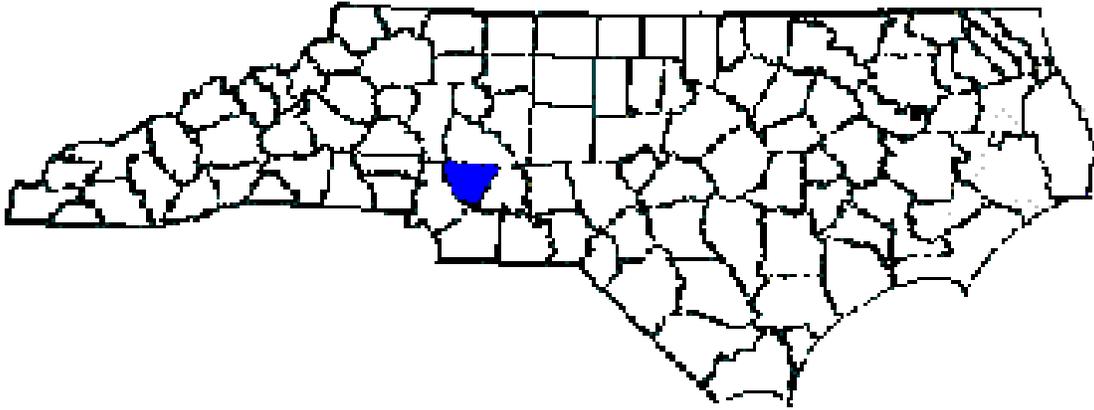


ANNUAL REPORT FOR 2011



**UT to Cold Water Creek Mitigation Site
Cabarrus County
TIP No. R-2533B (Site 23)**



Prepared By:
Natural Environment Unit & Roadside Environmental Unit
North Carolina Department of Transportation
September 2011

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SUMMARY

The following report summarizes the stream monitoring activities that have occurred during the Year 2011 at the UT to Cold Water Creek Stream Mitigation Site (permitted Site #23) in Cabarrus County. The North Carolina Department of Transportation (NCDOT) completed construction in March 2005. This report provides the monitoring results for the fifth formal year of monitoring (Year 2011). The Year 2011 monitoring period was the fifth of five scheduled years of monitoring on the UT to Cold Water Creek Mitigation Site (See Success Criteria Section 2.1).

An on-site meeting was held on July 21, 2011 with USACOE, DWQ, WRC, and USFW personnel. The stream relocation is stable and vegetated and it was agreed that no further monitoring of the stream was required. There was some concern about the amount of buffer width that is available at the site.

The attached figure shows the constructed relocation overlaid on the proposed plan design (See Appendix C for plan design and Appendix D permit conditions). The constructed stream relocation follows closely to the proposed design. It appears it may have been shifted somewhat during construction away from the toe of the roadway slope. The R/W line is approximately 100' from the toe of the roadway slope and 140' from the shoulder point of the roadway.

In 2007 the shoulder slope along this section was rock plated due to roadway embankment instability. This resulted in a loss of approximately 50' width of buffer along the northern section. There have also been problems on the southern section with the adjacent landowner encroaching upon and mowing portions (approximately 25' width) of the site. NCDOT will reestablish this property line and place mitigation signs along this boundary to deter future encroachment.

There are sections within the site that have sparse woody vegetation. These areas have been replanted twice. Lack of survival is attributed to the rocky soil conditions present in this cut section. While woody vegetation may be sparse, there is herbaceous vegetation present. NCDOT feels that these areas have been vegetated "to the maximum extent practical".

Based on the overall conclusions of monitoring at permitted Site #23 for UT to Cold Water Creek, it has met the required monitoring protocols for the fifth formal year of monitoring. The channel throughout the relocated stream is stable at this time.

NCDOT proposes to discontinue stream monitoring at the UT to Cold Water Creek Mitigation Site.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during the Year 2011 at the UT to Cold Water Creek Stream Mitigation Site. Site # 23 is located on NC 49 in Cabarrus County at Sta. 164+00 to Sta. 166+00 –L1- RT. (Figure 1). The UT to Cold Water Creek Site was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number R-2533B in Cabarrus County.

The mitigation site provided approximately 718 linear feet of stream restoration. Construction was completed during March 2005 by NCDOT. Stream restoration involved restoring sinuosity to the stream, sloping the adjacent streambanks to promote stability, and widening the floodplain to allow for major flood events. It also included the installation of cross vanes, coir fiber matting and live stakes along the streambank, and bareroot seedlings in the buffer area.

1.2 Purpose

In order for a mitigation site to be considered successful, the site must meet the success criteria. This report details the monitoring in 2011 at the UT to Cold Water Creek Mitigation Site. Hydrologic monitoring was not required for this site.

1.3 Project History

March 2005	Construction Completed.
March 2007	Stream Channel Monitoring (1 year)
March 2008	Replanted Site
September 2008	Stream Channel Monitoring (2 year)
October 2009	Stream Channel Monitoring (3 year)
October 2010	Stream Channel Monitoring (4 year)
September 2011	Stream Channel Monitoring (5 year)

1.4 Debit Ledger

The entire UT to Cold Water Creek (Site #23) stream mitigation site was used for the R-2533B project to compensate for unavoidable stream impacts.

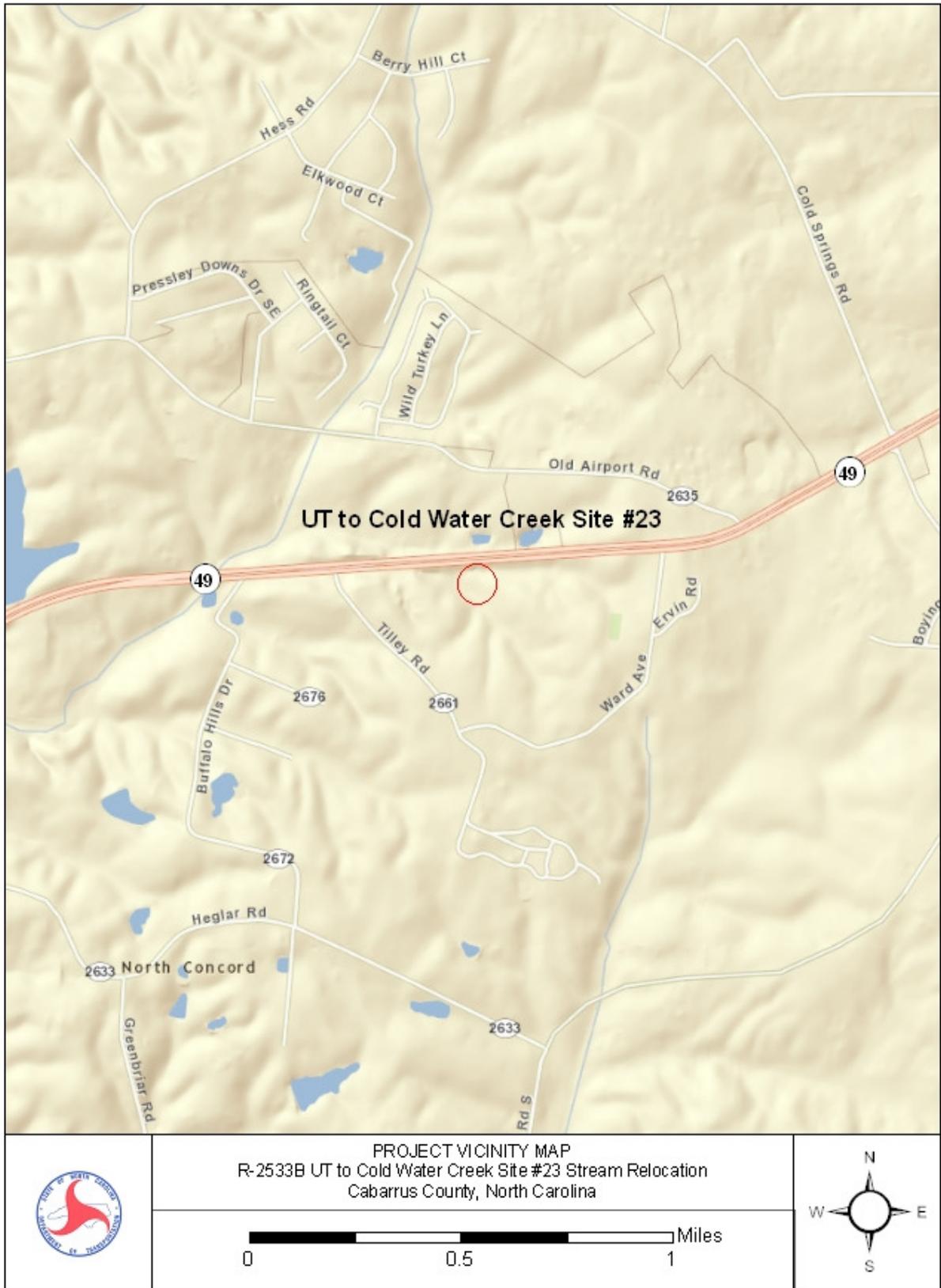


Figure 1. Site Location Map

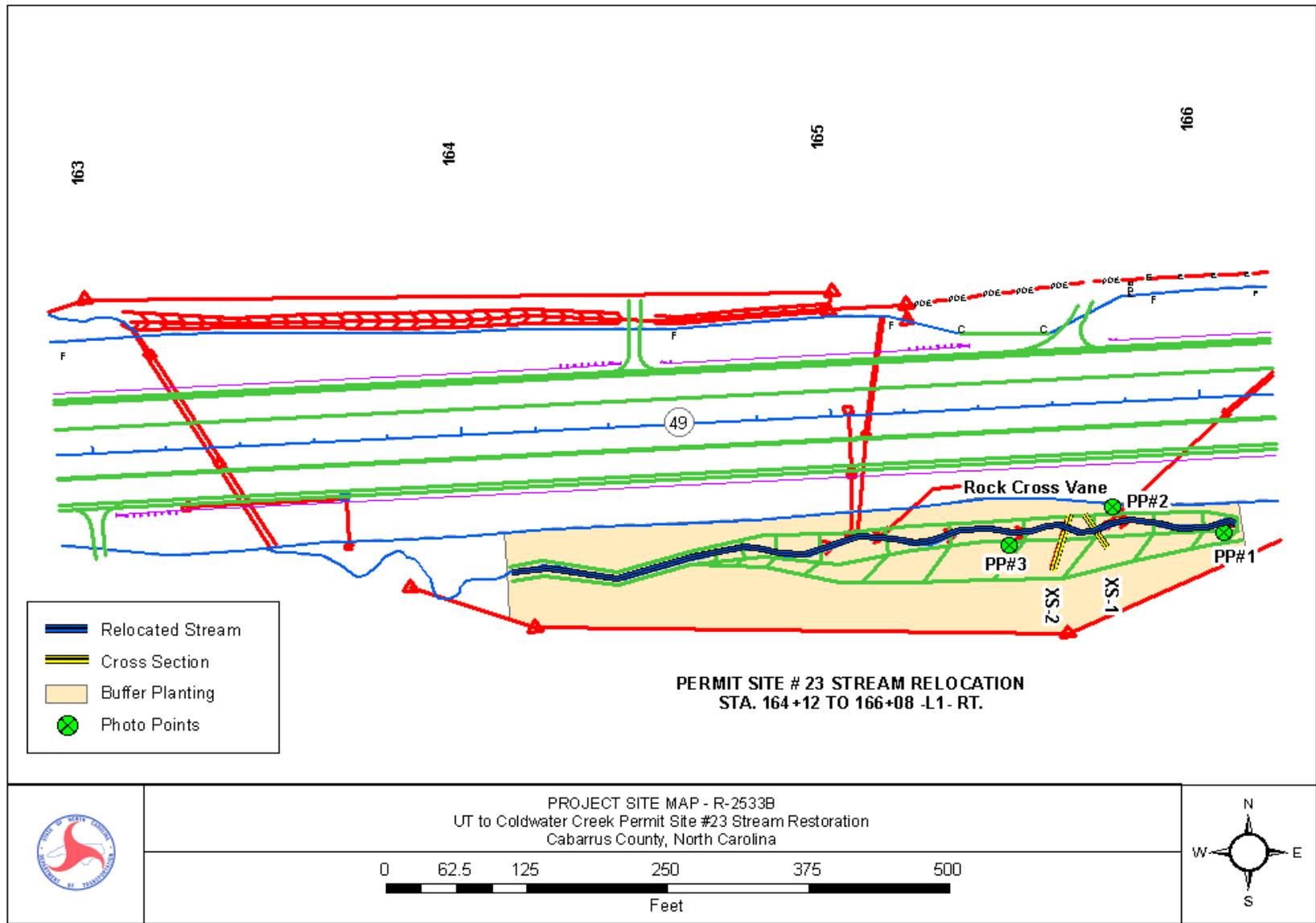


Figure 2. Site #23 Map

2.0 STREAM ASSESSMENT

2.1 Success Criteria

The following surveys were conducted in support of the monitoring assessment and in accordance with the regulatory permits obtained for this project:

Stream Geomorphological Assessment

- ◆ The stream shall be monitored for a duration of five years from the end of construction (channel modifications and vegetation planted)
- ◆ The data shall be collected and submitted to the US Army Corps of Engineers and N.C. Division of Water Quality no later than January 1st each year for five years after construction
- ◆ At Site #23, 718 linear feet of stream channel will be relocated. A permanent cross section shall be established in a meander and at an inflection point along the channel.
- ◆ In order to evaluate the stability of the new channel, the channel cross section at each permanent station identified above shall be measured on a yearly basis for five years and width:depth ratio compared to the as-built cross section

2.2 Stream Description

2.2.1 Post-Construction Conditions

The restoration of UT to Cold Water Creek Site #23 involved restoring sinuosity to the streams, sloping the adjacent streambanks to promote stability, and widening the floodplain to allow for major flood events. It also included the installation of coir fiber matting and live stakes along the streambank and bareroot seedlings in the buffer area throughout the entire reach.

2.2.2 Monitoring Conditions

The objective of the UT to Cold Water Creek Site #23 stream restoration was to build an E4/E5 to E4b/E5b stream as identified in Rosgen's Applied River Morphology. A total of two cross sections (one in a riffle and one in a pool) were surveyed. For this report, only cross sections containing riffles were used in the comparison of channel morphology presented below in Table 1 (Site #23).

Table 1. Abbreviated Morphological Summary (UT Cold Water Creek Site #23)

Variable	Proposed	2007	2008	2009	2010
		Riffle Cross-Section #1	Riffle Cross-Section #1	Riffle Cross-Section #1	Riffle Cross-Section #1
Drainage Area (mi ²)	0.1	0.1	0.1	0.1	0.1
Bankfull Width (ft)	6.0	5.7	6.0	6.02	5.82
Bankfull Mean Depth (ft)	2.0	0.8	0.8	0.64	0.57
Width/Depth Ratio	3	7.0	7.4	9.41	10.21
Bankfull Cross Sectional Area (ft ²)	12.0	4.6	4.8	3.88	3.33
Maximum Bankfull Depth (ft)	3.0	1.2	1.3	1.04	1.03
Width of Floodprone Area (ft)	18-100	9.0	10.1	8.78	8.68
Entrenchment Ratio	3.0-16.7	1.6	1.7	1.46	1.49

* Riffle values are used for classification purposes, pool values are shown in Appendix A.

2.3 Results of the Stream Assessment

2.3.1 Site Data

The assessment included the survey of two cross sections at Site #23. Longitudinal profile monitoring was not required per the permit conditions and therefore was not completed. All of the cross sections were established during the 2007 monitoring year. Cross section locations were determined based on choosing segments that were representative of the entire reach. The cross sections are shown in Appendix A.

Site #23 Cross-Sections:

- ◆ Cross-Section #1: UT Cold Water Creek Site #23, midpoint of riffle
- ◆ Cross-Section #2: UT Cold Water Creek Site #23, midpoint of pool

Based on comparisons of all four years of monitoring data, all of the cross sections appear stable with little or no active bank erosion. Graphs of the cross sections are presented in Appendix A. Future survey data will vary depending on actual location of rod placement and alignment; however, this information should remain similar in appearance. Pebble counts were not required per the permit conditions and therefore were not completed.

A site visit was conducted on July 21, 2011 with the regulatory agencies and NCDOT personnel present. It was agreed that the channel was stable and no further cross section survey work would be required for 2011.

3.0 VEGETATION: UT to COLD WATER CREEK

3.1 Description of Species

The following tree species were planted on the stream bank:

Salix nigra, Black Willow

Cornus amomum, Silky Dogwood

Alnus serrulata, Tag Alder

The following tree species were planted in the buffer area:

Liriodendron tulipifera, Yellow Poplar

Platanus occidentalis, Sycamore

Quercus nigra, Water Oak

Faxinus pennsylvanica, Green Ash

3.2 Results of Vegetation Monitoring

Streambank & Buffer Vegetation: The stream was vegetated partially with black willow, silky dogwood, cattails, tulip poplar, pokeberry, briars, winged elm, sycamore, green ash, water oak, and various herbaceous species. Lespedeza was very dense along portions of the site and the rock outcrops has hindered woody vegetation survival. In accordance with the permit conditions, only visual monitoring of the stream and buffer vegetation is required, therefore no vegetation plots were set at this site.

3.3 Conclusions

There were no vegetation monitoring plots established throughout the buffer planting area. After the fifth year of monitoring, the UT Cold Water Creek mitigation site shows by visual observation that the tree species planted on the streambank are surviving but the buffer plantings are surviving only in isolated areas along the channel. NCDOT proposes to discontinue the visual vegetation monitoring of this site.

4.0 OVERALL CONCLUSIONS/RECOMMENDATIONS

The UT to Cold Water Creek mitigation site has met the required monitoring protocols for the fifth formal year of monitoring. The channel throughout the relocated stream is stable at this time. The streambank and buffer have planted vegetation surviving in isolated areas for the fifth formal year of monitoring. NCDOT proposes to discontinue monitoring the UT to Cold Water Creek Mitigation Site.

5.0 REFERENCES

North Carolina Department of Transportation (NCDOT), November 19, 2001.
Permit for R-2533A and R-2533B (Action ID.199702364).

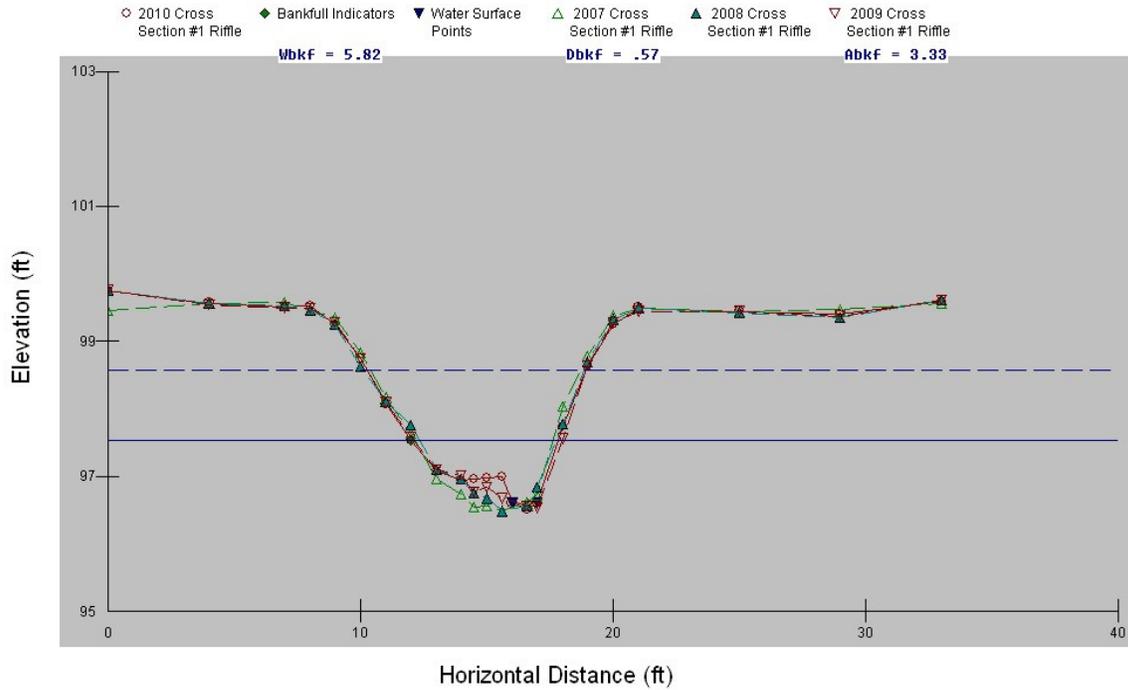
North Carolina Department of Transportation (NCDOT), November 26, 2001.
Permit for R-2533A and R-2533B (DWQ Project No. 011274).

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

US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines.
Prepared with cooperation from the US Environmental Protection Agency,
NC Wildlife Resources Commission, and the NC Division of Water Quality.

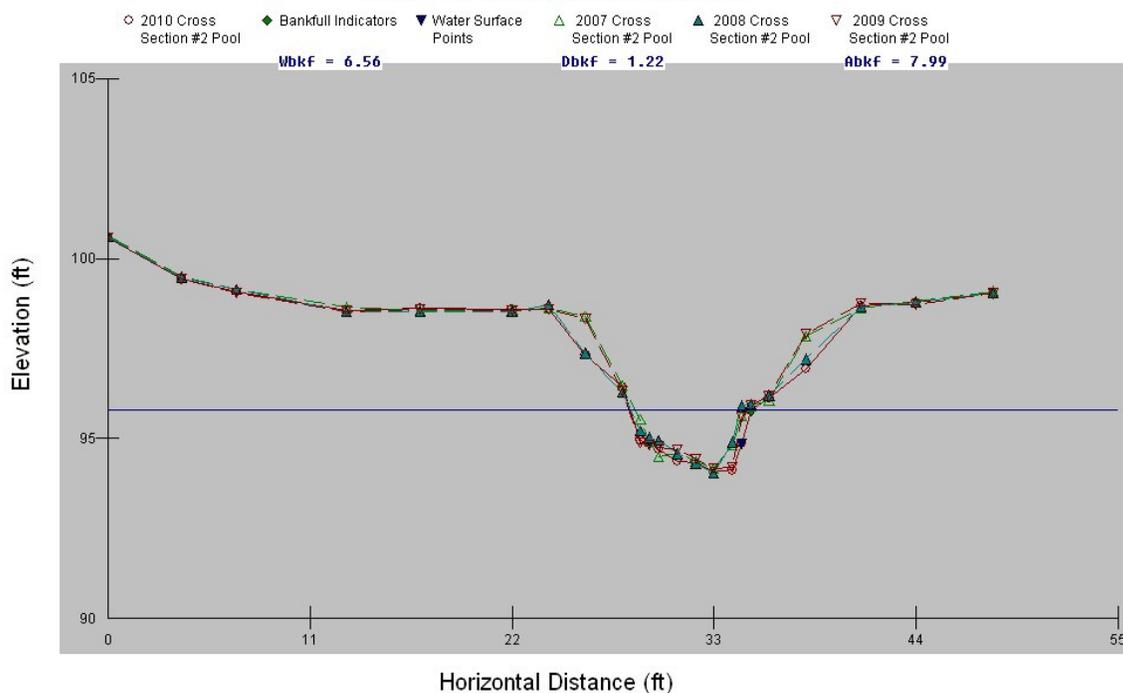
APPENDIX A
CROSS SECTIONS

R-2533B Site #23 XS-1 Riffle



Site #23: Cross-Section #1 (Riffle) Abbreviated Morphological Summary				
	2007	2008	2009	2010
Bankfull Cross Sectional Area (ft ²)	4.6	4.8	3.88	3.33
Maximum Bankfull Depth (ft)	1.2	1.3	1.04	1.03
Width of the Floodprone Area (ft)	9.0	10.2	8.78	8.68
Bankfull Mean Depth (ft)	0.8	0.8	0.64	0.57
Width/Depth Ratio	7.0	7.4	9.41	10.21
Entrenchment Ratio	1.6	1.7	1.46	1.49
Bankfull Width (ft)	5.7	6.0	6.02	5.82

R-2533B Site #23 XS-2 Pool



Site #23: Cross-Section #2 (Pool) Abbreviated Morphological Summary*				
	2007	2008	2009	2010
Bankfull Cross Sectional Area (ft ²)	7.83	7.1	5.86	7.99
Maximum Bankfull Depth (ft)	1.39	1.9	1.41	1.71
Bankfull Mean Depth (ft)	0.86	1.2	0.98	1.22
Bankfull Width (ft)	9.13	6.2	5.99	6.56

* According to the Rosgen Classification of Natural Rivers floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features.

APPENDIX B
SITE PHOTOGRAPHS

UT Cold Water Creek Site #23



Photo Point #1 (Upstream)



Photo Point #1 (Downstream)



Photo Point #2 (Upstream)



Photo Point #2 (Downstream)



Photo Point #3 (Upstream)
September 2011



Photo Point #3 (Downstream)

UT Cold Water Creek Site #23



Overview Photo (Upstream)
September 2011



Overview Photo (Downstream)

APPENDIX C

**CONSTRUCTED RELOCATION VS.
PROPOSED PLAN DESIGN**

APPENDIX D

R-2533B PERMIT CONDITIONS

404 conditions

5

jj. At Site twenty, 130 linear feet of stream channel will be relocated as shown on sheets 39-41 of the attached plans. A permanent cross section shall be established in a meander and at an inflection point along the channel.

* kk. At Site twenty-three, 718 linear feet of stream channel will be relocated as shown on sheets 42-45 of the attached plans. A permanent cross section shall be established in a meander and at an inflection point along the channel.

* ll. At Site twenty-four, 525 linear feet of stream channel will be relocated as shown on sheets 46-49 of the attached plans. A permanent cross section shall be established in a meander and at an inflection point along the channel.

mm. Relocated channels used for mitigation purposes will be bioengineered with state-of-the-art natural channel methodologies, native species, and structures and should be constructed in a manner so as to comply with the recommendations from the North Carolina Wildlife Resources Commission on stream restoration.

nn. Open channels constructed for the project will incorporate shrub and tree vegetation whenever possible to reduce thermal impacts and provide habitat.

oo. In order to evaluate the stability of the new channel, the channel cross section at each permanent station identified above shall be measured on a yearly basis for five years and the width:depth ratio compared to the as-built cross section. This information shall be provided to the District Engineer no later than January 1 of each year. The District Engineer will evaluate any deviations from the as-built width:depth ratio and remedial action (if any) will be determined on a case by case basis.

pp. Relocated channel banks shall be planted with Salix nigra, Cornus ammonum, Liquidambar styraciflua, Platanus occidentalis, Prunus serotina, and Betula nigra in an amount sufficient to stabilize the banks.

qq. Relocated channels shall be vegetated and stabilized prior to the release of water through them.

All conditions stated in the Water Quality Certification Number 3330 from the North Carolina Department of Environment and Natural Resources, Division of Water Quality Certification issued on October 11, 2001, remain conditions of this permit.

404 conditions

4. All bridge demolition work required by this project shall adhere to NCDOT's *Best Management Practices for Bridge Demolition and Removal*.
5. If an environmental document is required, this Certification is not valid until a FONSI or ROD is issued by the State Clearinghouse. All water quality-related conditions of the FONSI or ROD shall become conditions of this Certification.
6. Live or fresh concrete shall not come into contact with waters of the state until the concrete has hardened.
7. There shall be no excavation from or waste disposal into jurisdictional wetlands or waters associated with this permit without appropriate modification of this Certification. Should this occur, compensatory mitigation will be required since it is a direct impact from road construction activities.
- * 8. All channel relocations must be constructed in a dry work area, and stabilized before stream flows are diverted. Channel relocations shall be completed and stabilized prior to diverting water into the new channel. Whenever possible, channel relocations must be allowed to stabilize for an entire growing season. Vegetation used for bank stabilization shall be limited to native woody species, and should include establishment of a 30-foot wide wooded and an adjacent 20-foot wide vegetated buffer on both sides of the relocated channel to the maximum extent practical. A transitional phase incorporating coir fiber and seedling establishment is allowable. Rip-rap may be allowed if it is necessary to maintain the physical integrity of the stream, but the applicant must provide written justification and the calculations used to determine the extent of rip-rap coverage requested.
9. Placement of culverts and other structures in waters, streams, and wetlands shall be placed below the elevation of the streambed to allow low flow passage of water and aquatic life unless it can be shown to DWQ that providing passage would be impractical. Design and placement of culverts and other structures including temporary erosion control measures shall not be conducted in a manner that may result in dis-equilibrium of wetlands or stream beds or banks, adjacent to or upstream and down stream of the above structures. The applicant is required to provide evidence that the equilibrium shall be maintained if requested in writing by DWQ.
- * 10. *Mitigation:* Compensatory mitigation shall be the same as that approved by the US Army Corps of Engineers as long as the mitigation required equals a ratio of 1:1 restoration or creation of lost wetland acres as described in 15A NCAC 2H.0506 (h)(6). A report must be submitted to the NC Division of Water Quality that describes the final approved wetland and stream mitigation for this project within two (2) months of the issuance of the 404 permit issued by the Army Corps of Engineers.

Wetland impacts of 1.68 acres include headwater forest and mafic depression wetlands. NCDOT will mitigate these impacts by providing 3.16 acres of wetland restoration at Shepherd's Tree Mitigation Site and 1.13 acres of on-site preservation.

Compensatory mitigation for stream impacts will consist of 1,936 linear feet of on-site stream relocation/restoration, with 50-foot buffers, using *natural channel design*. The natural channel design specifications shall be calculated from field measurements of an unimpacted section of stream (reference reach). The plans must include reference reach data including a sketch map, the range of values (pattern data), and all calculations (including the determination of bankfull). The channel design should include a floodplain terrace at stream bankfull. The stream relocation shall be built and maintained according to approved plans before any mitigation credit is given. If this Office determines that the stream restoration or associated riparian area has become unstable, the stream shall be repaired or stabilized using only natural channel design techniques if

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possible. Additionally, the vegetation in the riparian shall be maintained and/or replaced according to the approved plans. Rip-rap and other hard structures may *only* be used if required by the Division of Land Resources or a Delegated Local Program. Additionally, all repair designs must be submitted to and receive written approval from this Office before the repair work is performed. Because the restored stream is proposed as compensatory mitigation for stream impacts, the restored portion and associated riparian area shall be preserved in perpetuity through a preservation easement or some other legally binding mechanism or agreement. The above easement or other legally binding mechanism or agreement must be in place before any mitigation credit shall be given. Additionally, the stream physical and biological monitoring plan shall be followed and reports shall be submitted to this Office after the first year and every other year afterwards for a total of five (5) years.

The remaining 2,136 linear feet of stream mitigation shall be provided via Shepherd's Tree Mitigation Site as follows: 1,080 linear feet of perennial stream impacts will be mitigated through off-site restoration at a ratio of 2:1; the remaining 794 linear feet will consist of off-site enhancement at a ratio of 2.8:1. To supplement these ratios, 262 linear feet of intermittent stream impacts will be mitigated through off-site restoration at a ratio of 9.7:1.

In accordance with 15A NCAC 2R.0500, this contribution will satisfy our compensatory mitigation requirements under 15A NCAC 2H.0506(h). Until plans are received and approved for the stream relocation using natural channel design, wetland or stream fill shall not occur.

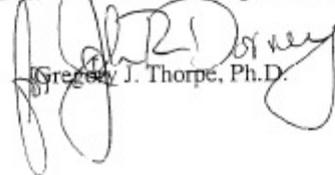
11. Upon completion of the project, the NCDOT shall complete and return the enclosed "Certification of Completion Form" to notify DWQ when all work included in the 401 Certification has been completed. The responsible party shall complete the attached form and return it to the 401/Wetlands Unit of the Division of Water Quality upon completion of the project.
12. The Applicant shall require its contractors (and/or agents) to comply with all of the terms of this Certification, and shall provide each of its contractors (and/or agents) a copy of this Certification.

Violations of any condition herein set forth shall result in revocation of this Certification and may result in criminal and/or civil penalties. This Certification shall become null and void unless the above conditions are made conditions of the Federal Permit. This Certification shall expire upon the expiration of the 404 Permit.

If you do not accept any of the conditions of this certification, you may ask for an adjudicatory hearing. You must act within 60 days of the date that you receive this letter. To ask for a hearing, send a written petition that conforms to Chapter 150B of the North Carolina General Statutes to the Office of Administrative Hearings, 6714 Mail Service Center, Raleigh, N.C. 27699-6714. This certification and its conditions are final and binding unless you ask for a hearing.

This the 11th day of October 2001

DIVISION OF WATER QUALITY



Gregory J. Thorpe, Ph.D.