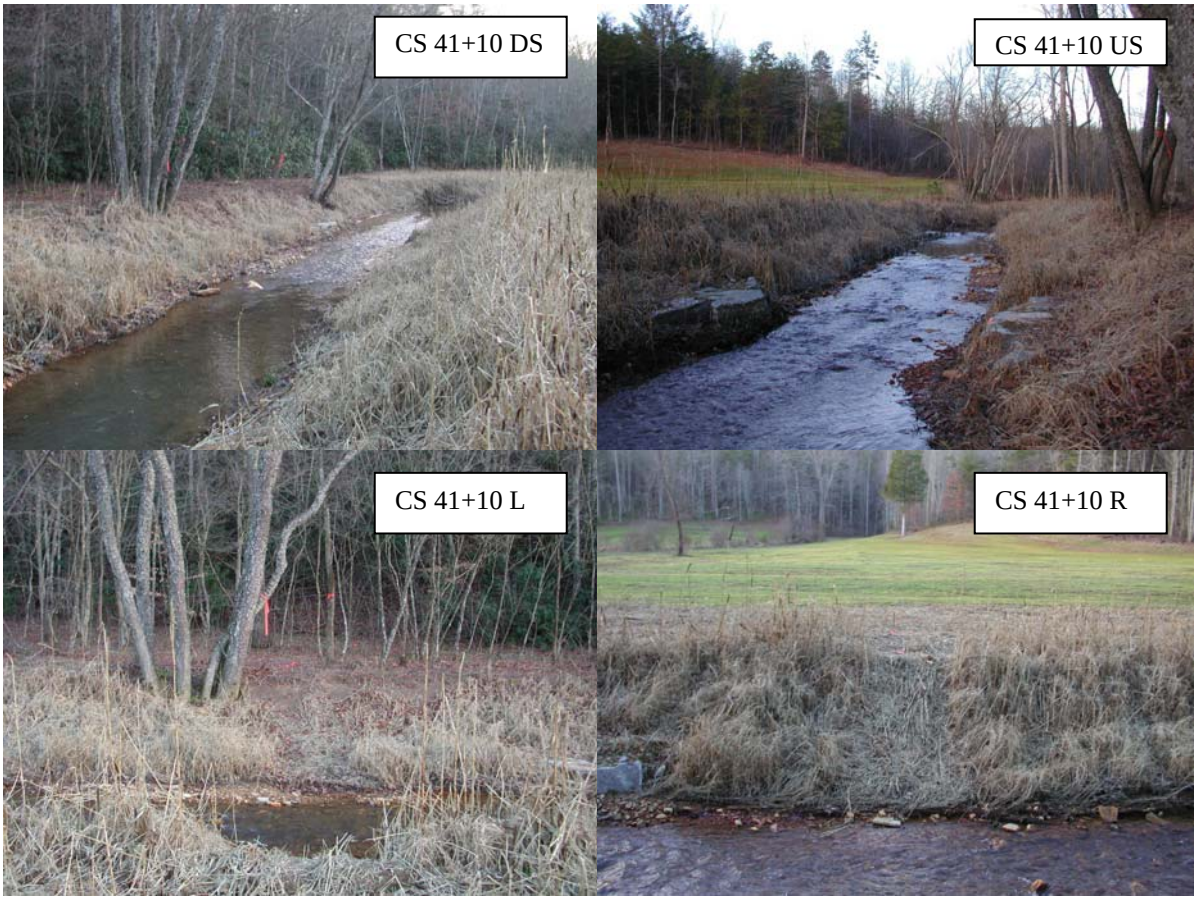
Beaver Creek Stream Restoration
Surry County, North Carolina



Cross-Section 51+10, Riffle

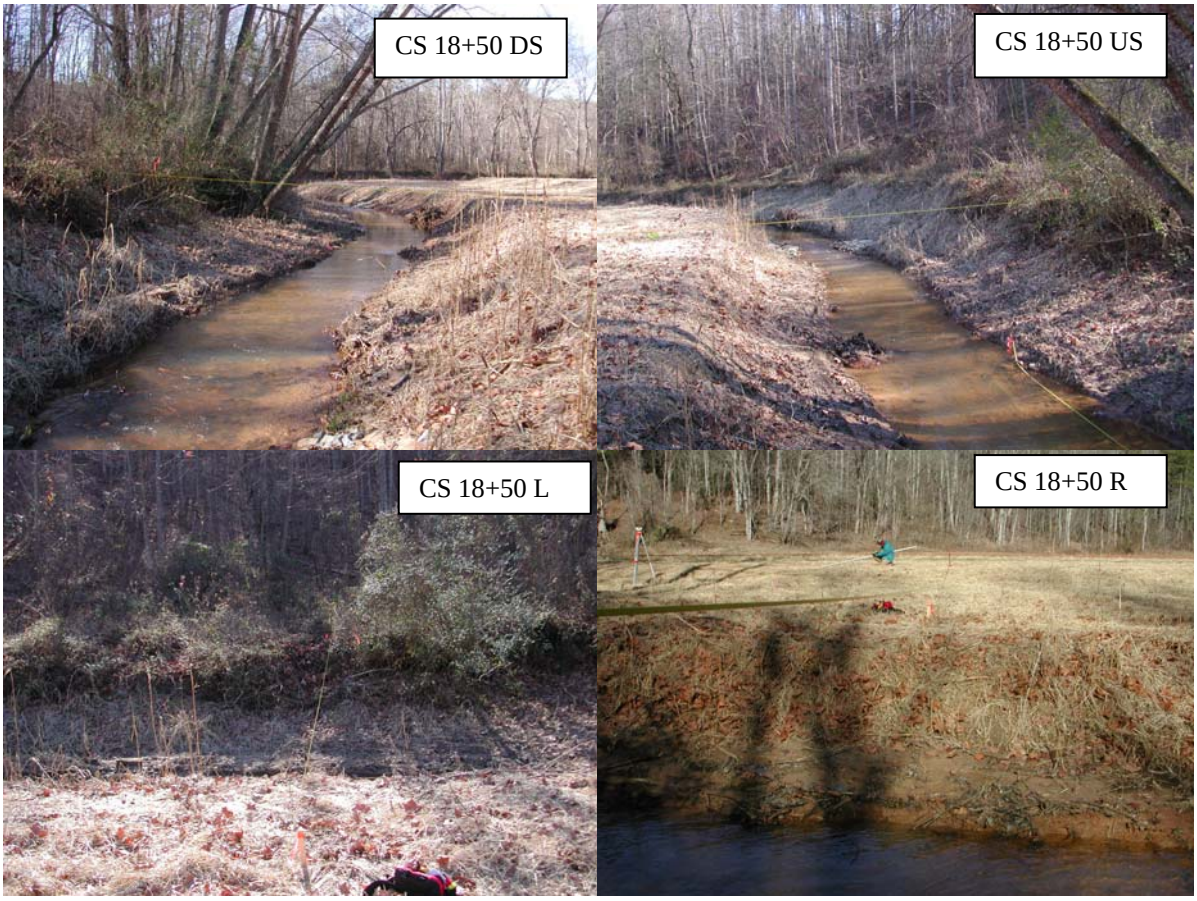


Cross-Section 47+12, Pool

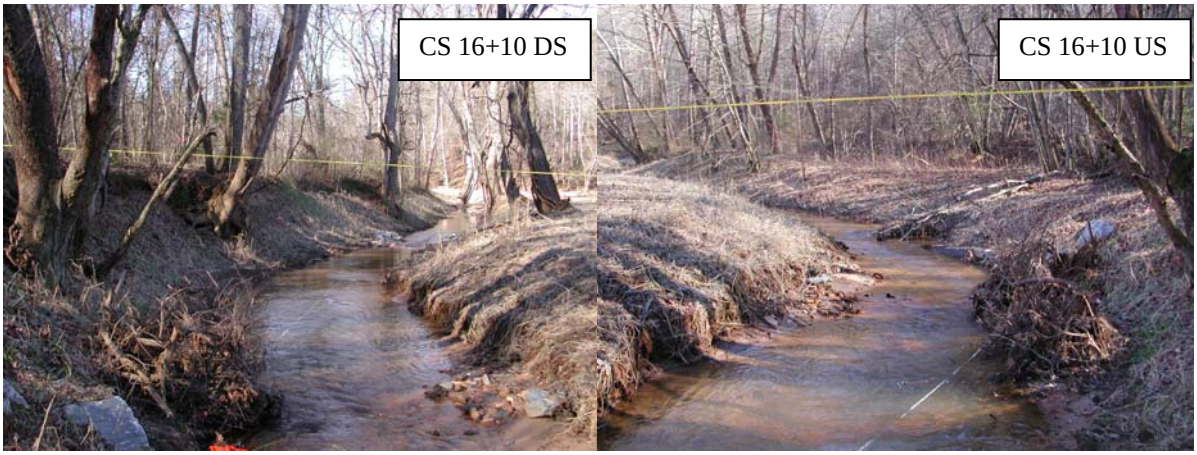


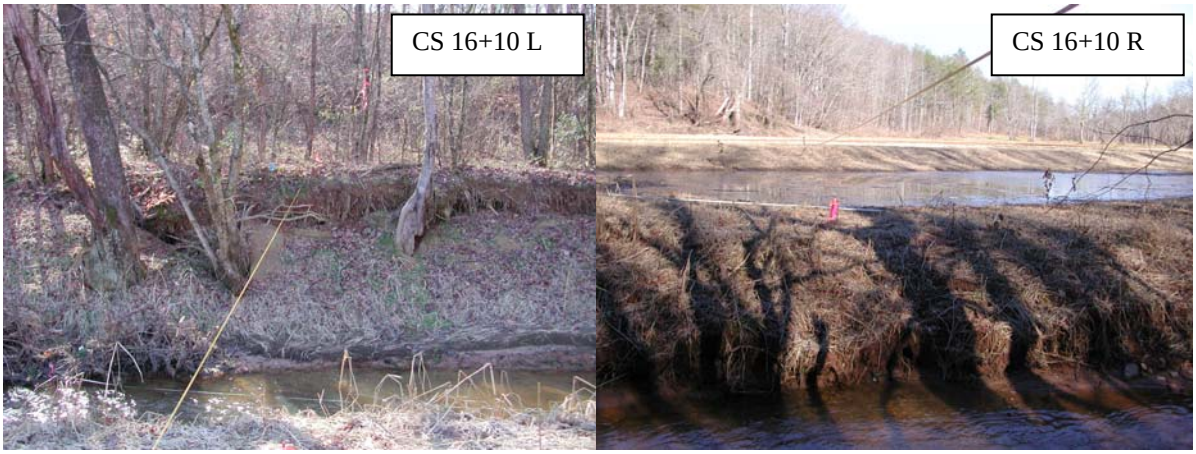
Cross-Section 41+10, Riffle

Cross-Section 28+50, Pool



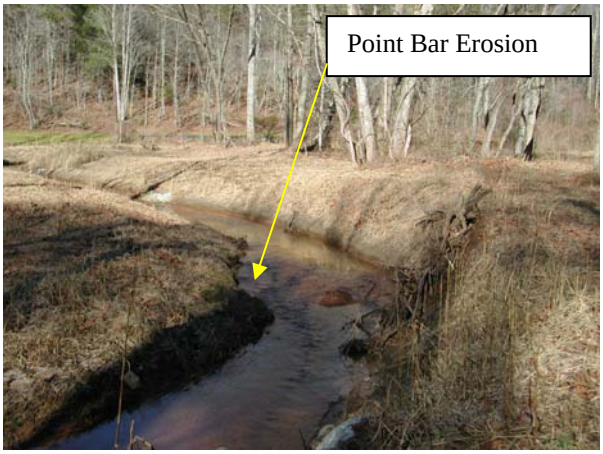
Cross-Section 18+50, Riffle





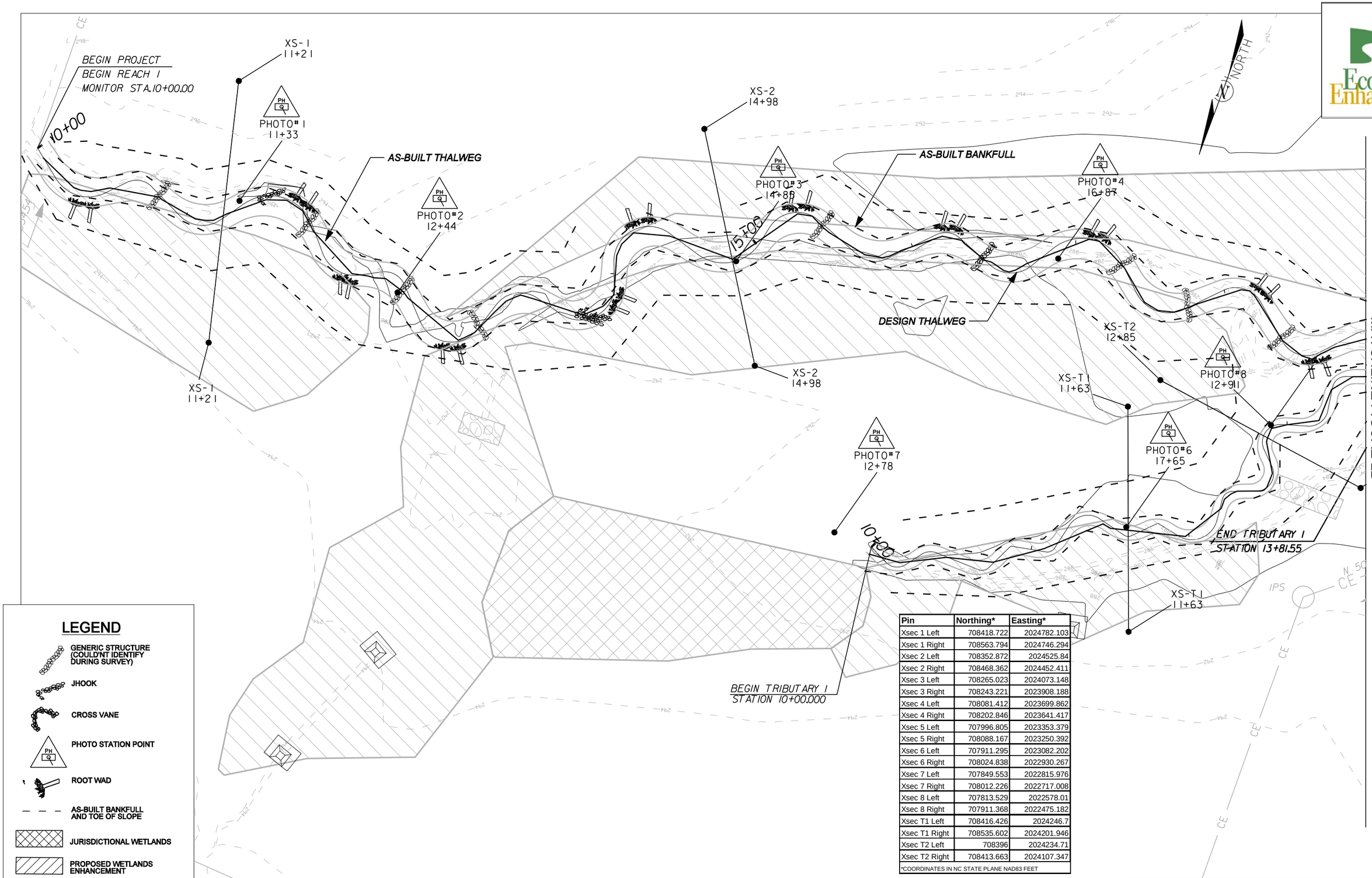
Cross-Section 16+10, Pool

Problem Area 1: Station 39+10, Cross-Vane Failure



Problem Area 2: Station 26+30, Point Bar Erosion

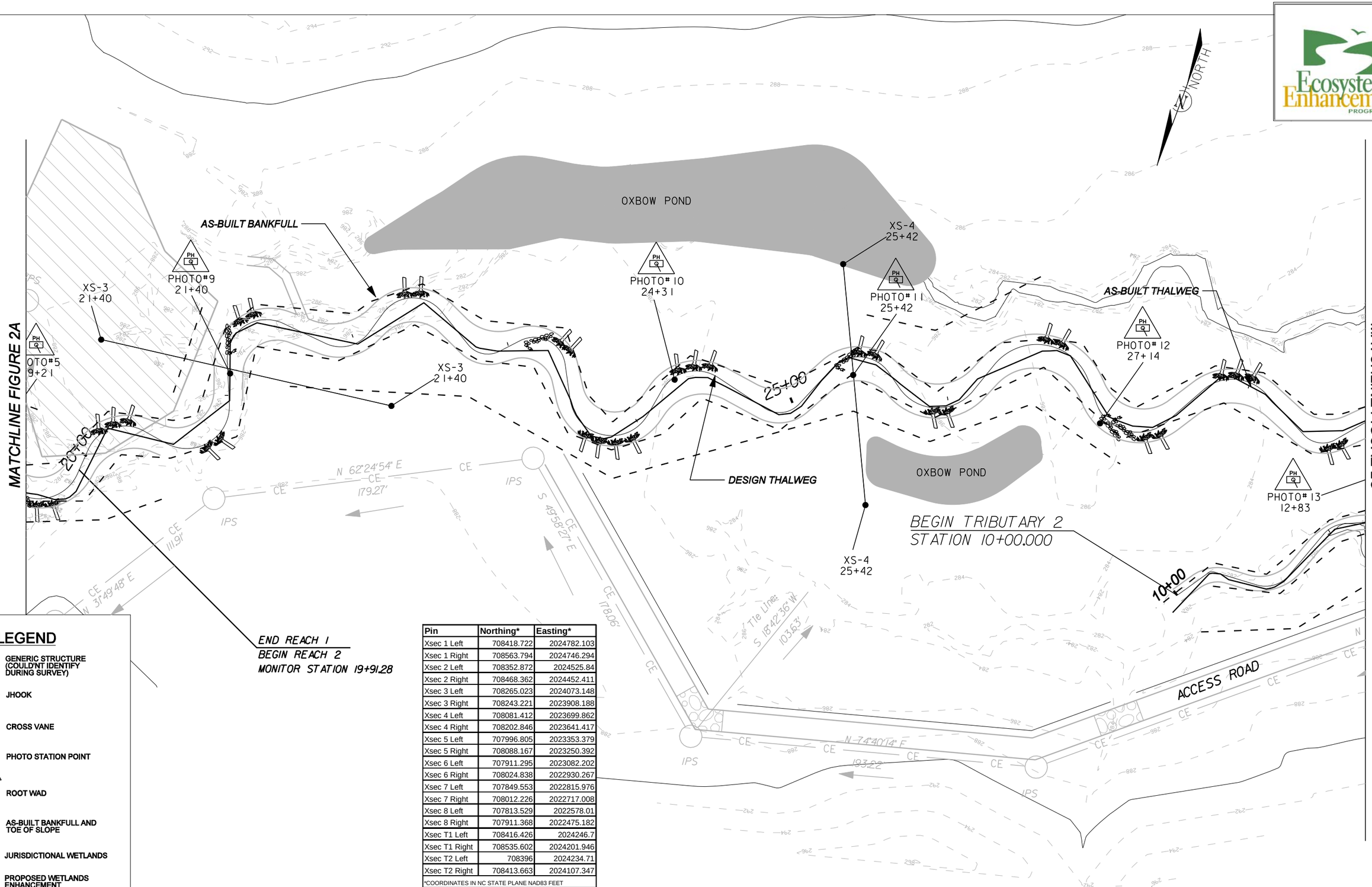
Problem Area 3: Station 12+50, Cross-Vane Failure



Pin	Northing*	Easting*
Xsec 1 Left	708418.722	2024782.103
Xsec 1 Right	708563.794	2024746.294
Xsec 2 Left	708352.872	2024525.84
Xsec 2 Right	708468.362	2024452.411
Xsec 3 Left	708265.023	2024073.148
Xsec 3 Right	708243.221	2023908.188
Xsec 4 Left	708081.412	2023699.862
Xsec 4 Right	708202.846	2023641.417
Xsec 5 Left	707996.805	2023353.379
Xsec 5 Right	708088.167	2023250.392
Xsec 6 Left	707911.295	2023082.202
Xsec 6 Right	708024.838	2022930.267
Xsec 7 Left	707849.553	2022815.976
Xsec 7 Right	708012.226	2022717.008
Xsec 8 Left	707813.529	2022578.01
Xsec 8 Right	707911.368	2022475.182
Xsec T1 Left	708416.426	2024246.7
Xsec T1 Right	708535.602	2024201.946
Xsec T2 Left	708396	2024234.71
Xsec T2 Right	708413.663	2024107.347

*COORDINATES IN NC STATE PLANE NAD83 FEET

FIGURE 2A - AS-BUILT PLAN VIEW



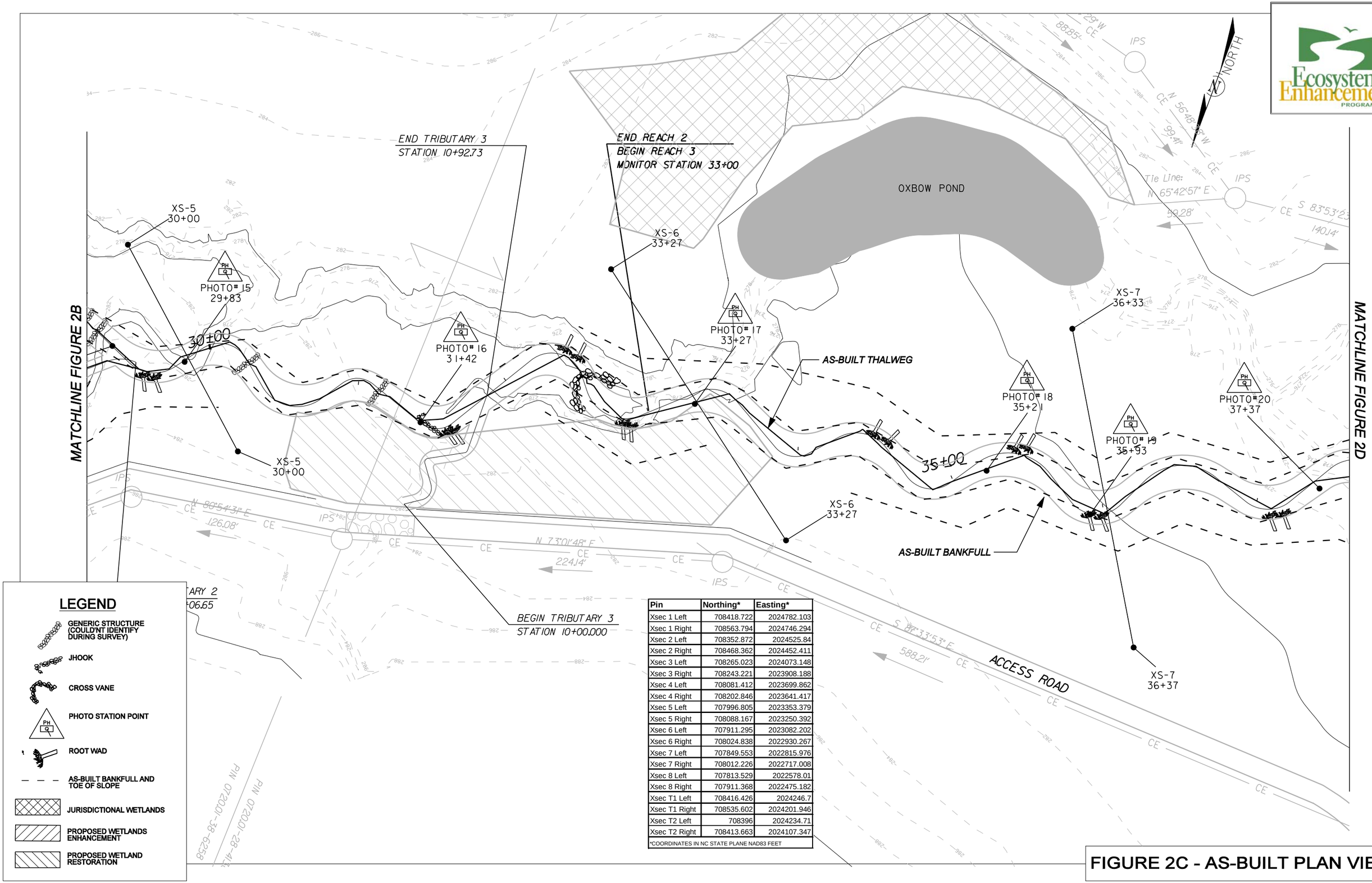
LEGEND

- GENERIC STRUCTURE (COULDN'T IDENTIFY DURING SURVEY)
- JHOOK
- CROSS VANE
- PHOTO STATION POINT
- ROOT WAD
- AS-BUILT BANKFULL AND TOE OF SLOPE
- JURISDICTIONAL WETLANDS
- PROPOSED WETLANDS ENHANCEMENT
- PROPOSED WETLAND RESTORATION

Pin	Northing*	Easting*
Xsec 1 Left	708418.722	2024782.103
Xsec 1 Right	708563.794	2024746.294
Xsec 2 Left	708352.872	2024525.84
Xsec 2 Right	708468.362	2024452.411
Xsec 3 Left	708265.023	2024073.148
Xsec 3 Right	708243.221	2023908.188
Xsec 4 Left	708081.412	2023699.862
Xsec 4 Right	708202.846	2023641.417
Xsec 5 Left	707996.805	2023353.379
Xsec 5 Right	708088.167	2023250.392
Xsec 6 Left	707911.295	2023082.202
Xsec 6 Right	708024.838	2022930.267
Xsec 7 Left	707849.553	2022815.976
Xsec 7 Right	708012.226	2022717.008
Xsec 8 Left	707813.529	2022578.01
Xsec 8 Right	707911.368	2022475.182
Xsec T1 Left	708416.426	2024246.7
Xsec T1 Right	708535.602	2024201.946
Xsec T2 Left	708396	2024234.71
Xsec T2 Right	708413.663	2024107.347

*COORDINATES IN NC STATE PLANE NAD83 FEET

FIGURE 2B - AS-BUILT PLAN VIEW



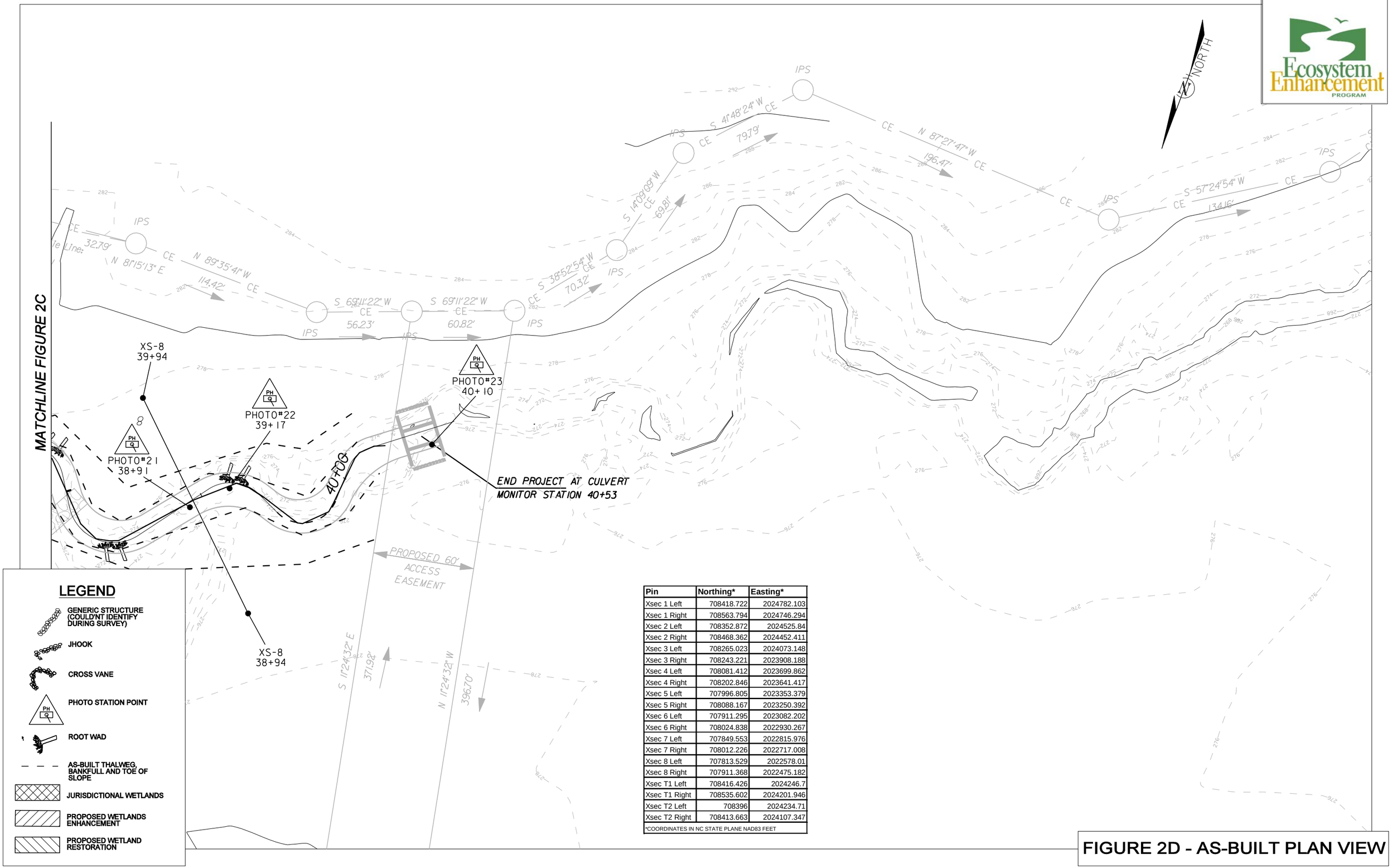
LEGEND

- GENERIC STRUCTURE (COULDN'T IDENTIFY DURING SURVEY)
- JHOOK
- CROSS VANE
- PHOTO STATION POINT
- ROOT WAD
- AS-BUILT BANKFULL AND TOE OF SLOPE
- JURISDICTIONAL WETLANDS
- PROPOSED WETLANDS ENHANCEMENT
- PROPOSED WETLAND RESTORATION

Pin	Northing*	Easting*
Xsec 1 Left	708418.722	2024782.103
Xsec 1 Right	708563.794	2024746.294
Xsec 2 Left	708352.872	2024525.84
Xsec 2 Right	708468.362	2024452.411
Xsec 3 Left	708265.023	2024073.148
Xsec 3 Right	708243.221	2023908.188
Xsec 4 Left	708081.412	2023699.862
Xsec 4 Right	708202.846	2023641.417
Xsec 5 Left	707996.805	2023353.379
Xsec 5 Right	708088.167	2023250.392
Xsec 6 Left	707911.295	2023082.202
Xsec 6 Right	708024.838	2022930.267
Xsec 7 Left	707849.553	2022815.976
Xsec 7 Right	708012.226	2022717.008
Xsec 8 Left	707813.529	2022578.01
Xsec 8 Right	707911.368	2022475.182
Xsec T1 Left	708416.426	2024246.7
Xsec T1 Right	708535.602	2024201.946
Xsec T2 Left	708396	2024234.71
Xsec T2 Right	708413.663	2024107.347

*COORDINATES IN NC STATE PLANE NAD83 FEET

FIGURE 2C - AS-BUILT PLAN VIEW



Pin	Northing*	Easting*
Xsec 1 Left	708418.722	2024782.103
Xsec 1 Right	708563.794	2024746.294
Xsec 2 Left	708352.872	2024525.84
Xsec 2 Right	708468.362	2024452.411
Xsec 3 Left	708265.023	2024073.148
Xsec 3 Right	708243.221	2023908.188
Xsec 4 Left	708081.412	2023699.862
Xsec 4 Right	708202.846	2023641.417
Xsec 5 Left	707996.805	2023353.379
Xsec 5 Right	708088.167	2023250.392
Xsec 6 Left	707911.295	2023082.202
Xsec 6 Right	708024.838	2022930.267
Xsec 7 Left	707849.553	2022815.976
Xsec 7 Right	708012.226	2022717.008
Xsec 8 Left	707813.529	2022578.01
Xsec 8 Right	707911.368	2022475.182
Xsec T1 Left	708416.426	2024246.7
Xsec T1 Right	708535.602	2024201.946
Xsec T2 Left	708396	2024234.71
Xsec T2 Right	708413.663	2024107.347

*COORDINATES IN NC STATE PLANE NAD83 FEET

FIGURE 2D - AS-BUILT PLAN VIEW