Bailey Fork Site Wetland and Stream Restoration Project

Mitigation Plan Report

Burke County, North Carolina

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EXECUTIVE SUMMARY

The Bailey Fork site was restored through a contract with EBX Neuse - I, LLC (EBX). This report documents the completion of the project and presents base-line as-built monitoring data for the five-year monitoring period. The stream and wetland mitigation units developed on the project meet or exceed the number of units that EBX contracted with the North Carolina Ecosystem Enhancement Program (NCEEP) to provide, as shown in Table 1. Table 1 summarizes site conditions before and after restoration as well as what was predicted in the restoration plan. The monitoring plan and as-built baseline data are discussed in detail in Sections 2.1 through 2.6 of this report.

<table>
<tr><th colspan="4">Table 1
Background Information</th></tr>
<tr><th colspan="4">Preconstruction Site Conditions</th></tr>
<tr><th colspan="4">Site</th></tr>
<tr><td>Location</td><td colspan="3">Burke County, approximately two miles southwest of the town of Morganton</td></tr>
<tr><td>USGS Hydro Unit</td><td colspan="3">03050101040020</td></tr>
<tr><td>NCDWQ Subbasin</td><td colspan="3">03-08-31</td></tr>
<tr><td>Contract Mitigation Units</td><td colspan="3">9,220 SMU; 13.9 Riverine WMU</td></tr>
<tr><th colspan="4">Stream</th></tr>
<tr><th>Reach</th><th>Length</th><th>Condition</th><th>Drainage Area</th></tr>
<tr><td>UT1</td><td>1,638 LF</td><td>Unstable E5 Channel</td><td>0.81 Mi^2</td></tr>
<tr><td>UT2</td><td>295 LF</td><td>Straightened & Incised E5</td><td>0.24 Mi^2</td></tr>
<tr><td>UT3</td><td>2,513 LF</td><td>Straightened & Incised E5</td><td>0.92 Mi^2</td></tr>
<tr><td>Bailey Fork</td><td>9,630 LF</td><td>Moderately Incised E5</td><td>8.3 Mi^2</td></tr>
<tr><th colspan="4">Wetland</th></tr>
<tr><th>Wetland</th><th colspan="2">Riverine/Non-Riverine</th><th>Acreage</th></tr>
<tr><td>Wetland #1</td><td colspan="2">Riverine</td><td>5.17 Ac</td></tr>
<tr><td>Wetland #2</td><td colspan="2">Riverine</td><td>0.15 Ac</td></tr>
<tr><td>Wetland #3</td><td colspan="2">Riverine</td><td>0.04 Ac</td></tr>
<tr><th colspan="4">Restoration Plan</th></tr>
<tr><th colspan="4">Stream</th></tr>
<tr><th>Reach</th><th colspan="2">Restoration/Enhancement Type</th><th>Length</th></tr>
<tr><td>UT1</td><td colspan="2">Restoration of dimension, pattern, and profile</td><td>1,920 LF</td></tr>
<tr><td>UT2</td><td colspan="2">Restoration of dimension, pattern, and profile</td><td>870 LF</td></tr>
<tr><td>UT3</td><td colspan="2">Restoration of dimension, pattern, and profile</td><td>3,227 LF</td></tr>
<tr><td>UT3</td><td colspan="2">Enhancement Level II</td><td>135 LF</td></tr>
<tr><td>Bailey Fork</td><td colspan="2">Enhancement Level II</td><td>9,630 LF</td></tr>
<tr><th colspan="4">Wetlands</th></tr>
<tr><th>Wetland Restoration/Enhancement</th><th colspan="2">Riverine/Non-Riverine</th><th>Acreage</th></tr>
<tr><td>Wetland Enhancement</td><td colspan="2">Riverine</td><td>5.3 Ac</td></tr>
<tr><td>Wetland Restoration</td><td colspan="2">Riverine</td><td>11.8 Ac</td></tr>
</table>

Table 1 **Background Information**			
Restoration Plan (cont'd)			
Riparian Buffer			
Riparian & Upland Buffer Acreage	38 Ac		
Post-Construction Site Conditions			
Stream			
Reach	**Restoration/Enhancement Type**	**Length**	**SMU**
UT1	Restoration of dimension, pattern, and profile	1,948 LF	1,948
UT2	Restoration of dimension, pattern, and profile	923 LF	923
UT3	Restoration of dimension, pattern, and profile	3,226 LF	3,226
UT3	Enhancement Level II	135 LF	54
Bailey Fork	Enhancement Level II	9,630 LF	3,852
Wetland			
Wetland Restoration/Enhancement	**Riverine/Non-Riverine**	**Acreage**	**WMU**
Wetland Enhancement	Riverine	5.3 Ac	2.7
Wetland Restoration	Riverine	12.1 Ac	12.1
Ecological Benefits			
Water Quality	Nutrient removal; Erosion reduction; Increased dissolved oxygen concentrations; Improved stream bank stability; Wetland filtering		
Water Quantity/Flood Attenuation	Increased water storage/flood control; Reduced downstream flooding by reconnecting stream with its floodplain; Improved groundwater recharge; Improved/restored hydrologic connections		
Aquatic and Terrestrial Habitat	Improved substrate and in-stream cover; Addition of large woody debris; Reduced water temperature by increasing shading; Restoration of terrestrial habitat; Improved aesthetics		

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Tables and Exhibits

Appendices

1.0 BACKGROUND INFORMATION

The Bailey Fork restoration site is located, in Burke County, North Carolina (Figure 1). The project is within cataloging unit 03050101. The site has recently been used for pasture and hay production. In the past the site has been used for row crop agriculture and pasture. Ditches were used to increase land use and improve drainage when the land was under agricultural production. The streams on the project site were channelized and riparian vegetation was cleared in most locations. Wetland and stream functions on the site had been severely impacted as a result of these land use changes.

The project involved the restoration of 12.1 acres of riverine wetlands, enhancement of 5.3 acres of riverine wetlands, restoration of 6,097 linear feet (LF) of stream, and enhancement of 9,765 LF of stream. Figures 2 and 3 summarize the restoration and enhancement zones on the project site. A total of 61 acres of stream, wetland, and riparian buffer are protected through a conservation easement.

1.1 Project Location

The Bailey Fork restoration site is located approximately two miles southwest of the town of Morganton, along Hopewell Road. The site is separated into two separate halves by Hopewell Road and I-40. The construction entrance for the northern half is located at a farm gate on the north side of Hopewell road immediately east of Bailey Fork. The construction entrance for the southern half is located at the end of an access road along I-40 that connects to Hopewell Road immediately west of the I-40 overpass.

1.2 Mitigation Goals and Objectives

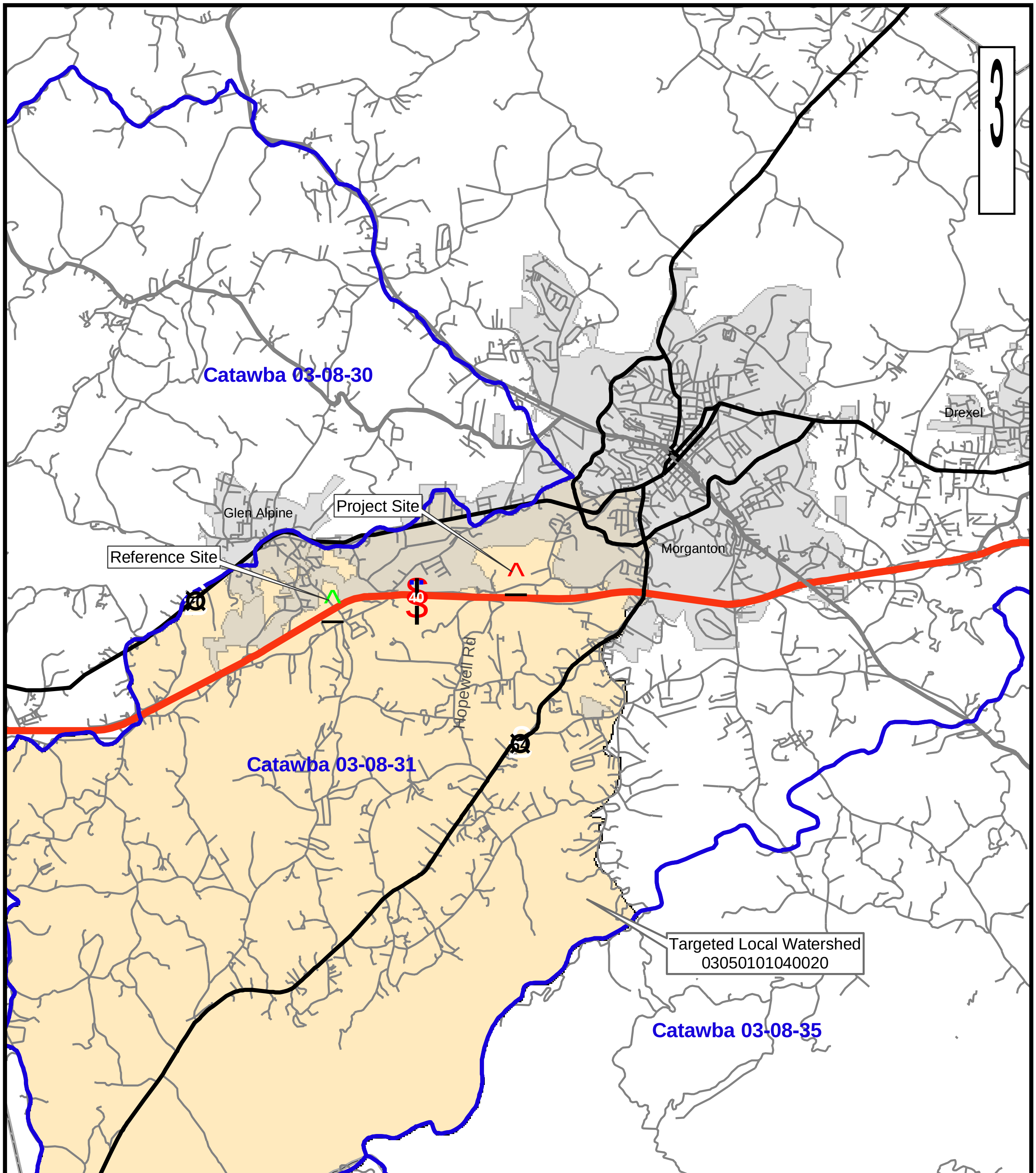
The specific goals for the Bailey Fork Site Restoration Project were as follows:

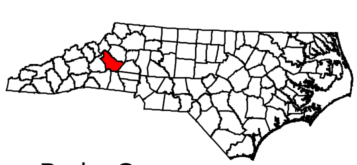
- Restoration of 6,097 LF of stream channel
- Enhancement of 9,765 LF of stream channel
- Restoration of 12.1 acres of riparian wetlands
- Enhancement of 5.3 acres of existing wetlands
- Separate cattle from stream, wetland and riparian buffer areas
- Development of an ecosystem-based restoration design
- Improvements to habitat functions
- Realization of significant water quality benefits.

1.3 Project Description and Restoration Approach

For analysis and design purposes, the on-site streams were divided into four reaches. The reaches were numbered sequentially, moving from south to north, with unnamed tributaries carrying a “UT” designation. UT1 is a second order stream that begins off site, flows into the project area from the southwest, and ends at its confluence with Bailey Fork. UT2 is a first order stream that begins off site, flows into the project area from the west, and ends at its confluence with UT1. UT3 is a second order stream that begins off site, flows into the project area from the south, and ends at its confluence with Silver Creek. Bailey Fork flows into the project area from the south and ends at the confluence with Silver Creek. Drainage area of the three tributaries ranges from 0.25 mi^2 to 0.92 mi^2, while the drainage area at the downstream end of Bailey Fork is 8.3 mi^2. All four reaches were classified as incised and straightened E5 channels prior to restoration activities.

Wetland functions on the site had been severely impaired as a result of agricultural conversion. Streams flowing through the site were channelized many years ago to reduce flooding and provide drainage for adjacent farm fields. As a result, nearly all wetland functions were destroyed within the project area.





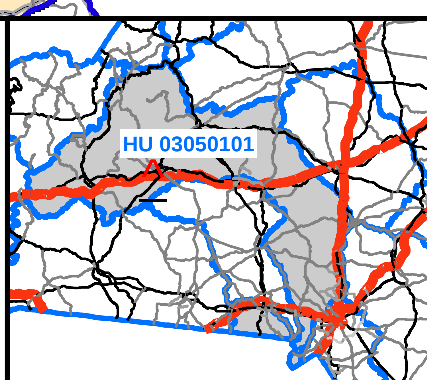


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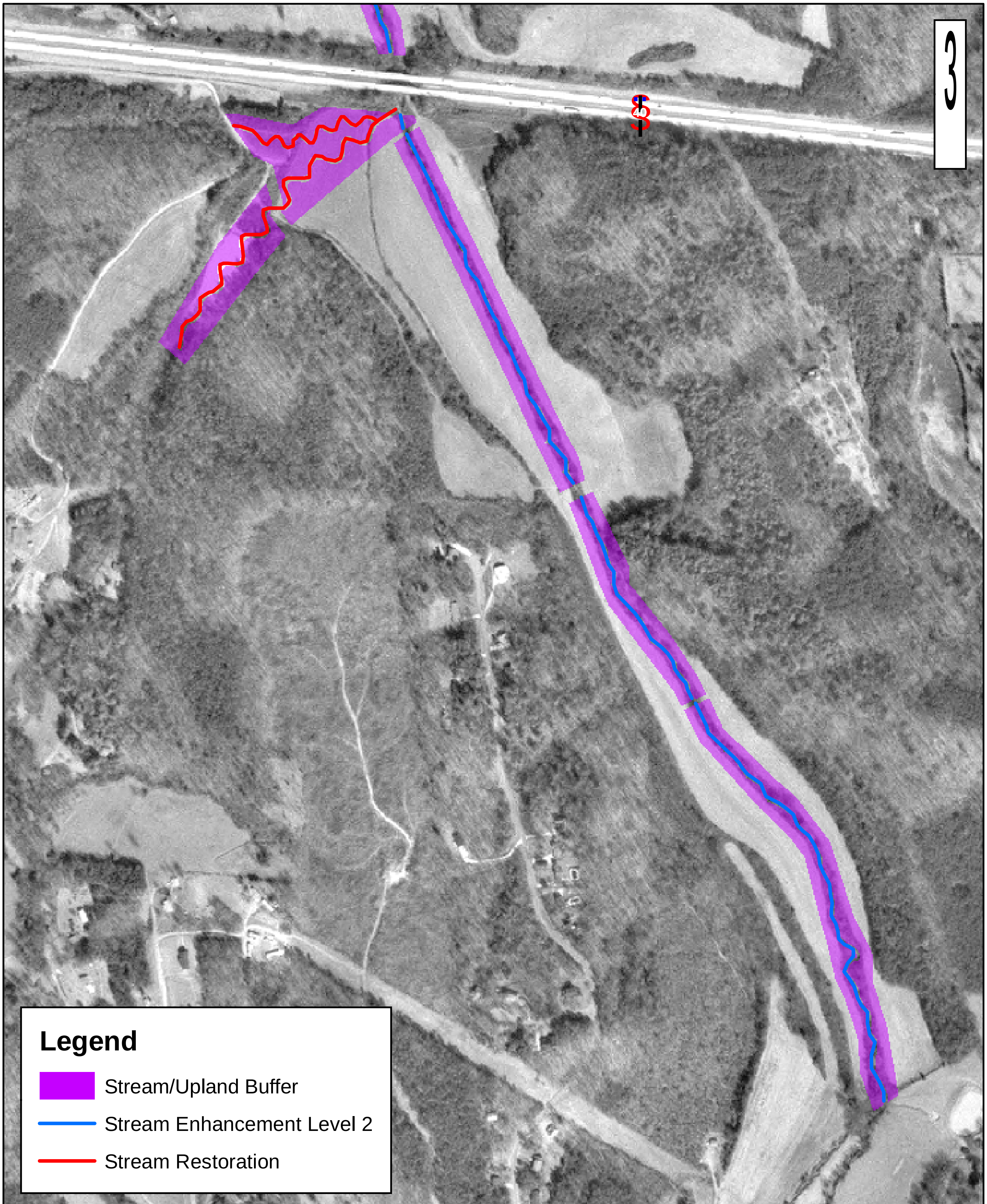
Figure 1. Project Vicinity Map
Bailey Fork Site

0 0.5 1 2 3
Miles



EBX

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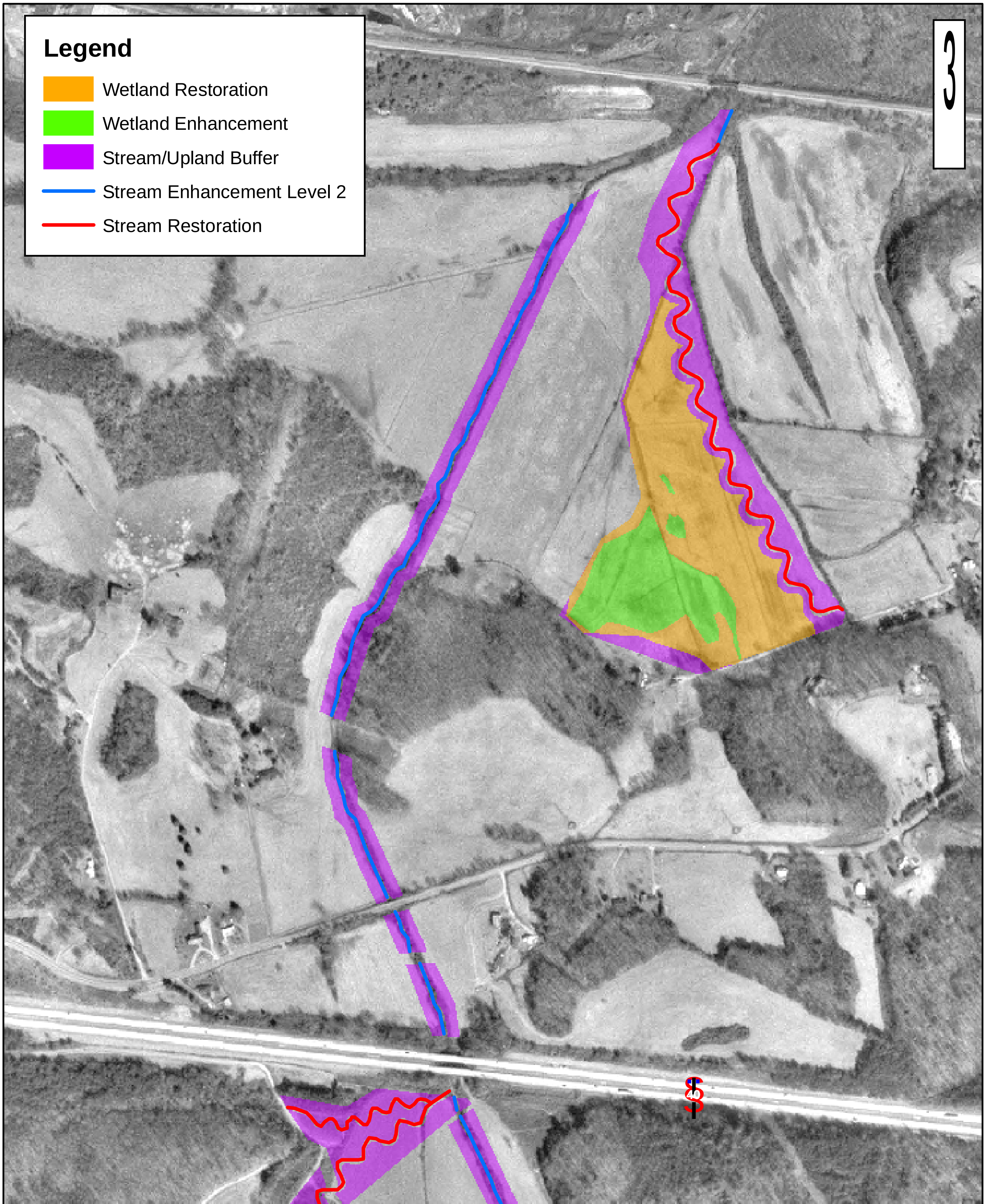
0 250 500 1,000
Feet

Figure 2.
Restoration Summary Map
Bailey Fork Site South



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0 250 500 1,000 Feet

Figure 3.
Restoration Summary Map
Bailey Fork Site North

The design for the restored stream involved the construction of a new, meandering channel across the agricultural fields. The stream type for the restored UT1, UT2, and UT3 reaches was a Rosgen "C5" channel with design dimensions based on those of reference reaches. The enhancement areas along Bailey Fork and UT3 were accomplished through the use of stabilizing in-stream structures in highly eroded areas and additional buffer planting. Wetland restoration of the prior-converted farm fields on the site involved grading areas of the farm fields and raising the local water table to restore a natural flooding regime. The streams through the site were restored to a stable dimension, pattern, and profile, such that riparian wetland functions were restored to the adjacent hydric soil areas. Drainage ditches within the restoration areas were filled to decrease surface and subsurface drainage and raise the local water table. Total stream length across the Bailey Fork Restoration Project was increased from approximately 14,076 LF to 15,862 LF.

The design allows stream flows larger than bankfull flows to spread onto the floodplain, dissipating flow energies and reducing stress on streambanks. In-stream structures were used to control streambed grade, reduce streambank stress, and promote bedform sequences and habitat diversity. The in-stream structures consisted of root wads, log vanes, log weirs, and rock vanes, which promote a diversity of habitat features in the restored channel. Where grade control was a consideration, constructed riffles or rock cross vanes were installed to provide long-term stability. Streambanks were stabilized using a combination of erosion control matting, bare-root planting, and transplants. Transplants provide living root mass to increase streambank stability and create holding areas for fish and aquatic biota. The purpose of the project is to restore wetland functions to prior-converted crop fields on the site and to restore stream functions to the impaired stream channels that flow through it. Native vegetation was planted across the site, and the entire restoration site is protected through a permanent conservation easement.

1.4 Construction Summary

Construction activities, in accordance with the approved restoration plan for the site, began in June 2005 on the southern half of the project (south of I-40) with site preparation, harvesting of root wads, and establishment of access sites and stockpile areas. Materials were stockpiled as needed for the initial stages of construction. Construction stakeout began in July 2005.

The next step was draining the pond at the upstream end of UT1. Draining efforts shown on the plan sheets proved to be inadequate and a design change was made to excavate a diversion ditch on the south side of the pond to lower the water table in the center where channel excavation was planned. The ditch was lined with a geotextile fabric to prevent erosion.

During the same period, the contractor graded the floodplain areas to reach design grades across the site. Grade stakes were installed along design contours to direct the grading activities. The excavated material was stockpiled in specified areas near field ditches and existing channels that were to be filled. Excavated material was also used to construct a path outside of the conservation easement to allow field access for the existing landowners. Where necessary, silt fencing was installed between stockpiles and the active ditches to prevent erosion of sediment into the channel.

Once the design floodplain and wetland grades were achieved, the new UT1 and UT2 stream channel were sculpted and constructed. Construction of the stream channels began at the downstream end and moved in an upstream direction for the entire length of the channels with the exception of UT1 within the pond, which was completed at the end of the project. Upon completion of each new channel segment, in-stream structures, matting, and transplants were installed, and the channel was prepared to accept flow from the old channel. Modifications made during construction included substituting constructed riffles for all rock cross vanes in the design. This was based on monitoring of similar projects where constructed riffles appeared to be more stable than cross vanes in moderate slope, small-bed material systems. Once fully prepared, temporary sediment traps at the downstream ends of the channels were removed, and water was directed into the newly constructed section of channel. Abandoned field ditches and remnant channels were immediately filled and graded.

After completing the restoration of reach UT2 and reach UT1 (to the existing pond), the contractor began installing structures in Bailey Fork starting at station 10+00 and moving downstream. Modifications made during construction involved the location and selection of in-stream structures and bank stabilization practices. Substitutions were made based on availability of materials and professional judgment. These changes are documented in the attached as-built drawings.

A second contractor began work on the northern half of the project (north of I-40) in November 2005. Construction activities began with site preparation, harvesting of root wads, and establishment of access sites and stockpile areas. Materials were stockpiled as needed for the initial stages of construction. Construction stakeout began in November 2005.

The contractor then graded the floodplain and wetland areas to reach design grades across the site. Grade stakes were installed along design contours to direct the grading activities. The excavated material was stockpiled in specified areas near field ditches and existing channels that were to be filled. Excavated material was also used to construct farm paths outside of the conservation easement to allow field access for the existing landowners. Where necessary, silt fencing was installed between stockpiles and the active ditches to prevent erosion of sediment into the channel.

Concurrently with the grading of the floodplain and wetland, the contractor began installing structures in Bailey Fork starting at I-40 and moving downstream. Modifications made during construction involved the location and selection of in-stream structures and bank stabilization practices. Substitutions were made based on availability of materials and professional judgment. These changes are documented in the attached as-built drawings.

Once the design floodplain and wetland grades were achieved, the new UT3 stream channel was sculpted and constructed. Construction of the stream channel began at the downstream end and moved in an upstream direction for the entire length of the channel. Construction was completed entirely in the dry. Upon completion of each new channel segment, in-stream structures, matting, and transplants were installed, and the channel was prepared to accept flow from the old channel. Modifications made during construction included substituting constructed riffles for all rock cross vanes in the design. This was based on monitoring of similar projects where constructed riffles appeared to be more stable than cross vanes in moderate slope, small-bed material systems. Once fully prepared, temporary sediment traps at the downstream ends of the channels were removed, and water was directed into the newly constructed section of channel. Abandoned field ditches and remnant channels were immediately filled and graded.

The final as-built lengths for all stream reaches and acreages for wetland areas are documented in Table 2. Early observations indicate that the vegetation treatments were effective at quickly establishing herbaceous ground cover. Temporary seeding (rye grain and German millet) applied to streambanks, beneath the erosion matting, sprouted within two weeks of application and have provided good ground coverage.

Table 2
Summary of As-built Lengths, Acreages, Mitigation Units, and Restoration Approaches

Reach Name	Wetland Acreage (acres)	WMU	As-built Length (ft)	SMU	Restoration Approach
Reach UT1	-----	-----	1,948	1,948	Restoration
Reach UT2	-----	-----	923	923	Restoration
Reach UT3	-----	-----	3,226	3,226	Restoration
Reach UT3	-----	-----	135	54	Enhancement Level II
Bailey Fork	-----	-----	9,630	3,852	Enhancement Level II
Riverine Wetland Enhancement	5.3	2.7	-----	-----	Enhancement
Riverine Wetland Restoration	12.1	12.1	-----	-----	Restoration
Total Length	**17.4**	**14.8**	**15,862**	**10,003**	---------

2.0 MONITORING PLAN

Channel stability, wetland hydrology, and vegetation survival will be monitored on the project site. Post-restoration monitoring will be conducted for five years following the completion of construction to document project success.

2.1 Stream Monitoring

Geomorphic monitoring of restored stream reaches will be conducted for five years to evaluate the effectiveness of the restoration practices. Monitored stream parameters include stream dimension (cross-sections), pattern (longitudinal survey), profile (profile survey), and photographic documentation. The methods used and any related success criteria are described below for each parameter.

2.1.1 Bankfull Events

The occurrence of bankfull events within the monitoring period will be documented by the use of crest gages and photographs. Crest gages were installed on the floodplain within 10 feet of the restored channels. One crest gage was placed on UT3, and one was placed immediately below the confluence of UT1 and UT2. The crest gages will record the highest watermark between site visits and will be checked at each site visit to determine if a bankfull event has occurred. Photographs will be used to document the occurrence of debris lines and sediment deposition on the floodplain during monitoring site visits.

Two bankfull flow events must be documented on each crest gage within the 5-year monitoring period. The two bankfull events must occur in separate years; otherwise, the stream monitoring will continue until two bankfull events have been documented in separate years.

2.1.2 Cross-sections

Two permanent cross-sections were installed per 1,000 LF of stream restoration work, with one located at a riffle cross-section and one located at a pool cross-section. Each cross-section was marked on both banks with permanent pins to establish the exact transect used. A common benchmark will be used for cross-sections and consistently referenced to facilitate comparison of year-to-year data. The annual cross-sectional survey will include points measured at all breaks in slope, including top of bank, bankfull, inner berm, edge of water, and thalweg, if the features are present. Riffle cross-sections will be classified using the Rosgen Stream Classification System.

There should be little change in the as-built cross-sections. If changes do take place they should be evaluated to determine if they represent a movement toward a more unstable condition (e.g., down-cutting or erosion) or a movement toward increased stability (e.g., settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio).

2.1.3 Longitudinal Profile

A longitudinal profile will be completed in years one, three, and five of the monitoring period. The profile will be conducted for the entire length of the project, or for at least 3,000 LF of restored channel. Measurements will include thalweg, water surface, inner berm, bankfull, and top of low bank. All measurements will be taken at the head of each feature (e.g., riffle, run, pool, glide) and the maximum pool depth. The survey will be tied to a permanent benchmark.

The longitudinal profiles should show that the bedform features are remaining stable; i.e., they are not aggrading or degrading. The pools should remain deep with flat water surface slopes, and the riffles should remain steeper and shallower than the pools. Bedforms observed should be consistent with those observed for channels of the design stream type.

2.1.4 Bed Material Analyses

Since the streams through the project site are dominated by sand-size particles, pebble count procedures would not show a significant change in bed material size or distribution over the monitoring period; therefore, bed material analyses will not be conducted for this project.

2.1.5 Benthic Macroinvertebrates

Benthic macroinvertebrate data will be collected from an upstream reference reach and within project reaches UT1 and UT3. Post-restoration sampling will begin at least one year after construction activities have been completed, and annually thereafter for a total of three years. Sampling will be conducted each year at during the same season as the pre-construction sampling. Sample collection follows protocols described in the standard operating procedures of the Biological Assessment Unit of the North Carolina Division of Water Quality (NCDWQ). The Qual-4 collection method is used for the collection of macroinvertebrate samples, and a North Carolina-certified laboratory performs the identification of the macroinvertebrate samples. The metrics calculated include total and Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa richness, EPT abundance and biotic index values.

2.1.6 Photo Reference Sites

Photographs will be used to document restoration success visually. Reference stations will be photographed before construction and for at least five years following construction. Reference photos will be taken once a year, from a height of approximately five to six feet. Permanent markers will be established to ensure that the same locations (and view directions) on the site are monitored during each monitoring period. Selected site photographs are shown in Appendix 1.

2.1.6.1 Lateral Reference Photos

Reference photo transects will be taken at each permanent cross-section. Photographs will be taken of both banks at each cross-section. The survey tape will be centered in the photographs of the bank. The water line will be located in the lower edge of the frame, and as much of the bank as possible will be included in each photo. Photographers should make an effort to consistently maintain the same area in each photo over time.

2.1.6.2 Structure Photos

Photographs will be taken at each grade control structure along the restored stream. Photographers should make every effort to consistently maintain the same area in each photo over time. Photographs will be used to evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures subjectively. Lateral photos should not indicate excessive erosion or continuing degradation of the banks. A series of photos over time should indicate successive maturation of riparian vegetation.

2.2 Wetland Hydrologic Monitoring

Groundwater monitoring stations were installed across the wetland restoration area to document hydrologic conditions. Eight groundwater monitoring stations were installed, with four automated groundwater wells and four manually-read stations. Groundwater monitoring stations follow the U.S. Army Corps of Engineers (USACE) standard methods found in Wetland Regulatory Assistance Program (WRAP) Technical Notes ERDC TN-WRAP-00-02 (July 2000).

In order to determine if the rainfall is normal for the given year, rainfall amounts will be tallied using data obtained from the nearest automated weather station, located in Morganton, NC, approximately two miles southwest of the project site (Morganton, NC, UCAN: 14224, COOP: 315838).

It is anticipated that the monitoring data will show that the site has been saturated within 12 inches of the soil surface for at least 7 percent of the growing season and that the site has exhibited an increased frequency of flooding. This criterion is based on the modeling analysis presented in Section 7.6 of the restoration plan. The restored site will be compared to a reference site data. In addition, the restored site's hydrology will be compared to pre-restoration conditions both in terms of water table depth and frequency of overbank events.

2.3 Vegetation Monitoring

Successful restoration of the vegetation on a wetland mitigation site is dependent upon hydrologic restoration, active planting of preferred canopy species, and volunteer regeneration of the native plant community. In order to determine if the criteria have been met, vegetation monitoring quadrants were installed across the restoration site, as directed by North Carolina Ecosystem Enhancement Program (NCEEP). The number of quadrants required was based on the species/area curve method, as described in NCEEP monitoring guidance documents. A total of twenty-one plots were installed, which constitutes 1.1 percent of the total site. The size of individual quadrants was 100 square meters for woody tree species, and 1 square meter for herbaceous vegetation. Vegetation monitoring will occur in spring, after leaf-out has occurred. Individual quadrant data will be provided and will include diameter, height, density, and coverage quantities. Individual seedlings will be marked such that they can be found in succeeding monitoring years. Mortality will be determined from the difference between the previous year's living, planted seedlings and the current year's living, planted seedlings.

At the end of the first growing season, species composition, density, and survival will be evaluated. For each subsequent year, until the final success criteria are met, the restored site will be evaluated between July and November.

The interim measure of vegetative success for the site will be the survival of at least 320, 3-year old, planted trees per acre at the end of year three of the monitoring period. The final vegetative success criteria will be the survival of 260, 5-year old, planted trees per acre at the end of year five of the monitoring period.

2.4 Maintenance and Contingency Plans

Maintenance requirements vary from site to site and are generally driven by the following conditions:

- Projects without established, woody floodplain vegetation are more susceptible to erosion from floods than those with a mature, hardwood forest
- Projects with sandy, non-cohesive soils are more prone to short-term bank erosion than cohesive soils or soils with high gravel and cobble content
- Alluvial valley channels with wide floodplains are less vulnerable than confined channels
- Wet weather during construction can make accurate channel and floodplain excavations difficult
- Extreme and/or frequent flooding can cause floodplain and channel erosion
- Extreme hot, cold, wet, or dry weather during and after construction can limit vegetation growth, particularly temporary and permanent seed
- The presence and aggressiveness of invasive species can affect the extent to which a native buffer can be established.

Maintenance issues and recommended remediation measures will be detailed and documented in the as-built and monitoring reports. Factors that may have caused any maintenance needs, including any of the conditions listed above, shall be discussed. NCEEP approval will be obtained prior to any remedial action.

2.5 Monitoring Results – 2006 As-Built Data

The five-year monitoring plan for the Bailey Fork Site includes criteria to evaluate the success of the vegetation, wetland, and stream components of the project. The specific locations of vegetation plots, wells, permanent cross-sections, crest gauges, and a rainfall gauge are shown on the as-built drawing sheets. Photo points, located at each of the grade control structures along the restored stream channel, are also located on the as-built drawing sheets.

2.5.1 Morphology

For monitoring wetland and stream success criteria, 13 permanent cross-sections, 1 rain gauge, and 2 crest gauges were installed. The permanent cross-sections will be used to monitor channel dimension and bank erosion over time. The rain gauge and crest gauge will be used to document the occurrence of bankfull events. In addition, a complete longitudinal survey was completed for the restored stream channels to provide a base-line for evaluating changes in bed conditions over time. The longitudinal profiles included the elevations of all grade control structures. The permanent cross-section and longitudinal data are provided in Appendix 2. The location of the permanent cross-sections, rain gauge, and the stream gauges are shown on the as-built plan sheets in Appendix 3.

2.5.1.1 Results and Discussion

No monitoring results are available at the submittal of this report. As-built data will be compared with first year monitoring data in the Year 1 Monitoring Report, scheduled for submittal to NCEEP during December 2006.

2.5.2 Hydrology

The restoration plan for the Bailey Fork Site specifies that eight monitoring wells (four automated and four manual) would be established across the restored site. A total of eight wells (four automated and four manual) were installed during early-March 2006 to document water table hydrology in all required monitoring locations. The locations of monitoring wells are shown on the as-built plan sheets.

2.5.2.1 Results and Discussion

No monitoring results are available at the submittal of this report. Site hydrology from the first growing season will be discussed in the Year 1 Monitoring Report, scheduled for submittal to NCEEP during December 2006.

2.5.3 Vegetation

Bare-root trees were planted within all areas of the conservation easement. A minimum 30-foot buffer was established along all restored stream reaches. In general, bare-root vegetation was planted at a target density of 700 stems per acre, in an 8-foot by 8-foot grid pattern. Planting of bare-root trees was completed in April 2006. Species planted are summarized in Table 3.

Table 3
Vegetation Species Planted Across the Restoration Site

Scientific Name	Common Name	Percent Planted by Species	Total Number of Stems
Bare Root Trees Species			
Betula nigra	River Birch	6%	2,500
Fraxinus pennsylvanica	Green Ash	14%	5,300
Platanus occidentalis	Sycamore	20%	8,000
Quercus phellos	Willow oak	8%	3,200
Quercus rubra	Red oak	9%	3,300
Quercus michauxii	Swamp chestnut oak	5%	2,100
Liriodendron tulipifera	Tulip poplar	15%	5,400
Celtis laevigata	Sugarberry	5%	2,100
Diospyros virginiana	Persimmon	10%	3,900
Nyssa sylvatica	Blackgum	8%	3,300
Native Herbaceous Species			
Agrostis alba	Bentgrass	10%	n/a
Elymus virginicus	Virginia wild rye	15%	n/a
Panicum virgatum	Switchgrass	15%	n/a
Tripsicum dactyloides	Gamagrass	5%	n/a
Polygonum pennsylvanicum	Smartweed	5%	n/a
Schizachyrium scoparium	Little bluestem	5%	n/a
Juncus effusus	Soft rush	5%	n/a
Bidens frondosa	Devil's beggartick	10%	n/a
Coreopsis lanceolata	Lanceleaf tickseed	10%	n/a
Panicum clandestinum	Deertounge	10%	n/a
Andropogon gerardii	Big bluestem	5%	n/a
Sorghastrum nutans	Indian grass	5%	n/a
Woody Vegetation for Live Stakes			
Cornus amommum	Silky dogwood	40%	n/a
Salix sericea	Silky willow	30%	n/a
Sambucus canadensis	Elderberry	10%	n/a
Physocarpus opulifolius	Ninebark	20%	n/a

The restoration plan for the Bailey Fork Site specifies that the number of quadrants required will be based on the species/area curve method, as described in NCEEP monitoring guidance documents, with a minimum of three quadrants. The size of individual quadrants will be 100 square meters for woody tree species, and 1 square meter for herbaceous vegetation. A total of 21 vegetation plots, each 10 by 10 meters in size, were established across the restored site. The initial planted density within each of the vegetation monitoring plots is given in Table 4. The average density of planted bare root stems, based on the data from the 21 monitoring plots, is 698 stems per acre. The locations of the vegetation plots are shown on the as-built plan sheets.

Table 4
Bailey Fork Initial Stem Counts for Each Species Arranged by Plot

	Plots																				
Tree Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Betula nigra											4	4	4	1	4	4	7	10	1	5	
Fraxinus pennsylvanica			2	2							4	4		6		8	4		5	6	7
Platanus occidentalis			1	8	10	3	7			9			3		3			5	2	2	1
Quercus phellos			4			1		5													
Quercus rubra																					1
Quercus michauxii							3	2			2	2									
Liriodendron tulipiferra	5	2		2				1	3	7	9	9									
Celtis laevigata	5	5							3				4	9	4	5	4		4		6
Diospyros virginiana																					
Nyssa sylvatica		4	1		1	5		8	7												
Quercus spp.		3			3		3														
Unknown	8	5	10	5	4	8	4	1	3				6	1	6		2	4	3	3	1
Totals:	18	19	18	17	18	17	17	17	16	16	19	19	17	17	17	17	17	19	15	16	16

2.5.3.1 Results and Discussion

No monitoring results are available at the submittal of this report. As-built data will be compared with first year monitoring data in the Year 1 Monitoring Report, scheduled for submittal to NCEEP during December 2006.

2.6 Areas of Concern

No areas of concern have been identified during the first months following completion of the project.

3.0 REFERENCES

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APPENDIX 1

SELECTED PROJECT PHOTOGRAPHS

BAILEY FORK PHOTO LOG


UT1 constructed riffle


UT1 new channel construction_1


UT1 new channel construction_2


UT1 new channel construction_3


UT1 end of reach


UT1 log weir

BAILEY FORK PHOTO LOG

UT1 constructed riffle_1

UT1 constructed riffle_2

UT1 constructed riffle_3

UT1 constructed riffle_4

UT2 confluence with UT1

UT2 constructed riffle_1

BAILEY FORK PHOTO LOG


UT2 constructed riffle_2


UT2 newly constructed channel_1


UT2 newly constructed channel_2


UT3 construction complete_1


UT3 construction complete_2


UT3 construction complete_3

BAILEY FORK PHOTO LOG

UT3 construction complete_4

UT3 constructed riffle_1

UT3 constructed riffle_2

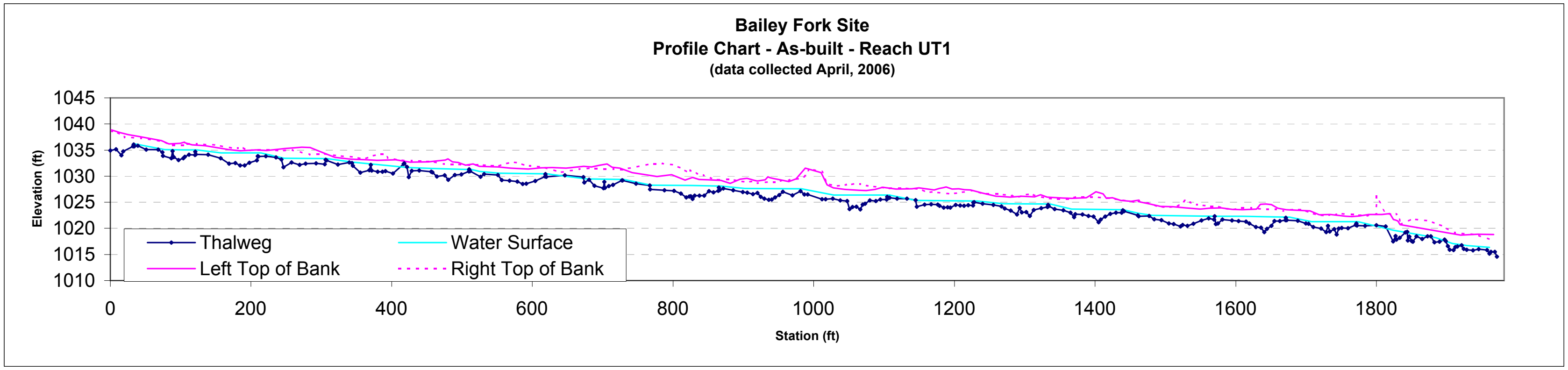
UT3 constructed riffle_3

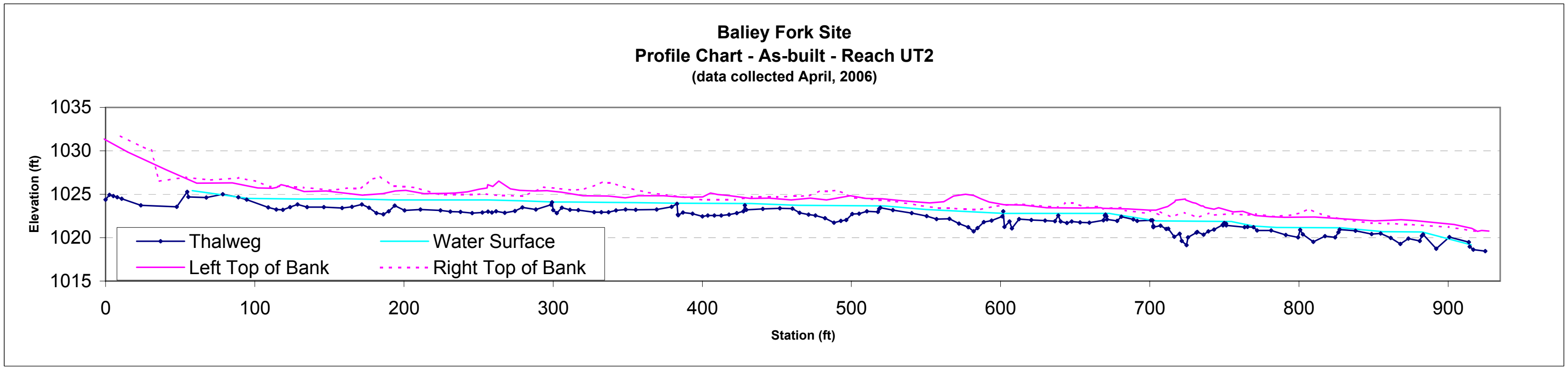
UT3 log weir_1

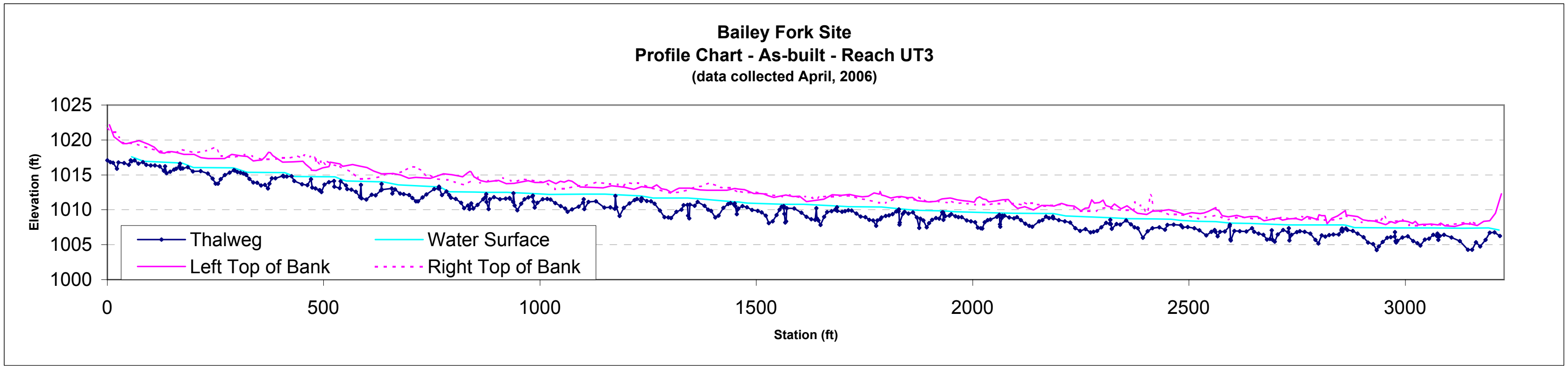
UT3 log weir_2

APPENDIX 2

AS-BUILT CROSS-SECTIONS AND LONGITUDINAL PROFILES


Bailey Fork Site
Profile Chart - As-built - Reach UT1
(data collected April, 2006)
Elevation (ft)
1045
1040
1035
1030
1025
1020
1015
1010
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)
Thalweg
Water Surface
Left Top of Bank
Right Top of Bank


Baliey Fork Site
Profile Chart - As-built - Reach UT2
(data collected April, 2006)
Elevation (ft)
1035
1030
1025
1020
1015
0
100
200
300
400
500
600
700
800
900
Station (ft)
Thalweg
Water Surface
Left Top of Bank
Right Top of Bank

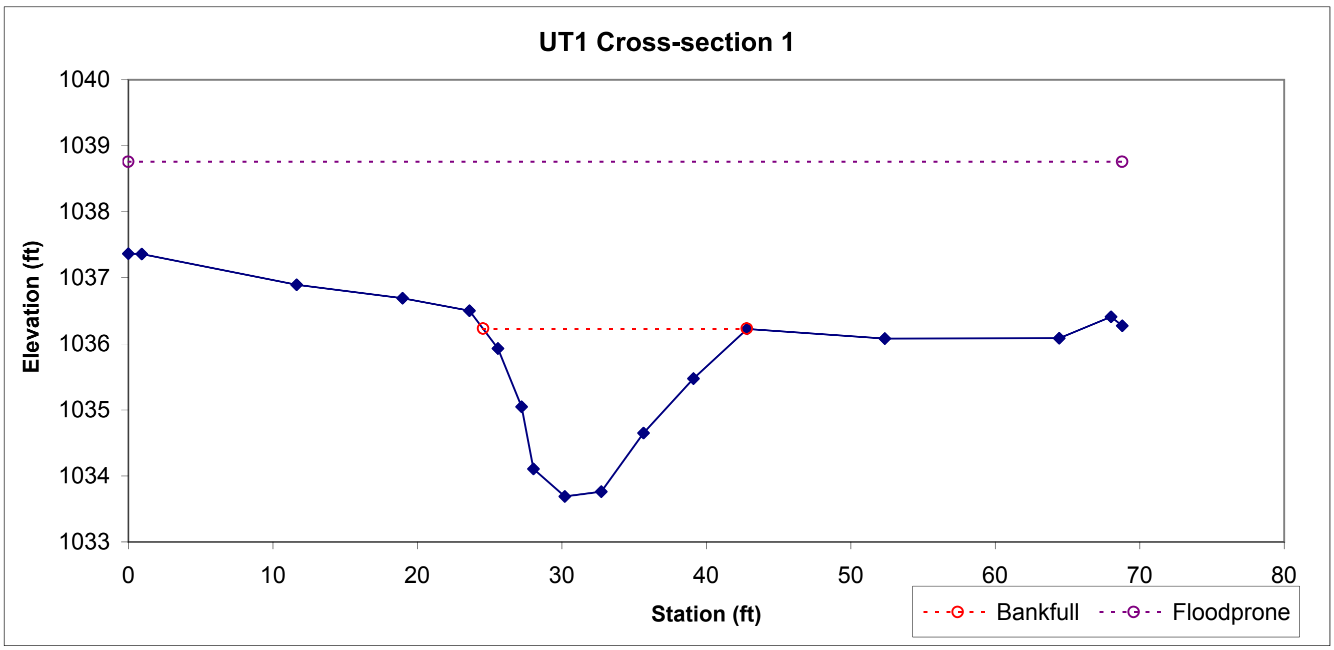

Bailey Fork Site
Profile Chart - As-built - Reach UT3
(data collected April, 2006)
Elevation (ft)
1025
1020
1015
1010
1005
1000
0
500
1000
1500
2000
2500
3000
Station (ft)
Thalweg
Water Surface
Left Top of Bank
Right Top of Bank

UT1 Permanent Cross-section 1
(As-Built Data - collected April 2006)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	---	25.4	18.3	1.4	2.5	13.1	1.0	3.8	1036.2	1036.2



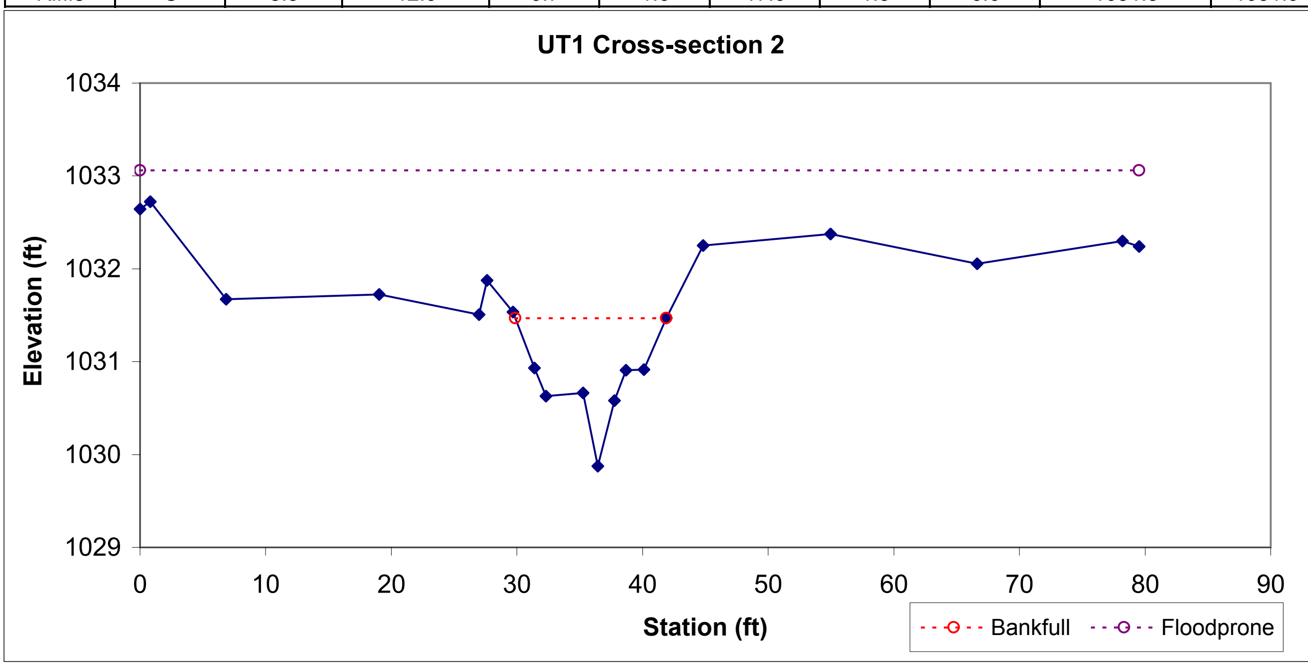
UT1 Permanent Cross-section 2

(As-Built Data - collected April 2006)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	8.5	12.0	0.7	1.6	17.0	1.3	6.6	1031.5	1031.9



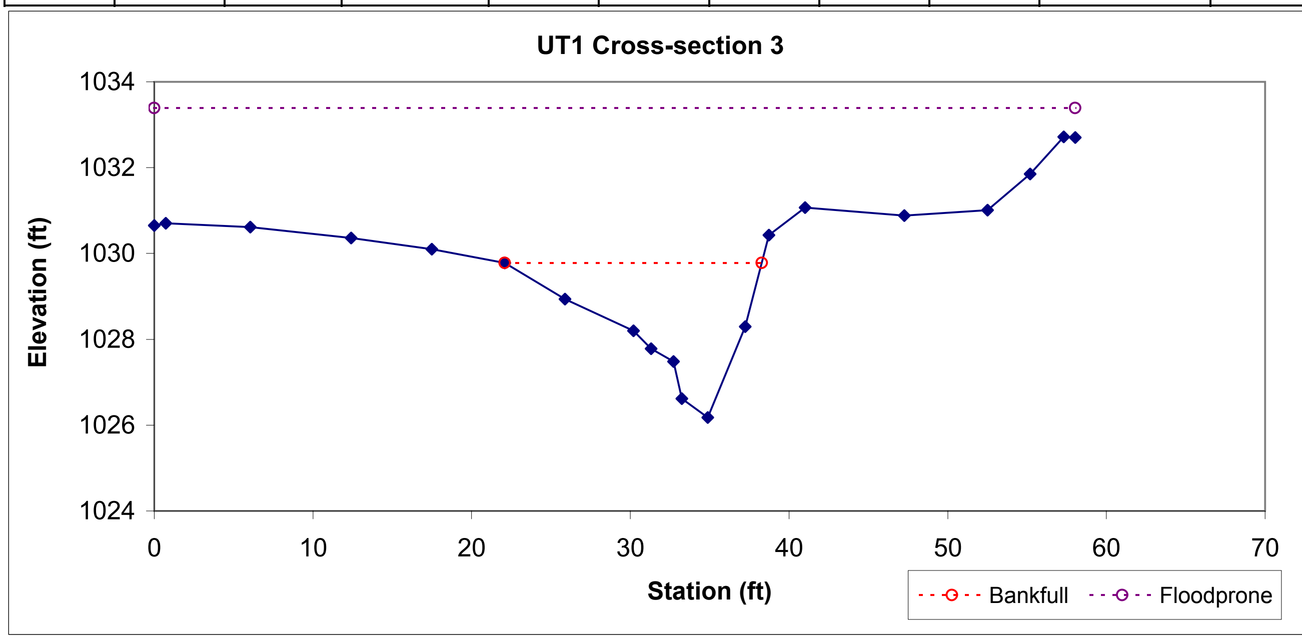
UT1 Permanent Cross-section 3

(As-Built Data - collected April 2006)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	---	25.6	16.2	1.6	3.6	10.2	1.0	3.6	1029.8	1029.8

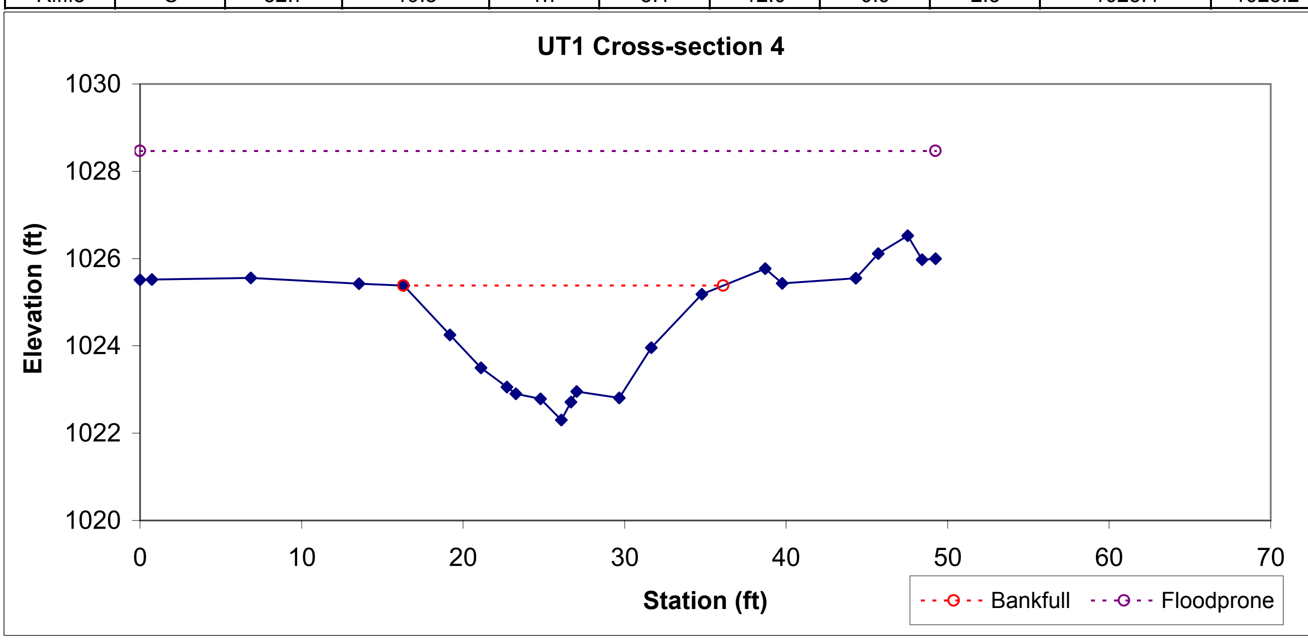


UT1 Permanent Cross-section 4
(As-Built Data - collected April 2006)


Looking at the Left Bank


Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	32.7	19.8	1.7	3.1	12.0	0.9	2.5	1025.4	1025.2

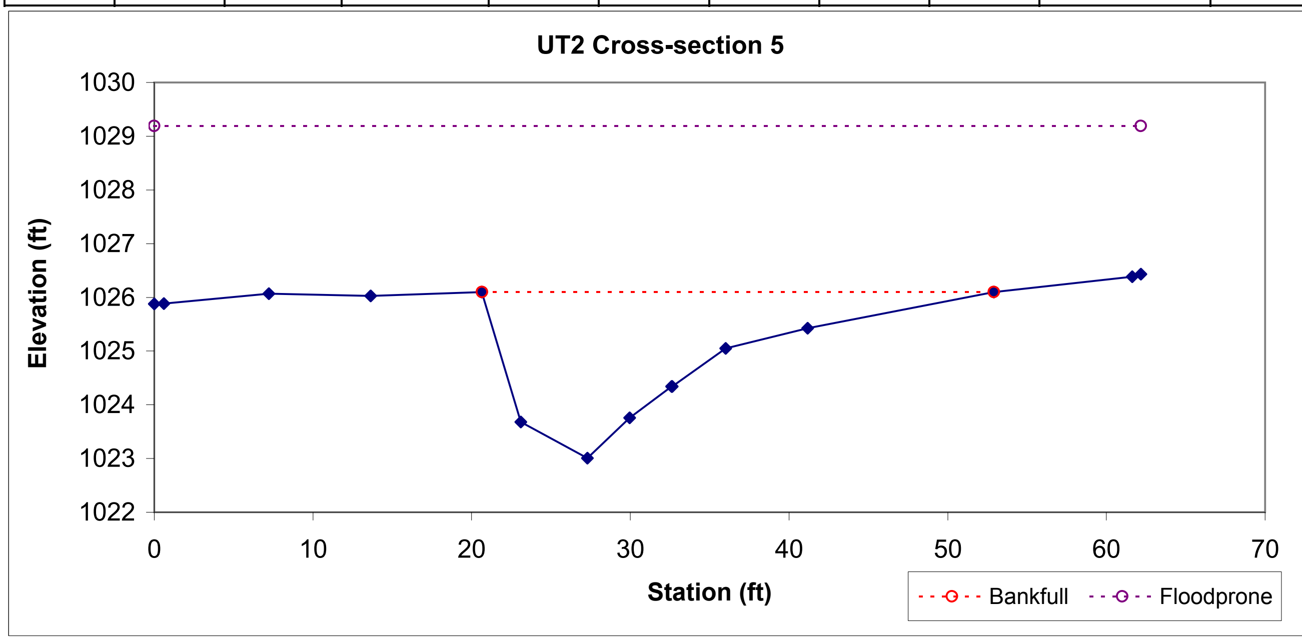


UT2 Permanent Cross-section 5
(As-Built Data - collected April 2006)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	---	40.4	32.3	1.3	3.1	25.8	1.0	1.9	1026.1	1026.1

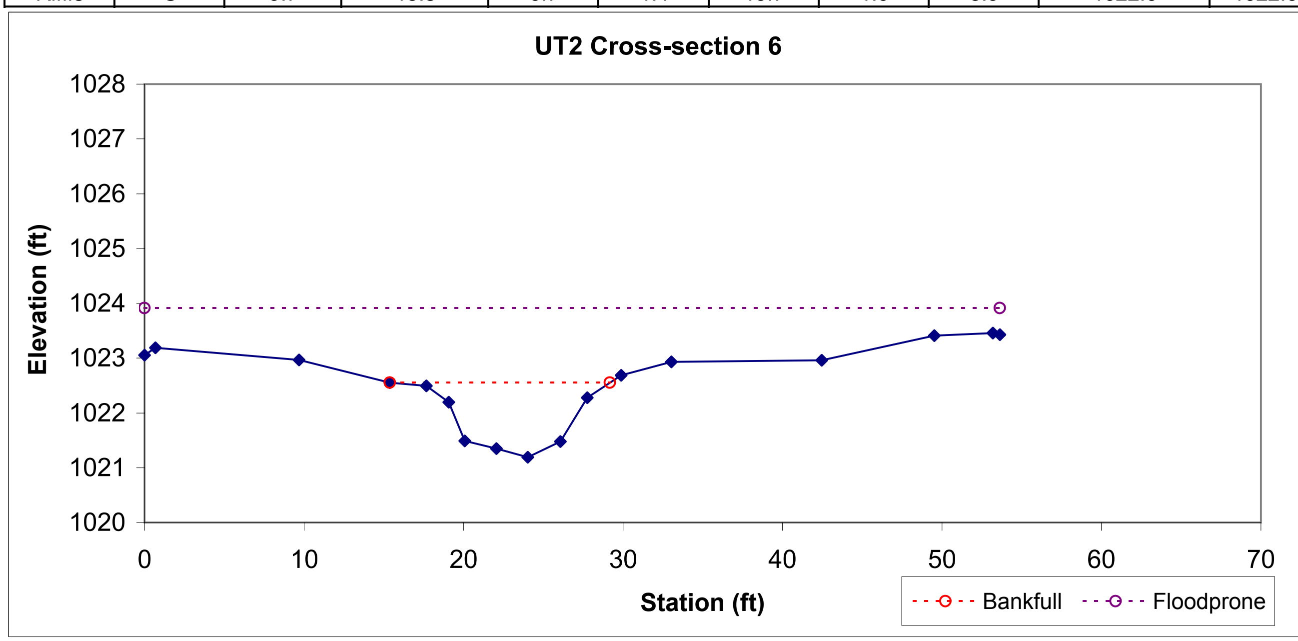


UT2 Permanent Cross-section 6
(As-Built Data - collected April 2006)

Looking at the Left Bank

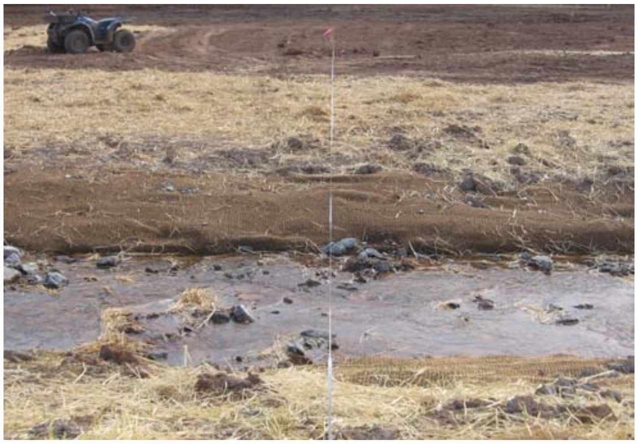
Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	9.7	13.8	0.7	1.4	19.7	1.0	3.9	1022.6	1022.6



UT3 Permanent Cross-section 7

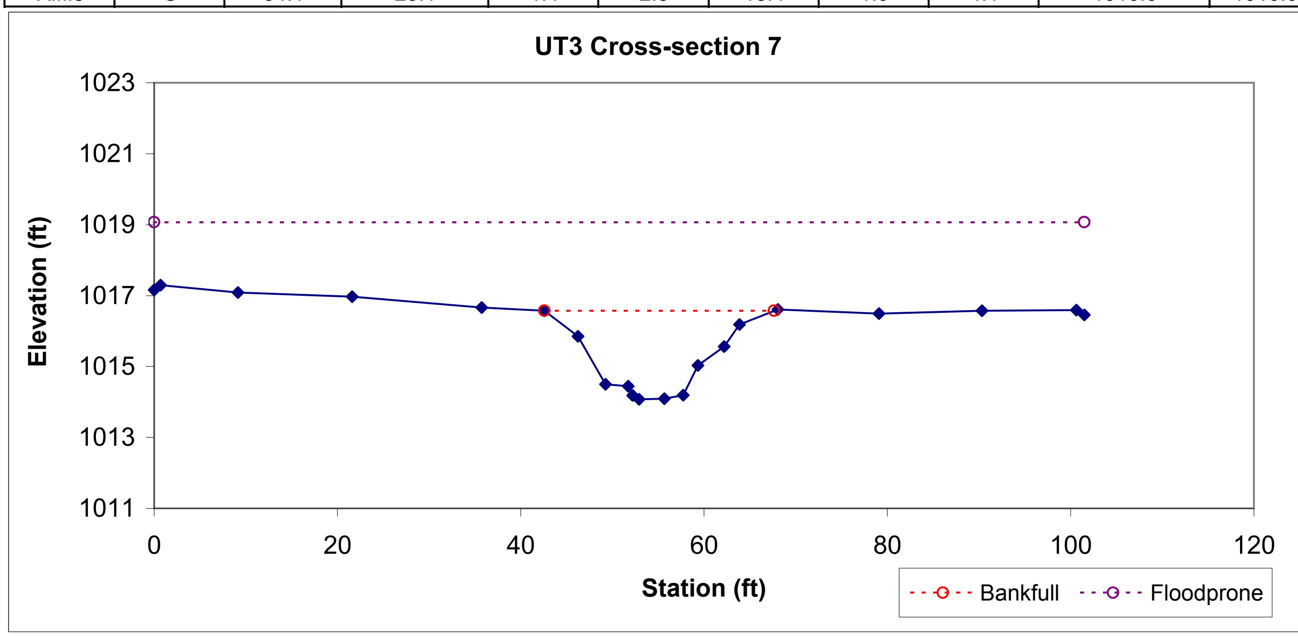
(As-Built Data - collected April 2006)



Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	34.1	25.1	1.4	2.5	18.4	1.0	4.1	1016.6	1016.6



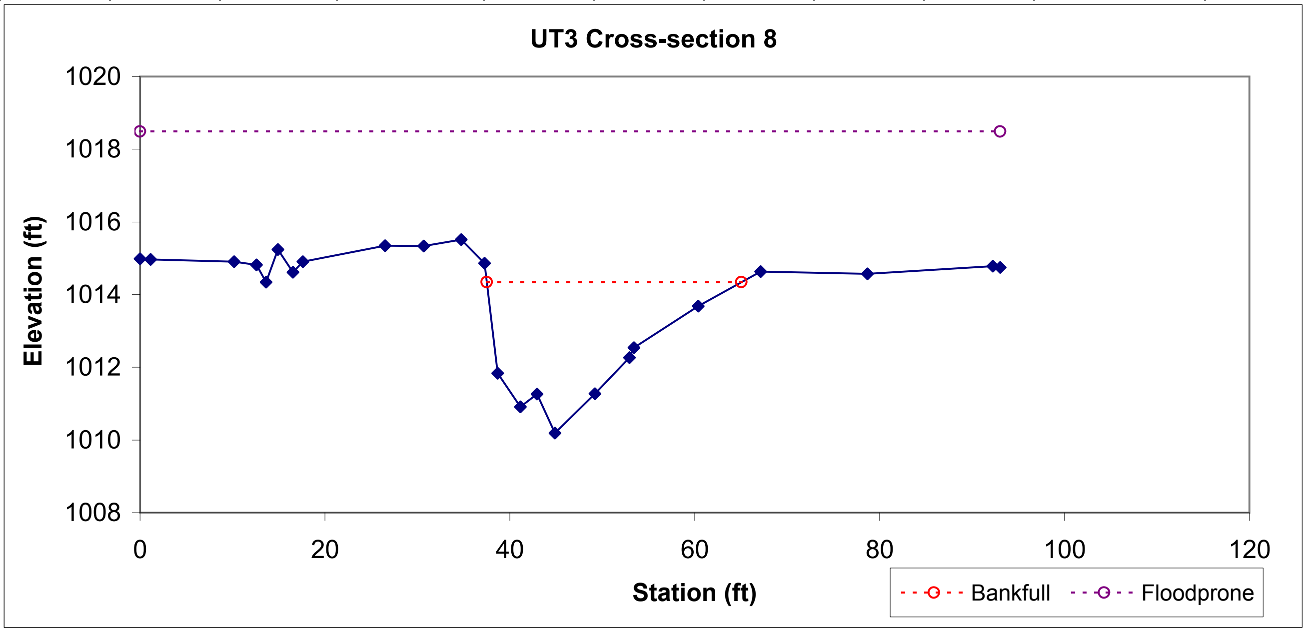
UT3 Permanent Cross-section 8

(As-Built Data - collected April 2006)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	---	57.8	27.5	2.1	4.2	13.1	1.1	3.4	1014.3	1014.6



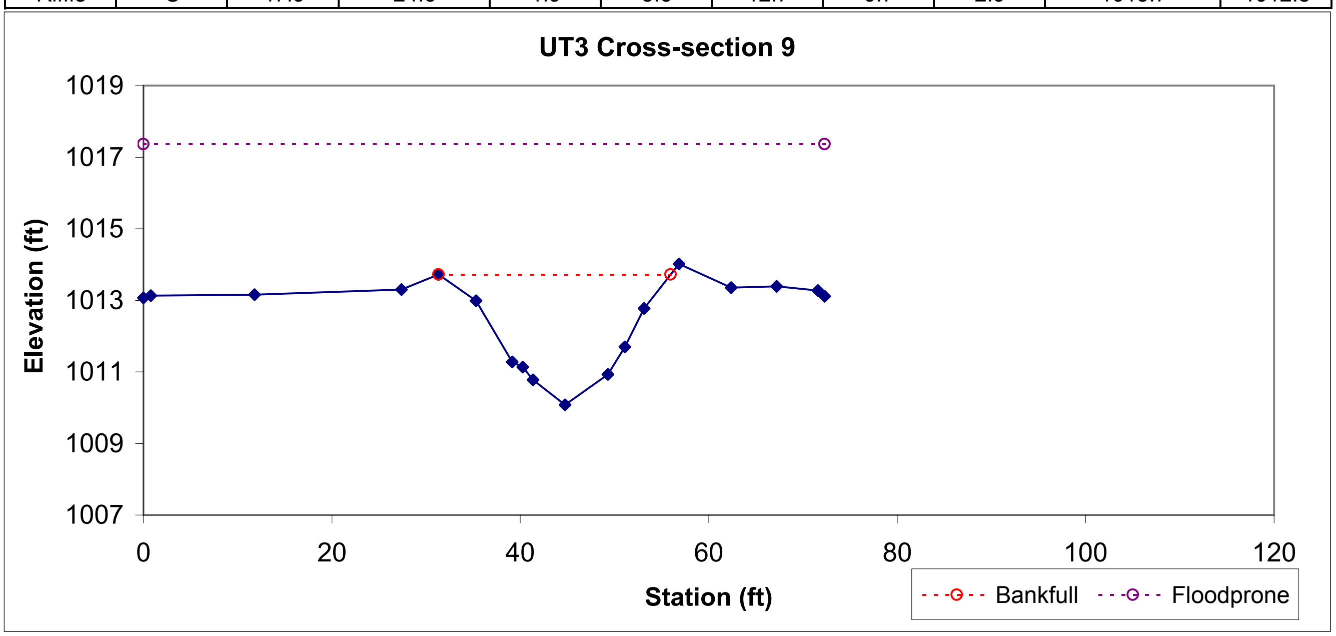
UT3 Permanent Cross-section 9

(As-Built Data - collected April 2006)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	47.9	24.6	1.9	3.6	12.7	0.7	2.9	1013.7	1012.8



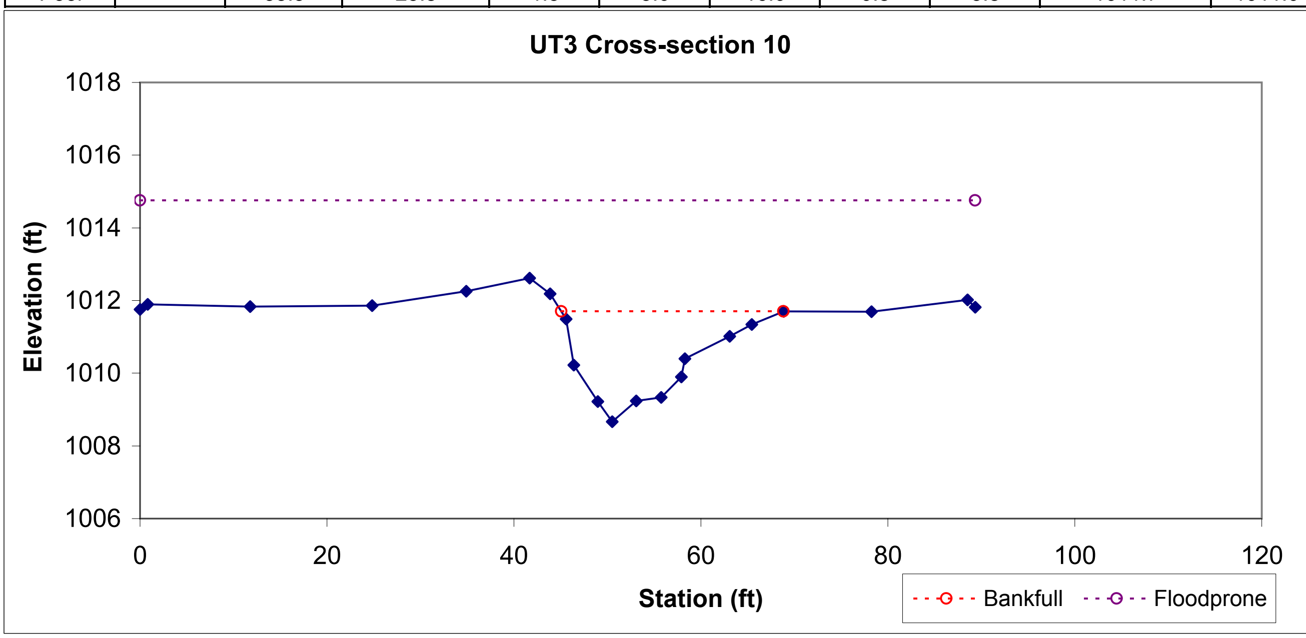
UT3 Permanent Cross-section 10

(As-Built Data - collected April 2006)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	---	35.3	23.8	1.5	3.0	16.0	0.8	3.8	1011.7	1011.0



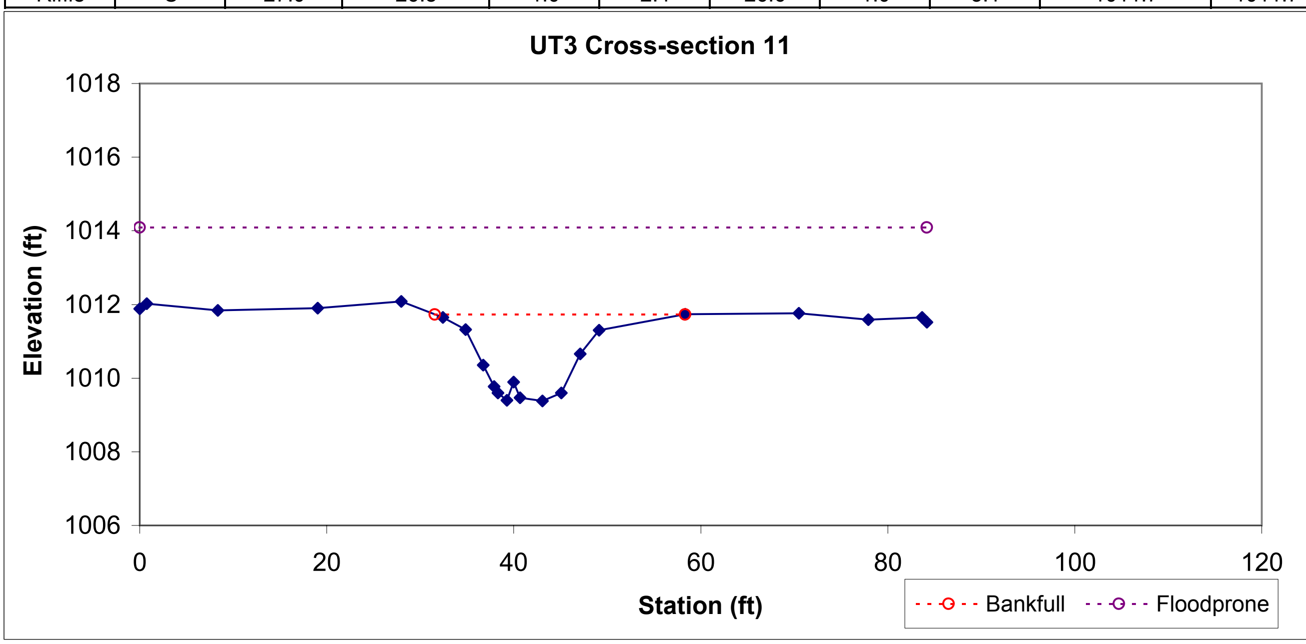
UT3 Permanent Cross-section 11

(As-Built Data - collected April 2006)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	27.0	26.8	1.0	2.4	26.6	1.0	3.1	1011.7	1011.7

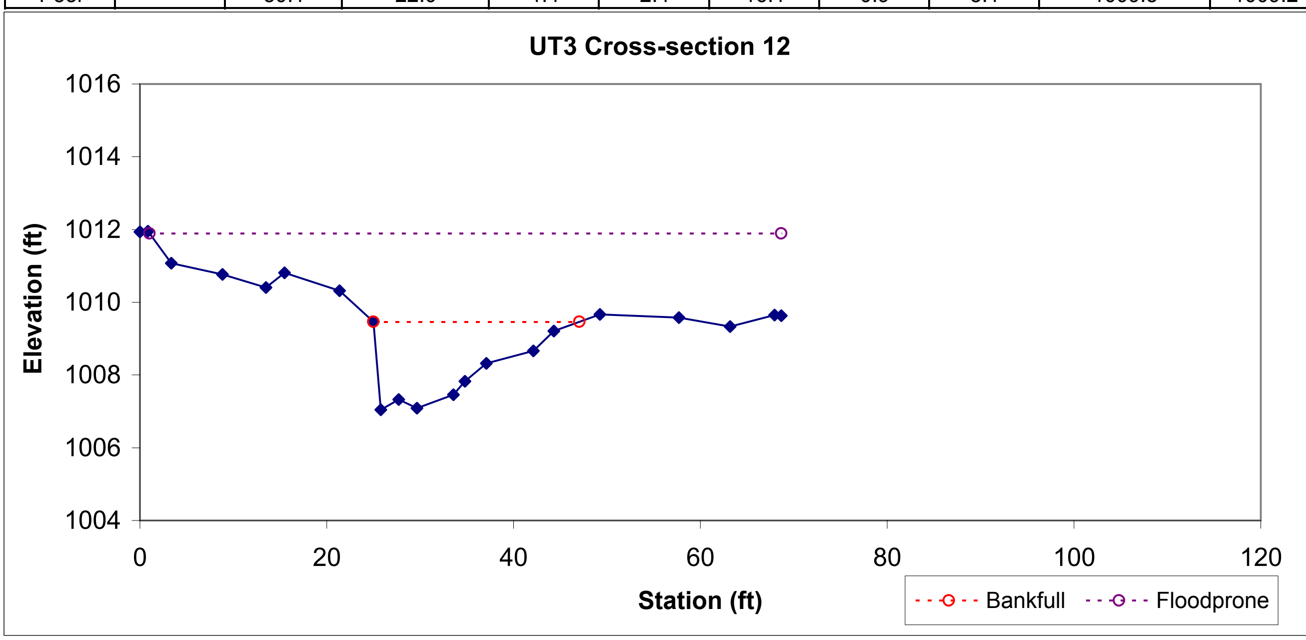


UT3 Permanent Cross-section 12
(As-Built Data - collected April 2006)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	---	30.1	22.0	1.4	2.4	16.1	0.9	3.1	1009.5	1009.2

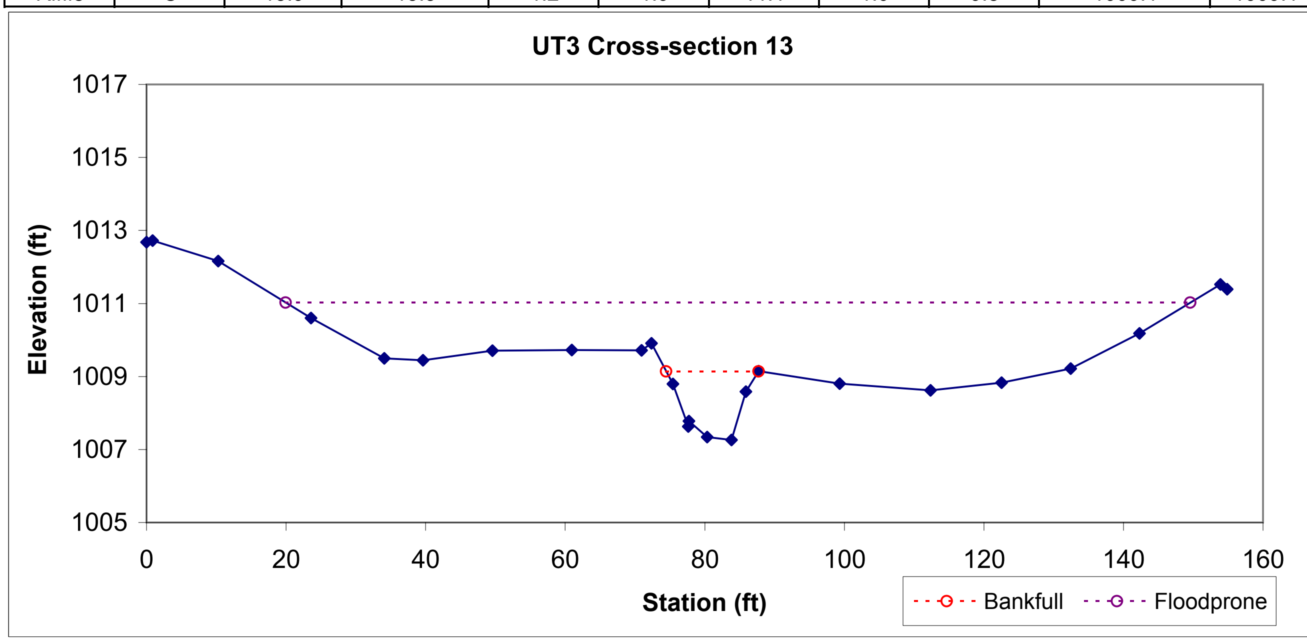


UT3 Permanent Cross-section 13
(As-Built Data - collected April 2006)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	15.9	13.3	1.2	1.9	11.1	1.0	9.8	1009.1	1009.1



APPENDIX 3

AS-BUILT PLAN SHEETS