LITTLE GRASSY CREEK PROJECT

ANNUAL MONITORING REPORT FOR 2008 (YEAR 1)

EEP Project #224

Submitted to:

NCDENR - Ecosystem Enhancement Program
2728 Capital Blvd, Suite 1H 103
Raleigh, NC 27604

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Final

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1.0 EXECUTIVE SUMMARY

The Little Grassy Creek Restoration Site ("Site") was preserved and enhanced through an on-call contract with the North Carolina Ecosystem Enhancement Program (NCEEP). This Annual Report details the monitoring activities during the 2008 growing season (Monitoring Year 1) on the Site. As per the approved Restoration Plan for the Site, this Annual Monitoring Report presents data on stream dimension, stem count data from vegetation monitoring stations, and discusses any observed tendencies relating to stream stability and vegetation survival success.

Land use on the Site consists primarily of agriculture with limited forested areas around the perimeter. Overall, Little Grassy Creek has a stable pattern and the downstream portion of the Site has a greater diversity of bedform in terms of riffle and pool sequences. The upstream portion of the Site consists of natural bedrock grade control above Gela Road. UT1 drains a small, agricultural/forested watershed and is classified as a C5 stream type upstream, transitioning to an E5 stream type downstream.

A total of 7 vegetation monitoring plots 100 square meters (m^2) (10m x 10m) in size were used to predict survivability of the woody vegetation planted on-site. The Year 1 vegetation monitoring indicated an average survivability of 497 stems per acre. Data from the Year 1 monitoring event of the seven vegetation plots showed a range of 202 to 728 stems per acre. Based on these results, vegetation plots 1, 2, 3, 4, 5, and 7 are on track to meet the interim success criteria of 320 stems per acre at the end of monitoring Year 5. The density for plot 6 was 202 stems per acre.

According to the cross-section survey, stream dimension remained stable during the Year 1 monitoring. The in-stream cross-vane structure also remained stable during Year 1.

The total length of stream channel enhanced on the Site was 2,539 linear feet (LF). This entire length was inspected during Year 1 of the monitoring period (2008) to assess stream performance. During Year 1 monitoring, the Site did not experience any restoration-related problems.

In summary, the Site is on track to meet the stream success criteria specified in the Site's Restoration Plan.

2.0 PROJECT BACKGROUND

The project involved the preservation of 12,710 LF of stream and 2,539 LF of stream enhancement. Table 1 summarizes the restoration areas on the Site. Selected site photographs are shown in Appendix A and B. A total of 55.5 acres of stream and riparian buffer are protected through a permanent conservation easement.

2.1 Project Objectives

The specific goals for the Little Grassy Creek Site Restoration Project were as follows:

- Stabilizing the banks on 469 LF of UT1 and 100 LF on Little Grassy Creek
- Controlling invasive species for 7 acres of stream buffer along UT1
- Enhancing stream buffer on approximately 8.3 acres along UT1 and Little Grassy Creek
- Preserving approximately 14,698 LF of stream along UT1 and Little Grassy Creek
- Establishing native streambank and floodplain vegetation in the permanent conservation easement
- Improving water quality in the Little Grassy Creek watershed by restoring the riparian buffer and reducing bank erosion.

2.2 Project Structure, Restoration Type and Approach

The stream enhancement design for UT1 at the confluence with Little Grassy Creek allows stream flows larger than bankfull to spread onto the floodplain, dissipating flow energies and reducing stress on streambanks. In-stream structures on UT1 consisted of root wads which were used to reduce streambank stress, as well as promote bedform sequences and habitat diversity. The design for Little Grassy Creek included the installation of a cross vane at the downstream portion of the Site. The cross vane was placed to provide grade control, as well as reduce streambank stress and create habitat diversity. The ford crossing above the cross vane required the removal of an existing, failed concrete ford crossing, which was replaced with a permanent stone ford crossing. Another ford crossing was reconstructed to provide access to other areas of the site and also provides habitat diversity. By landowner request, a culvert for an unnamed tributary (UT) to Little Grassy Creek was repaired and stabilized in order to provide road access across the UT to other parts of the property. The culvert was outside the conservation easement area.

Streambanks were stabilized using a combination of erosion control matting, temporary and permanent seeding, and bare-root planting. The purpose of the project was to enhance and preserve stream functions on the Site. Native vegetation was planted across the Site, and these areas are protected through a permanent conservation easement. Invasive species were cleared on the Site during the construction phase and will be monitored for any re-establishment.

Table 1. Project Restoration Components

Little Grassy Creek Restoration Site: EEP No. 224						
Project Segment or Reach ID	**Existing Feet/Acres**	**Mitigation Type ***	**Approach**	**Linear Footage or Acreage**	**Stationing**	**Comment**
UT1	-	P	-	164	see plan sheets	Plant native vegetation
UT1	2,643	E	-	2,464	10+00 36+27	Bank sloping, root wad installation and riparian buffer planting
Little Grassy Creek	12,624	P	-	12,546	10+00 136+21	Plant native vegetation
Little Grassy Creek	-	E	-	75	see plan sheets	One cross vane installed, banks were seeded, mulched and matted. Install stone ford crossing
Mitigation Unit Summations						
Stream (lf)	Riparian Wetland		Non-riparian Wetland	Total Wetland	Buffer (Ac)	Comment
3,557	NA		NA	NA	55.5	

* P = Preservation

E = Enhancement

2.3 Location and Setting

The Site is located in Granville, County, NC (Figure 1), approximately 2.5 miles southwest of the town of Stovall. The Site lies in the Roanoke River Basin within North Carolina Division of Water Quality sub-basin 03-02-06 and NCEEP targeted local watershed 03010102161020. The project area is approximately five miles downstream of the headwaters of Little Grassy Creek.

2.4 Project History and Background

Land use on the Site consists primarily of agriculture with limited forested areas around the perimeter. Overall, Little Grassy Creek has a stable pattern and the downstream portion of the Site has a greater diversity of bedform in terms of riffle and pool sequences. The upstream portion of the Site consists of natural bedrock grade control above Gela Road. UT1 drains a small, agricultural/forested watershed and is classified as a C5 stream type upstream, transitioning to an E5 stream type downstream.

The chronology of the Little Grassy Creek Project is presented in Table 2. The contact information for all designers, contractors, and relevant suppliers is presented in Table 3. Relevant project background information is presented in Table 4.

2.5 Project Plan

Plans depicting the as-built conditions of the major project elements, locations of permanent monitoring cross-sections, and locations of permanent vegetation monitoring plots are presented in Figures 2A, 2B, 2C, 2D, 2E and 2F of this report.

Table 2. Project Activity and Reporting History

Little Grassy Creek Restoration Site: EEP No. 224			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan Prepared	N/A	N/A	Jul-06
Restoration Plan Amended	N/A	N/A	Jul-06
Restoration Plan Approved	N/A	N/A	Aug-06
Final Design – (at least 90% complete)	N/A	N/A	Sept-06
Construction Begins	Sep-07	N/A	Sep-07
Temporary S&E mix applied to entire project area	Oct-07	N/A	Sep-07
Permanent seed mix applied to entire project area	Oct-07	N/A	Oct-07
Planting of live stakes	Oct-07	N/A	Sep-07
Planting of bare root trees	Oct-07	N/A	Jan-08
End of Construction	Oct-07	N/A	Sep-07
Survey of As-built conditions (Year 0 Monitoring-baseline)	Oct-07	Oct-07	Oct-07
Year 1 Monitoring	Dec-08	Oct-08	Dec-08

Table 3. Project Contact Table

Little Grassy Creek Restoration Site: EEP No. 224	
Designer	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 200 Cary, NC 27518 Contact: Kevin Tweedy, Tel. 919-463-5488
Construction Contractor	
River Works, Inc.	8000 Regency Parkway, Suite 200 Cary, NC 27518 Contact: Will Pedersen, Tel. 919-459-9001
Planting Contractor	
River Works, Inc.	8000 Regency Parkway, Suite 200 Cary, NC 27518 Contact: Will Pedersen, Tel. 919-459-9001
Seeding Contractor	
River Works, Inc.	8000 Regency Parkway, Suite 200 Cary, NC 27518 Contact: Will Pedersen, Tel. 919-459-9001
Seed Mix Sources	Mellow Marsh Farm, 919-742-1200
Nursery Stock Suppliers	International Paper, 1-888-888-7159
Monitoring Performers	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 200 Cary, NC 27518
Stream Monitoring Point of Contact:	Dwayne Huneycutt, Tel. 919-463-5488
Vegetation Monitoring Point of Contact:	Dwayne Huneycutt, Tel. 919-463-5488

Table 4. Project Background Table

Little Grassy Creek Restoration Site: EEP No. 224	
Project County:	Granville County, NC
Drainage Area:	
Reach: UT1	0.24 mi²
Reach: Little Grassy Creek	8.1 mi²
Estimated Drainage % Impervious Cover:	
UT1	<5%
Little Grassy Creek	<5%
Stream Order:	
UT1	1
Little Grassy Creek	4
Physiographic Region	Coastal Plain
Ecoregion	Carolina Slate Belt
Rosgen Classification of As-Built	
UT1	Cc
Little Grassy Creek	E4
Cowardin Classification	
UT1	Riverine, Intermittent, Streambed
Little Grassy Creek	Riverine, Lower Perennial, Unconsolidated Bottom
Dominant Soil Types	
UT and Little Grassy Creek	Ch
Reference site ID	N/A
USGS HUC for Project and Reference sites	03010102161020
NCDWQ Sub-basin for Project and Reference	03-02-06
NCDWQ classification for Project and Reference	
UT1	C
Little Grassy Creek	C
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor?	N/A
% of project easement fenced	25%

3.0 PROJECT CONDITION AND MONITORING RESULTS

3.1 Vegetation Assessment

3.1.1 Description of Vegetative Monitoring

The upstream construction on the Site consisted of 2,464 LF of invasive species removal and riparian buffer planting. The downstream construction consisted of 270 LF of riparian buffer planting. Upon completion of the cross vane structure, the adjacent banks were seeded, mulched, matted, and live staked. UT1 underwent invasive species removal and riparian buffer planting.

At the time of planting, seven vegetation plots – labeled 1 through 7 - were delineated on-site to monitor survival of the planted woody vegetation. Each vegetation plot is 0.025 acre in size, or 10 meters x 10 meters. All of the planted stems inside the plot were flagged to distinguish them from any colonizing individuals and to facilitate locating them in the future. The trees also were marked with aluminum metal tags to ensure that the correct identification is made during future monitoring of the vegetation plots. All woody vegetation within monitored survival plots were marked with blue flagging tape and will be evaluated for at least five years to determine survival rates. Invasive species survival rates will be monitored in these plots as well as survival of planted vegetation. Plots included both live staked and other planted areas.

The woody vegetation was planted randomly six to eight feet apart from the top of the stream banks to the outer edge of the project's re-vegetation limits. In general, bare-root vegetation was planted at a target density of 680 stems per acre, in an 8-foot by 8-foot grid pattern. The tree species planted at the Site are shown in Table 5. The permanent seed mix of herbaceous species applied to the project's riparian area included soft rush (*Juncus effuses),* little bluestem (*Schizachyrium scoparium*), redtop (*Agrostis alba),* Virginia wild rye (*Elymus virginicus),* switchgrass (*Panicum virgatum), gamma grass (Tripsicum dactyloides),* smartweed (*Polygonum pennsylvanicum),* tick seed (*Bidens frondosa),* lance leaf coreopsis (*Coreopsis lanceolata*), deer tongue (*Panicum clandestinum*), big bluestem (*Andropogon gerardii*) and Indian grass (*Sorgastrum nutans*). This seed mixture was broadcast on the Site at a rate of 15 pounds per acre. All planting was completed in September 2007.

On a designated corner within each of the seven vegetation plots, one herbaceous plot was also delineated. The herbaceous plots measure 1 meter x 1meter in size. These plots were photographed at the end of the growing season. The locations of the seven vegetation plots are presented in Figures 2A through 2F.

The vegetation monitoring protocol used for collecting vegetation data is the CVS-EEP Protocol for Recording Vegetation, version 4.0 (Lee et al. 2006). The taxonomic standard applied for the seven vegetation plots was "Flora of the Carolinas, Virginia and Georgia" by Alan S. Weakley.

3.1.2 Vegetative Success Criteria

Success of woody vegetation plantings will be defined as 320 stems per acre after five years. When woody vegetation does not survive, a determination will be made as to the need for replacement; in general, if greater than 25 percent die, replacement will be

required. The presence of non-native species shall be evaluated on a yearly basis and removal may be required by hand cutting and/or herbicide treatment. Herbaceous vegetation, primarily native grasses, planted at the site shall have at least 95 percent coverage of the seeded/planted area. No bare patches shall exceed 10 square feet. Any herbaceous vegetation not meeting these criteria shall be replaced. At a minimum, at all times ground cover at the project site shall be in compliance with the North Carolina Erosion and Sedimentation Control Ordinance.

Table 5
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	9%	275
Acer rubrum	Red maple	6%	183
Fraxinus pennsylvanica	Green Ash	9%	275
Platanus occidentalis	Sycamore	12%	366
Quercus phellos	Willow Oak	6%	183
Diospyros virginiana	Persimmon	6%	183
Liriodendron tulipifera	Tulip poplar	12%	366
Carpinus carolinina	Ironwood	6%	183
Cercis canadensis	Redbud	6%	183
Corylus americana	American hazelnut	8%	244
Lindera benzoin	Spicebush	16%	488
Sambucus canadensis	Elderberry	4%	122
Native Herbaceous Species			
Elymus virginicus	Virginia wildrye	15%	N/A
Panicum virgatum	Switchgrass	15%	N/A
Tripsicum dactyloides	Gamma grass	5%	N/A
Polygonum pennsylvanicum	Smartweed	5%	N/A
Juncus effusus	Soft rush	5%	N/A
Schizachyrium scoparium	Little bluestem	5%	N/A
Agrostis alba	Redtop	10%	N/A

Table 5
Vegetation Species Planted Across the Restoration Site

Scientific Name	Common Name	Percent Planted by Species	Total Number of Stems
Bidens frondosa	Tick seed	10%	N/A
Coreopsis lanceolata	Lance leaf coreopsis	10%	N/A
Panicum clandestinum	Deer tongue	10%	N/A
Andropogon gerardii	Big bluestem	5%	N/A
Sorgastrum nutans	Indian grass	5%	N/A
Woody Vegetation for Live Stakes			
Cornus amomum	Silky Dogwood	40%	400
Physocarpus opulifolius	Ninebark	10%	100
Salix serecia	Silky Willow	40%	400
Sambucus canadensis	Elderberry	10%	100

3.1.3 Vegetative Observations and Results

The species planted as part of the permanent ground cover seed mixture broadcast on the Site after construction were present during Year 1 monitoring of the Site.

Tables A.1. through A.5. in Appendix A present vegetation metadata, vegetation vigor, vegetation damage and stem count data of the monitoring stations at the end of the Year 1 monitoring period. Data from the Year 1 monitoring event of the seven vegetation plots showed a range of 202 to 728 stems per acre. Data for Year 1 showed that the Site exhibited an average of 497 stems per acre. Based on these results, plots 1, 2, 3, 4, 5, and 7 are on track to meet the interim success criteria of 320 stems per acre at the end of monitoring Year 5. The density for plot 6 was 202 stems per acre, and the plot will need to be replanted in winter/spring 2009.

Trees within each monitoring plot were flagged regularly to prevent planted trees from losing their identifying marks due to flag degradation. It is important for trees within the monitoring plots to remain marked to ensure they are all accounted for during the annual stem counts and calculation of tree survivability. Permanent aluminum tags were used on surviving stems to aid in relocation and identification during future counts. Flags were also used to mark trees because they do not interfere with the growth of the tree.

No significant volunteer woody species were observed in any of the vegetation plots. The plots will be assessed during Year 2 monitoring for significant volunteer species.

3.1.4 Vegetative Problem Areas

There are quite a few weedy species occurring on the Site, though few seem to be posing significant problems for the woody or herbaceous hydrophytic vegetation. The weedy species are mostly annuals and seem to pose very little threat to survivability on-site.

However, blackberry (*rubus spp.*) was noted as a risk to stem survivability in plot 6. Plot 7 did not exhibit a significant risk from *rubus spp.* during the site visit. Based on the individual plot results, it is unlikely that plot 6 will meet the success criteria of 320 stems per acre at the end of Year 5 without supplemental plantings. Plot 7 should be observed closely in the coming year to determine if future supplemental planting of the area will be required.

3.1.5 Vegetation Photographs

Photographs are used to visually document vegetation plot success. A total of seven reference stations were established to document tree conditions at each vegetation plot across the Site. Additional photo stations were also established at each of the seven vegetation plots for herbaceous vegetation monitoring. Reference photos of both tree conditions and herbaceous conditions were taken at least once per year. Photos of the tree plots showing the on-site vegetation are included in Appendix A of this report. Photos of the herbaceous plots are also included in Appendix A.

3.2 Stream Assessment

3.2.1 Morphometric Success Criteria

To document the stated stream success criteria, the following monitoring program was instituted following construction completion on the Site:

Cross-sections: Four permanent cross-sections were surveyed and established with an effort made to include both riffles and pools. Two pool cross-sections and one riffle cross-section were installed on UT1. One pool cross-section was installed on Little Grassy Creek. Each cross-section was marked on both banks with permanent pins to establish the exact transect used. For monitoring, a common benchmark will be used for cross-sections and consistently used to facilitate the comparison of year-to-year data. The annual cross-section survey will include points measured at all breaks in slope, including top of bank, bankfull, inner berm, edge of water and thalweg and at two-foot intervals between. Calculations will be made of width/depth ratio, entrenchment ratio, and low bank height ratio. Riffle cross-sections will be classified using the Rosgen stream classification system.

The approved Restoration Plan requires the following criteria be met to achieve stream restoration success. There should be little change in as-built cross-sections. If changes do take place, they will be evaluated to determine if they represent a movement toward a more unstable condition (e.g., down-cutting, erosion) or are minor changes that represent an increase in stability (e.g., settling, vegetative changes, deposition along the banks, decrease in width/depth ratio and/or cross-sectional area).

Longitudinal Profiles: In accordance with the Site Restoration Plan, the five-year monitoring for the Site does not include surveying the longitudinal profile within the enhanced areas of UT1 or Little Grassy Creek.

The as-built profile was conducted after construction in October 2007 for the enhanced lengths of UT1 and Little Grassy Creek. Measurements included thalweg, water surface, bankfull, and top of low bank. Each of these measurements was taken at the head of each feature (e.g., riffle, pool, and glide). All surveys were tied to a single, permanent benchmark.

3.2.2 Morphometric Results

Year 1 cross-section monitoring data for stream stability were collected during September 2008. There are four permanent cross-sections along the restored channels, one is located across a riffle and three are located across pools. The cross-sections were re-surveyed to document stream dimension at the end of monitoring Year 1. Data from each of these cross-sections are summarized in Appendix B. The cross-sections show that there has been very little adjustment to stream dimension since construction.

Cross-section 2 is located on UT1 at station is 34+00. It is located across a riffle, which is normally found between meander bends. Cross-section 2 remained stable during Year 1 monitoring and exhibited relatively no change since as-built conditions.

Cross-sections 1 and 3 are located on UT1 at stations 33+25 and 35+75, respectively. The cross-sections are located across pools found at the apex of meander bends. Based on the cross-section data, the pool on cross-section 1 has deepened slightly since as-built conditions. The pool on cross-section 3 has deepened significantly and has also shown an increase in bankfull area. The pool cross-sections are showing slow development of point bar features on the inside bank of the meander bends.

Cross-section 4 is located across the cross vane on Little Grassy Creek at station 126+50.m The data show that cross-section 4 has deepened slightly and the bankfull area has remained stable since as-built conditions. During Year 1 monitoring, the Site did not experience any stream enhancement-related problems. However, a beaver dam was observed in October of 2008 on Little Grassy Creek. The dam is located upstream of the ford crossing above the historic mill.

3.2.3 Stream Photographs

Photographs are used to visually document restoration success. One reference station was established to document conditions at the constructed grade control cross vane on Little Grassy Creek. Additional photo stations were also established at each of the four permanent cross-sections. The location of the cross vane photo station is shown in Figure 2F. Reference photos are taken at least once per year.

Both stream banks are photographed at each permanent cross-section photo station. For each stream bank photo, the photo view line follows a survey tape placed across the channel, perpendicular to flow (representing the cross-section line). The photograph is framed so that the survey tape is centered in the photo (appears as a vertical line at the center of the photograph), keeping the channel water surface line horizontal and near the lower edge of the frame.

Photographs will be used to document restoration success visually. Reference stations were photographed before construction and will be photographed for at least five years following construction. Reference photos will be taken once per year, from a height of

approximately five to six feet. Permanent markers are established to ensure that the same locations (and view directions) on the Site are monitored during each monitoring event.

A photo log of the cross vane is presented in Appendix B of this report. Data for each of the four permanent cross-sections are also included in Appendix B. Due to a large rain event on the day of the cross-section survey, the cross-section 4 photo shows slightly turbid water within the channel. The cross-vane photo taken on June 5, 2008 shows turbid water which was prompted by the monitoring personnel when walking across the ford crossing upstream of the cross-vane. The cross-vane is located downstream of the preservation section of channel where no in-stream channel work was completed. The photos were taken a year after construction, therefore, the turbidity observed in these photos are not directly related to restoration activities.

The last cross vane photograph was taken in October 2008, at the end of the monitoring season, to document the evolution of the structure since as-built conditions. The cross-section photographs were taken in September 2008.

3.2.4 Stream Stability Assessment

A summary of the results obtained from the visual inspection of in-stream structures performed during Year 1 of post-construction monitoring is presented in Table B.1. The percentages noted are a general, overall field evaluation of the how the features were performing at the time of the photo point survey. According to the visual stability assessment, during Year 1 monitoring, all features are performing as designed.

3.2.5 Morphology and Hydraulic Summary Table

The Year 1 data collected during the project's post construction monitoring period are summarized in the morphology and hydraulic summary table presented in Appendix B.

4.0 OVERALL CONCLUSIONS AND RECOMMENDATIONS

Stream Monitoring - The total length of enhanced stream channel on the Site was 2,539 LF. During Year 1 monitoring, the Site did not experience any stream enhancement-related problems. Based on the data collected, all riffles, pools, and other constructed features along the enhanced channels are stable and functioning as designed.

Overall, the Site is on track to achieve the stream morphology success criteria specified in the Restoration Plan for the Site.

Vegetation Monitoring - For the 7 vegetation plots, monitoring indicated a survivability range of 202 stems per acre to 728 stems per acre with an overall average of 497 stems per acre. The data shows that vegetation plot 6 will need to be replanted in winter/spring 2009. Vegetation plots 1, 2, 3, 4, 5, and 7 are on track for meeting the success interim criteria of 320 trees per acre by the end of Year 5.

5.0 WILDLIFE OBSERVATIONS

Observations of deer and raccoon tracks are common on the Site. During certain times of the year, frogs and crawfish and have been periodically observed.

6.0 REFERENCES

Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (http://cvs.bio.unc.edu/methods.htm)

Rosgen, D. L. 1994. *A Classification of Natural Rivers*. Catena 22: 169-199.

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.

USDA, NC Agricultural Research Service, *Soil Survey of Granville County, North Carolina*, 1997.

Weakley, Alan S. 2005. *Flora of the Carolinas, Virginia and Georgia.* University of North Carolina Herbarium, University of North Carolina, Chapel Hill.

FIGURES

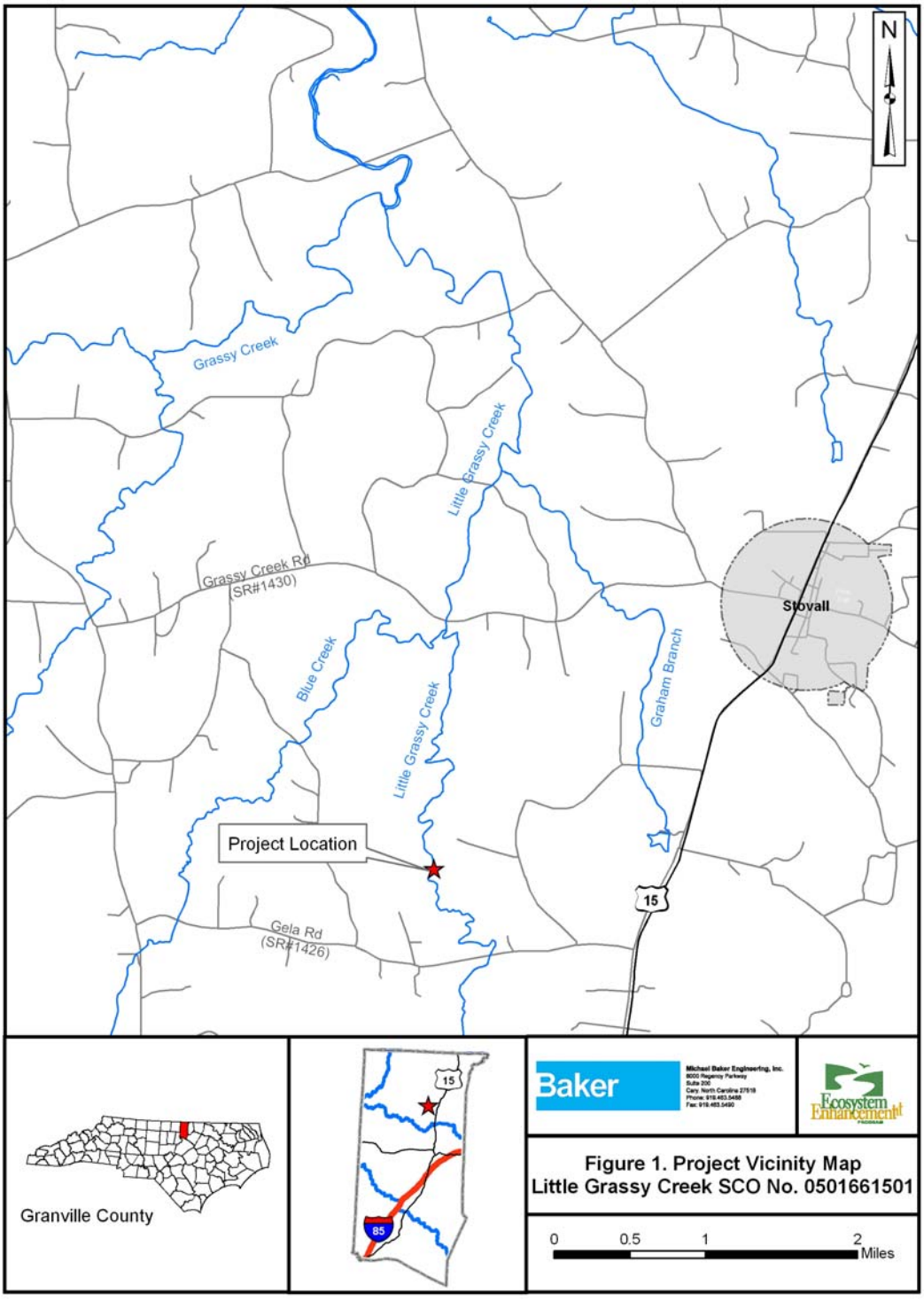


Figure 1. Location of Little Grassy Creek Restoration Site.

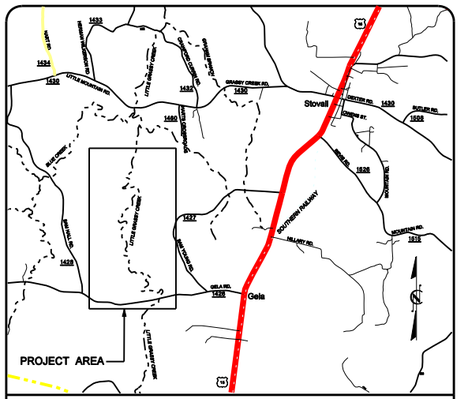
STATE	SEP SCO NO.	SHEET NO.	TOTAL SHEETS
NC	0501661501	1	10

LITTLE GRASSY CREEK PROJECT

GRANVILLE COUNTY

LOCATION: STOVALL, NORTH CAROLINA
OFF GELA ROAD SR 1426

TYPE OF WORK: STREAM ENHANCEMENT AND PRESERVATION AS–BUILT



VICINITY MAP

INDEX OF SHEETS

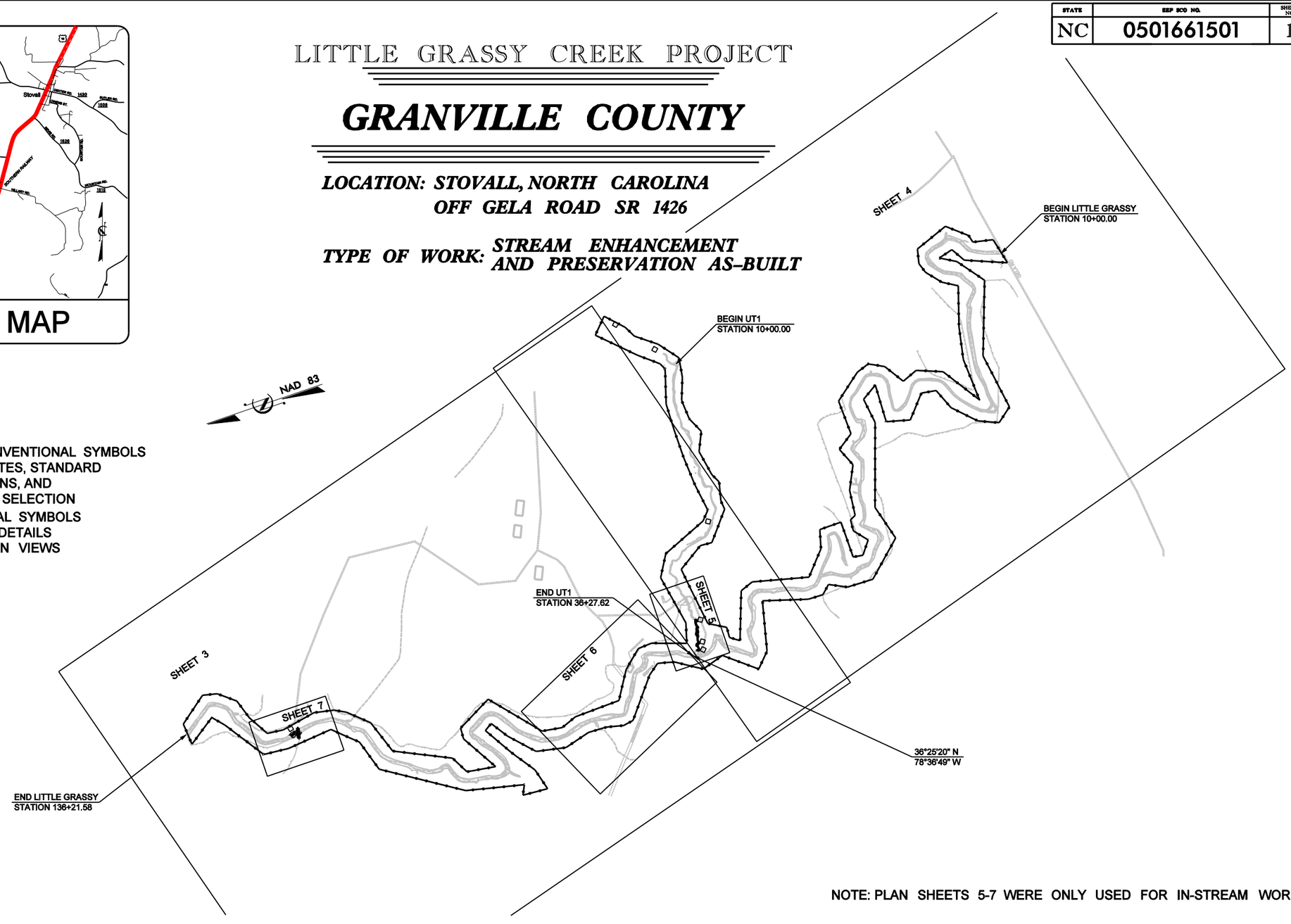


FIGURE 2A

NOTE: PLAN SHEETS 5-7 WERE ONLY USED FOR IN-STREAM WORK.

PROJECT: 0501661501

GRAPHIC SCALES

40 20 0 40 80
PLANS

40 20 0 40 80
PROFILE (HORIZONTAL)

20 10 0 20 40
PROFILE (VERTICAL)

PREPARED FOR THE OFFICE OF:
NCDENR – ECOSYSTEM ENHANCEMENT PROGRAM
2728 CAPITAL BLVD, SUITE 1H 103
RALEIGH, NC 27604

Ecosystem Enhancement PROGRAM

NCEEP CONTACT: ROBIN DOLIN
CLIENT CONTACT

PROJECT LENGTH

EXISTING STREAM LENGTH	=	15,267 FEET
AS–BUILT ENHANCEMENT STREAM LENGTH	=	2,539 FEET
AS–BUILT PRESERVATION STREAM LENGTH	=	12,710 FEET
LITTLE GRASSY CREEK ENHANCEMENT	=	75 FEET
LITTLE GRASSY CREEK PRESERVATION	=	12,546 FEET
UT1 ENHANCEMENT	=	2,464 FEET
UT1 PRESERVATION	=	164 FEET

PREPARED IN THE OFFICE OF:
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Suite 200
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Phone: 919.463.5488
Fax: 919.463.5490

MARCH 08
COMPLETION DATE:

JOSHUA WHITE, PG
PROJECT MANAGER

KEVIN TWEEDY, PE
PROJECT DESIGN ENGINEER

PROJECT ENGINEER

THIS DOCUMENT ORIGINALLY ISSUED AND SEALED BY:

KEVIN L. TWEEDY.
027337
APRIL 2, 2008

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P.E.
SIGNATURE:

2/26/03

BUCK PROJECT REFERENCE NO.	SHEET NO.
050661501	3

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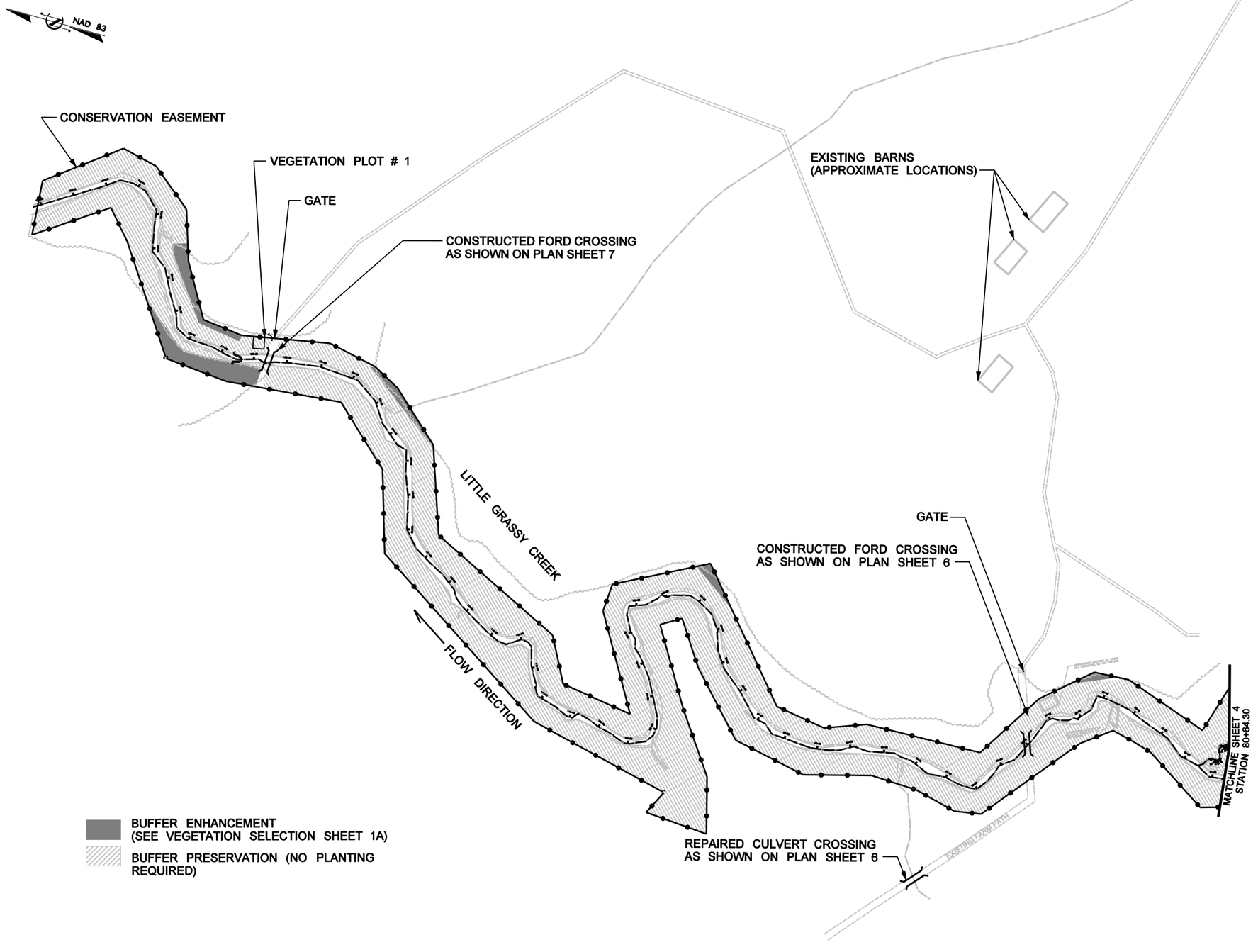

FIGURE 2B

AS-BUILT PLAN OVERVIEW/
VEGETATION PLAN
LITTLE GRASSY CREEK

160 80 0 160 320
SCALE (FT)

12/15/2008
I:\projects\NCDOT\Design\as-built\VR2241WM_PSH_asb_03.dgn

BUCK PROJECT REFERENCE NO.	SHEET NO.
050661501	4

PROJECT ENGINEER

THIS DOCUMENT
ORIGINALLY ISSUED AND
SEALED BY:

KEVIN L. TWEEDY
027337
APRIL 2, 2008

THIS MEDIA SHALL NOT BE CONSIDERED
A CERTIFIED DOCUMENT

Baker

Baker Engineering NY, Inc.
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VEGETATION PLOT # 7

VEGETATION PLOT # 6

VEGETATION PLOT # 5

NAD 83

CONSERVATION EASEMENT

GELA RD

UT1 STATION 10+00 TO 31+74
INVOLVED INVASIVE SPECIES
CONTROL RIPARIAN BUFFER
PLANTING. SEE VEGETATION
SELECTION FOR ADDITIONAL
DETAIL.

VEGETATION PLOT # 4

UT1 STATION 31+74 TO 36+27.62
INVOLVED STABILIZATION OF
SEVERAL UNSTABLE MEANDER
BENDS. SEE PLAN SHEET 5 FOR
ADDITIONAL DETAIL.

FLOW DIRECTION

MATCHLINE SHEET 3
STATION 80+64.30

LITTLE GRASSY CREEK

VEGETATION PLOT # 3

VEGETATION PLOT # 2

BUFFER ENHANCEMENT
(SEE VEGETATION SELECTION SHEET 1A)

BUFFER PRESERVATION (NO PLANTING
REQUIRED)

FIGURE 2C

AS-BUILT PLAN OVERVIEW/
VEGETATION PLAN
UT1/LITTLE GRASSY CREEK

160 80 0 160 320
SCALE (FT)

12/05/2008
R:\R2241WM\Design\as-built\R2241WM_PSH_asb_04.dgn

2/26/03

EEP SCO NO.	SHEET NO.
050661501	5

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NAD 83

VEGETATION PLOT # 4

REMOVED EXISTING FENCE
WITHIN CONSERVATION EASEMENT

VEGETATION PLOT # 3

END UT1 STATION 36+27.62
LITTLE GRASSY STATION 81+95.11

TOP OF BANK

THALWEG

REGRADED CHANNEL

REGRADED POINT BAR

VEGETATION PLOT # 2

X1

X2

X3

BE 1327
X=2113954
Y=972945.5
Z=391.56

BE 1489
X=2113790
Y=972927.8
Z=388.37

B

CE

NOTE:

SLOPED, SEEDED, STRAWED, MATTED, AND LIVE STAKED ALONG DISTURBED BANKS.

FIGURE 2D

AS-BUILT
PLAN VIEW – UT1

20 0 20 40
SCALE (FT)

12/15/2008
C:\R2241WM\Design\as-built\R2241WM_PSH_asb_05.dgn

BUCK PROJECT REFERENCE NO.	SHEET NO.
050661501	6

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NAD 83

APPROXIMATE LOCATION OF STONE MILL STRUCTURE. DO NOT DISTURB.

APPROXIMATE LOCATION OF MILL CAM STRUCTURE. DO NOT DISTURB.

GRADED APPROACHES AND RECONSTRUCTED PERMANENT FORD CROSSING WITH CLASS 2 STONE BASE MIXED WITH CLASS B STONE

REGRADED FARM PATH WITH EXISTING SOIL ONSITE AND ARMORED SIDE SLOPES WITH CLASS 2 STONE

EXISTING FARM PATH

24" CMP

FIGURE 2E

AS-BUILT PLAN VIEW
LITTLE GRASSY CREEK

10 5 0 10 20
SCALE (FT)

2/26/03

12/15/2008
I:\2050\661501\WM\Design\as-built\R2241WM_PSH_asb_06.dgn

EEP SCO NO.	SHEET NO.
050661501	7

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NAD 83

STOCK PILE

VEGETATION PLOT # 1

REMOVED CONCRETE WITHIN THE CHANNEL. GRADED APPROACHES AND RECONSTRUCTED PERMANENT FORD CROSSING WITH CLASS 2 STONE BASE MIXED WITH CLASS B STONE.

THALWEG

BE 2785
X=2114023
Y=976008.6
Z=377.04

INSTALLED CROSS VANE

BE 2756
X=2114003
Y=975830.9
Z=377.81

X4

EDGE OF CHANNEL

PHOTO POINT

TOP OF BANK

REGRADED, SLOPED, SEEDED, AND MATTED FLOODPLAIN

NOTE:
SLOPED, SEEDED, STRAWED, MATTED, AND LIVE STAKED ALONG DISTURBED BANKS.

FIGURE 2F

AS-BUILT PLAN VIEW
LITTLE GRASSY CREEK

20 0 20 40
SCALE (FT)

2/26/03

12/15/2008
I:\R2241\WM\Design\as-built\R2241WM_PSH_asb_07.dgn

APPENDIX A

VEGETATION RAW DATA

VEGETATION TABLES

Table A.1. Vegetation Metadata

Little Grassy Creek Restoration Site: EEP No. 224	
Report Prepared By	Dwayne Huneycutt
Date Prepared	12/19/2008 12:52
database name	backup_cvs-eep-entrytool-v2.2.5_2008 ALL OTHER Projects_Not Crowns.mdb
database location	L:\Monitoring\Veg Plot Info\CVS Data Tool
computer name	DHUNEYCUTT-2
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	224
project Name	Little Grassy
Description	
River Basin	Roanoke
length(ft)	2,539
stream-to-edge width (ft)	50
area (sq m)	23585.69
Required Plots (calculated)	7
Sampled Plots	7

Table A.2. Vegetation Vigor by Species

Little Grassy Creek Restoration Site: EEP No. 224								
	Species	**4**	**3**	**2**	**1**	**0**	**Missing**	**Unknown**
	Betula nigra	3	8	7	1	2		
	Corylus americana		2	3				
	Diospyros virginiana		4	7				
	Fraxinus pennsylvanica			8				
	Quercus phellos	1	5	1		1		
	Sambucus canadensis		2					
	Carpinus caroliniana			2				
	Cercis canadensis		4	4	1			
	Liriodendron tulipifera			2		1		
	Platanus occidentalis	3	9	4		1		
	Acer rubrum		2	1	1	1		
	Unknown				1	27	1	
TOT:	**12**	**7**	**36**	**39**	**4**	**33**	**1**	

Table A.3. Vegetation Damage by Species

Little Grassy Creek Restoration Site: EEP No. 224				
	Species	**All Damage Categories**	**No Damage**	**Unknown**
	Acer rubrum	5	5	
	Betula nigra	21	20	1
	Carpinus caroliniana	2	2	
	Cercis canadensis	9	5	4
	Corylus americana	5	5	
	Diospyros virginiana	11	11	
	Fraxinus pennsylvanica	8	8	
	Liriodendron tulipifera	3	2	1
	Platanus occidentalis	17	16	1
	Quercus phellos	8	7	1
	Sambucus canadensis	2	2	
	Unknown	29	12	17
TOT:	**12**	**120**	**95**	**25**

Table A.4. Vegetation Damage by Plot

Little Grassy Creek Restoration Site: EEP No. 224

	Plot	All Damage Categories	No damage	Unknown
	LG-A-VP1-year:1	21	21	
	LG-A-VP2-year:1	19	14	5
	LG-A-VP3-year:1	13	13	
	LG-A-VP4-year:1	17	15	2
	LG-A-VP5-year:1	24	19	5
	LG-A-VP6-year:1	14	1	13
	LG-A-VP7-year:1	12	12	
TOT:	**7**	**120**	**95**	**25**

Table A.5. Planted Stems by Plot and Species

Little Grassy Creek Restoration Site: EEP No. 224

	Species	Total Planted Stems	# Plots	Average # Stems	plot LG-A-VP1-year:1	plot LG-A-VP2-year:1	plot LG-A-VP3-year:1	plot LG-A-VP4-year:1	plot LG-A-VP5-year:1	plot LG-A-VP6-year:1	plot LG-A-VP7-year:1
	Acer rubrum	4	2	2	3				1		
	Betula nigra	19	5	3.8	4	9	1	1			4
	Carpinus caroliniana	2	2	1	1				1		
	Cercis canadensis	9	3	3	3			2		4	
	Corylus americana	5	2	2.5	3				2		
	Diospyros virginiana	11	3	3.67		3	5		3		
	Fraxinus pennsylvanica	8	4	2		1	1	2			4
	Liriodendron tulipifera	2	2	1			1	1			
	Platanus occidentalis	16	4	4	2			5	8	1	
	Quercus phellos	7	4	1.75		1	1		4		1
	Sambucus canadensis	2	1	2	2						
	Unknown	1	1	1			1				
TOT:	**12**	**86**	**12**		**18**	**14**	**10**	**11**	**19**	**5**	**9**

Table A.6. Vegetative Problem Areas

Little Grassy Creek Restoration Site: EEP No. 224			
Feature/Issue	**Station # / Range**	**Probable Cause**	**Photo**
Low denisty - 202 stems/acre	See Plan Sheets	Heavy *Rubus spp.* within plot boundaries	VP6 10/10/2008

VEGETATION PHOTOS

Vegetation Plot 1 – 10/10/2008

Herbaceous Vegetation Plot 1 – 10/10/2008

Vegetation Plot 2 – 10/10/2008

Herbaceous Vegetation Plot 2 – 10/10/2008

Vegetation Plot 3 – 10/10/2008

Herbaceous Vegetation Plot 3 – 10/10/2008

Vegetation Plot 4 – 10/10/2008

Herbaceous Vegetation Plot 4 – 10/10/2008

Vegetation Plot 5 – 10/10/2008

Herbaceous Vegetation Plot 5 – 10/10/2008

Vegetation Plot 6 – 10/10/2008

Herbaceous Vegetation Plot 6 – 10/10/2008

Vegetation Plot 7 – 10/10/2008

Herbaceous Vegetation Plot 7 – 10/10/2008

APPENDIX B

GEOMORPHIC RAW DATA

STREAM TABLES

Table B.1. Categorical Stream Feature Visual Stability Assessment

Little Grassy Creek Restoration Site: EEP No. 224						
	Performance Percentage					
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles	100%	100%				
B. Pools	100%	100%				
C. Thalweg	100%	100%				
D. Meanders	100%	100%				
E. Bed General	100%	100%				
F. Bank Condition	100%	100%				
G. Wads	100%	100%				

Table B.2. Morphology and Hydraulic Monitoring Summary

Little Grassy Creek Restoration Project: EEP No. 224																
Reach: UT1																
Parameter	Cross-section 1 Pool					Cross-section 2 Riffle					Cross-section 3 Pool					
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	
Dimension																
BF Width (ft)	11.24					14.46					6.58					
BF Mean Depth (ft)	0.83					1.01					1.13					
Width/Depth Ratio	13.56					14.25					5.83					
BF Cross-sectional Area (ft^2)	9.30					14.70					7.40					
BF Max Depth (ft)	1.62					1.93					1.99					
Width of Floodprone Area (ft)																
Entrenchment Ratio	1.7					3.1					3.2					
Bank Height Ratio	0.8					1.2					1.7					
Wetted Perimeter (ft)																
Hydraulic Radius (ft)																
Substrate																
d50 (mm)																
d84 (mm)																

Parameter	MY-1 (2007)			MY-2 (2008)			MY-3 (2009)			MY-4 (2010)			MY-5 (2011)		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Pattern															
Channel Beltwidth (ft)	-														
Radius of Curvature (ft)	-														
Meander Wavelength (ft)	-														
Meander Width Ratio	-														
Profile															
Riffle length (ft)	-														
Riffle Slope (ft/ft)	-														
Pool Length (ft)	-														
Pool Spacing (ft)	-														
Additional Reach Parameters															
Valley Length (ft)	-														
Channel Length (ft)	-														
Sinuosity	-														
Water Surface Slope (ft/ft)	-														
BF Slope (ft/ft)	-														
Rosgen Classification	Cc														

Reach: Little Grassy Creek															
Parameter	Cross-section 4 Pool														
	MY1	MY2	MY3	MY4	MY5										
Dimension															
BF Width (ft)	29.46														
BF Mean Depth (ft)	2.79														
Width/Depth Ratio	10.56														
BF Cross-sectional Area (ft²)	82.20														
BF Max Depth (ft)	5.80														
Width of Floodprone Area (ft)															
Entrenchment Ratio	1.9														
Bank Height Ratio	1.4														
Wetted Perimeter (ft)															
Hydraulic Radius (ft)															
Substrate															
d50 (mm)															
d84 (mm)															
Parameter	MY-1 (2007)			MY-2 (2008)			MY-3 (2009)			MY-4 (2010)			MY-5 (2011)		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Pattern															
Channel Beltwidth (ft)	-														
Radius of Curvature (ft)	-														
Meander Wavelength (ft)	-														
Meander Width Ratio	-														
Profile															
Riffle length (ft)	-														
Riffle Slope (ft/ft)	-														
Pool Length (ft)	-														
Pool Spacing (ft)	-														
Additional Reach Parameters															
Valley Length (ft)	-														
Channel Length (ft)	-														
Sinuosity	-														
Water Surface Slope (ft/ft)	-														
BF Slope (ft/ft)	-														
Rosgen Classification	-														

STREAM DATA

AND PHOTOS

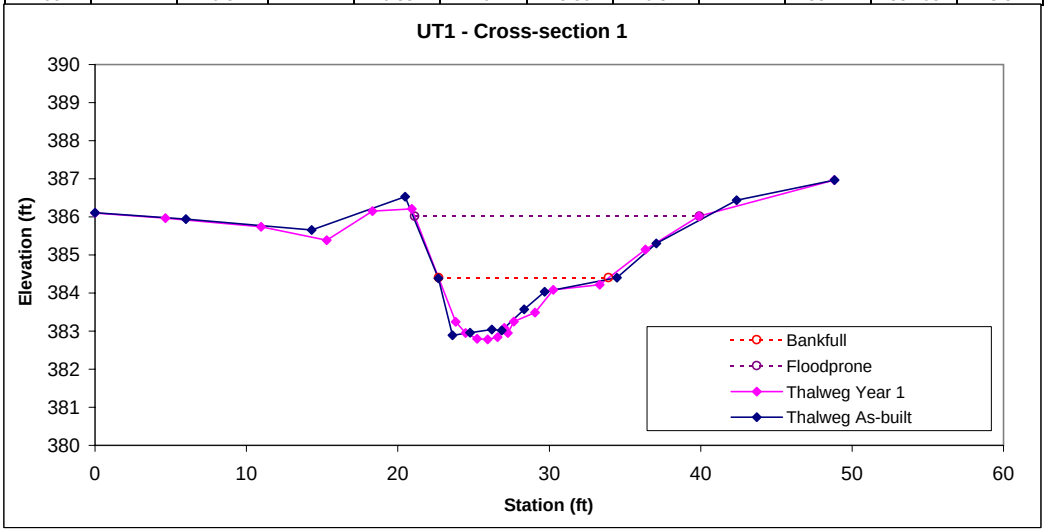
Permanent Cross-section 1, Station 10+15

(Year 1 - Data Collected September 2008

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		9.3	11.24	0.83	1.62	13.56	0.8	1.7	384.4	384.08	18.82



Pt #	North	East	Elevation	Note	Station
519	972837.3	2113836	386.0982	X1 Lpin	0
520	972841.9	2113836.9	385.9681	X1	4.641401
521	972848.1	2113838.2	385.7419	X1	10.96166
522	972852.3	2113839	385.3833	X1	15.30271
523	972855.3	2113839.6	386.1514	X1	18.32281
524	972857.8	2113840.2	386.2061	X1 Ltb	20.93029
527	972860.7	2113840.7	383.2417	X1	23.81458
528	972861.3	2113840.9	382.9507	X1 Lch	24.465
529	972862.1	2113841	382.8025	X1 Twg	25.24476
530	972862.7	2113841.2	382.778	X1	25.92362
531	972863.4	2113841.3	382.8423	X1	26.57885
533	972863.8	2113841.4	383.0872	X1 Wsf	27.02237
532	972864.1	2113841.4	382.95	X1 Rch	27.27065
534	972864.4	2113841.5	383.2556	X1	27.66494
535	972865.8	2113841.8	383.4858	X1	29.06218
536	972867	2113842	384.0817	X1 Rtb	30.26938
537	972870	2113842.6	384.2159	X1	33.32606
538	972873	2113843.2	385.1425	X1	36.35332
539	972876.4	2113843.9	386.0156	X1	39.87421
5115	972885.2	2113845.7	386.9683	X1 RPIN	48.81881

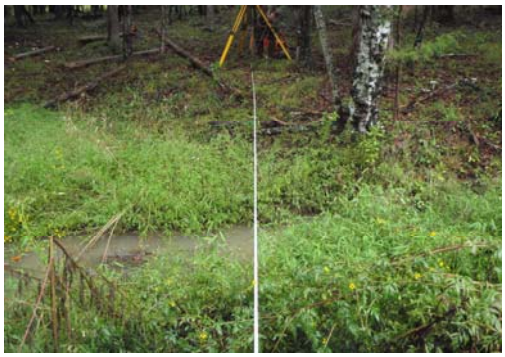
Bankfull Line	
Station	Elevation
22.69	384.4
33.93	384.4

Floodprone Line	
Station	Elevation
21.11	386.02
39.93	386.02

Permanent Cross-section 2, Station 10+93

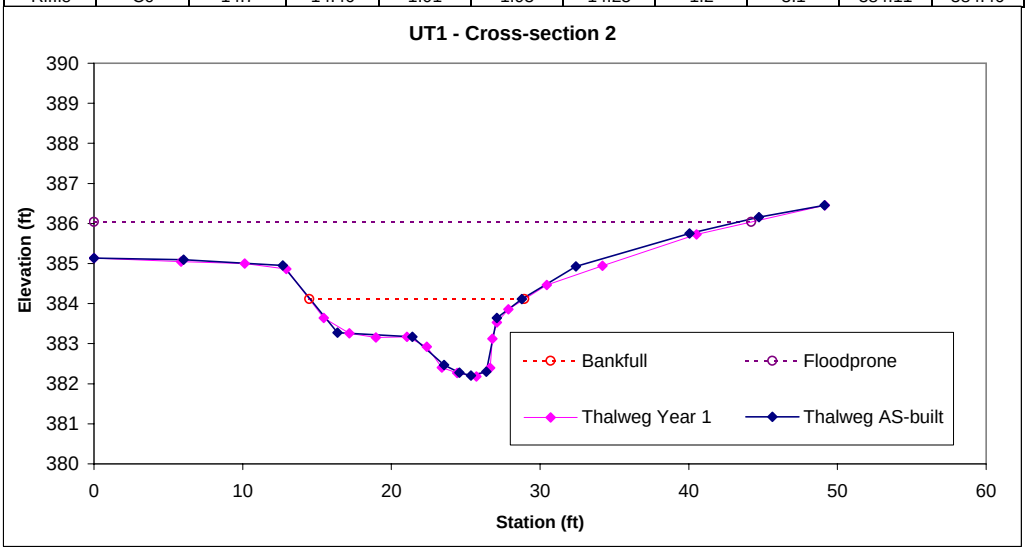
(Year 1 - Data Collected September 2008

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	Cc	14.7	14.46	1.01	1.93	14.25	1.2	3.1	384.11	384.46



Pt #	North	East	Elevation	Note	Station
500	972856.6	2113769.5	385.1335	X2 Lpin	0
501	972862.4	2113770	385.0506	X2	5.853582
502	972866.7	2113770.3	384.9996	X2	10.13244
503	972869.5	2113770.6	384.8671	X2 Ltb	12.94273
504	972872	2113770.8	383.639	X2	15.45936
505	972873.7	2113770.9	383.262	X2	17.1765
506	972875.5	2113771.1	383.1562	X2	18.95194
507	972877.6	2113771.2	383.1744	X2	21.04594
508	972878.9	2113771.4	382.92	X2 Lch	22.39099
509	972879.9	2113771.4	382.4031	X2	23.38762
510	972880.9	2113771.5	382.2706	X2	24.42975
511	972882.2	2113771.6	382.1831	X2 Twg	25.7135
512	972883.1	2113771.7	382.3925	X2 Rch	26.64286
513	972883.3	2113771.7	383.1192	X2 Wsf	26.79781
514	972883.6	2113771.8	383.5333	X2	27.09725
515	972884.4	2113771.8	383.8548	X2	27.86989
516	972886.9	2113772	384.4624	X2 Rtb	30.44603
517	972890.7	2113772.4	384.9452	X2	34.19376
518	972897	2113772.9	385.7265	X2	40.51904
5209	972905.6	2113773.6	386.4531	X2 RPIN	49.14949

Bankfull Line	
Station	Elevation
14.49	384.11
28.95	384.11

Floodprone Line	
Station	Elevation
0	386.04
44.21	386.04

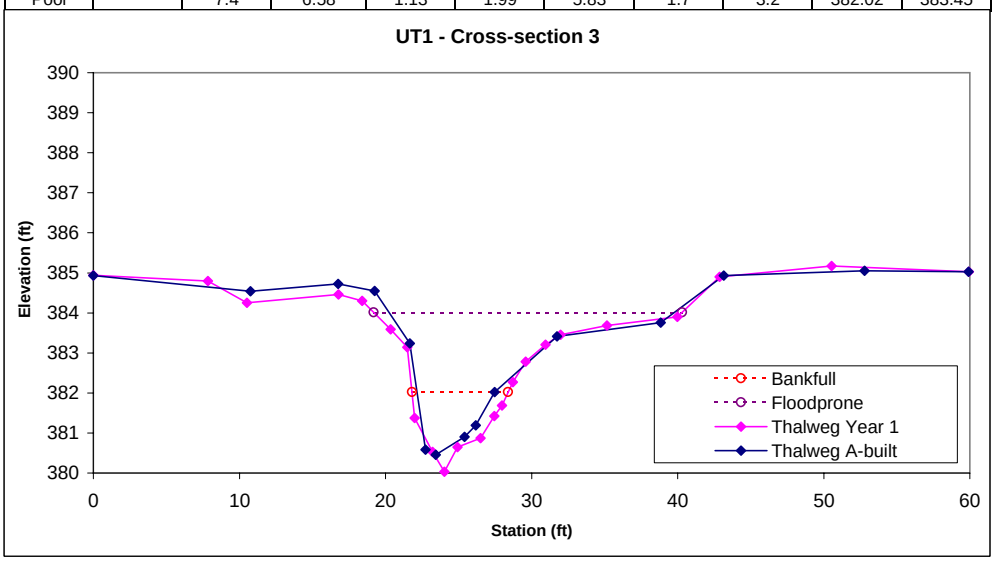
Permanent Cross-section 3, Station 12+53

(Year 1 - Data Collected September 2008

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		7.4	6.58	1.13	1.99	5.83	1.7	3.2	382.02	383.45



Pt #	North	East	Elevation	Note	Station
540	972902.2	2113611	384.93978	X3 Lpin	0
541	972907.2	2113617	384.79815	X3	7.85255
542	972908.9	2113619	384.24903	X3	10.51008
543	972912.8	2113624	384.46258	X3	16.77289
544	972913.9	2113625	384.29696	X3 Rtb	18.40048
545	972915.1	2113627	383.59192	X3	20.35647
546	972915.8	2113628	383.13825	X3	21.48495
547	972916.1	2113628	381.3741	X3 Lch	21.99269
548	972916.9	2113629	380.52944	X3	23.20941
549	972917.4	2113630	380.02895	X3 Twg	24.03785
550	972917.8	2113631	380.64452	X3	24.92998
551	972919.1	2113632	380.868	X3	26.50494
552	972919.5	2113632	381.42075	X3	27.4554
553	972919.9	2113633	381.69059	X3 Rch	27.97434
554	972920.2	2113633	382.27278	X3 Wsf	28.71011
555	972920.7	2113634	382.78132	X3	29.59155
556	972921.8	2113635	383.20852	X3	30.95789
557	972922.4	2113636	383.45019	X3 Rtb	31.97817
558	972924.4	2113638	383.68633	X3	35.16184
559	972927.5	2113642	383.90213	X3	39.9839
560	972929.4	2113644	384.90161	X3	42.8654
561	972934.3	2113650	385.16887	X3	50.54361
5226	972940.2	2113657	385.03105	X3 LPIN	59.92761

Bankfull Line	
Station	Elevation
21.81	382.02
28.39	382.02

Floodprone Line	
Station	Elevation
19.19	384.01
40.3	384.01

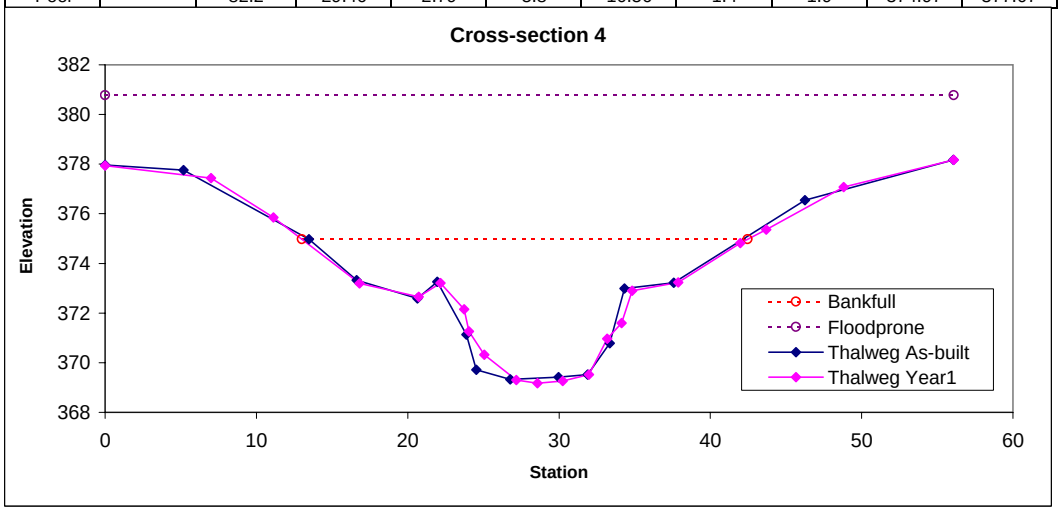
Permanent Cross-section 4, Station 10+62

(Year 1 - Data Collected September 2008)

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		82.2	29.46	2.79	5.8	10.56	1.4	1.9	374.97	377.07



Pt #	North	East	Elevation	Note	Station
562	975937.8	2113978.4	377.9366	X4 lpin	0
563	975939.6	2113985.2	377.4316	X4 Ltb	7.009878
564	975940.7	2113989.1	375.8445	X4	11.12781
565	975942.1	2113994.6	373.1934	X4	16.8041
566	975943.1	2113998.4	372.6515	X4	20.7233
567	975943.5	2113999.8	373.2094	X4 Roc	22.1553
568	975943.9	2114001.3	372.1476	X4 Roc	23.73015
569	975944	2114001.6	371.2644	X4 Lch	24.0512
570	975944.3	2114002.6	370.3142	X4	25.05974
571	975944.8	2114004.6	369.3034	X4	27.16891
572	975945.2	2114006	369.169	X4 Twg	28.57404
573	975945.5	2114007.6	369.2647	X4	30.25337
574	975946	2114009.3	369.5272	X4	31.96973
575	975946.3	2114010.5	370.9664	X4 Rch	33.18464
576	975946.7	2114011.3	371.592	X4 Wsf	34.12651
577	975946.9	2114012	372.8943	X4	34.82338
578	975947.6	2114015	373.2352	X4	37.88041
579	975948.9	2114018.9	374.8155	X4	41.97562
580	975949.2	2114020.5	375.3586	X4	43.68925
581	975950.6	2114025.5	377.0742	X4	48.80802
5264	975952.3	2114032.6	378.1669	X4 RPIN	56.09168

Bankfull Line	
Station	Elevation
13	374.97
42.46	374.97

Floodprone Line	
Station	Elevation
0	380.77
56.09	380.77

Little Grassy Creek Cross Vane –
June 5, 2008

Little Grassy Creek Cross Vane –
October 10, 2008