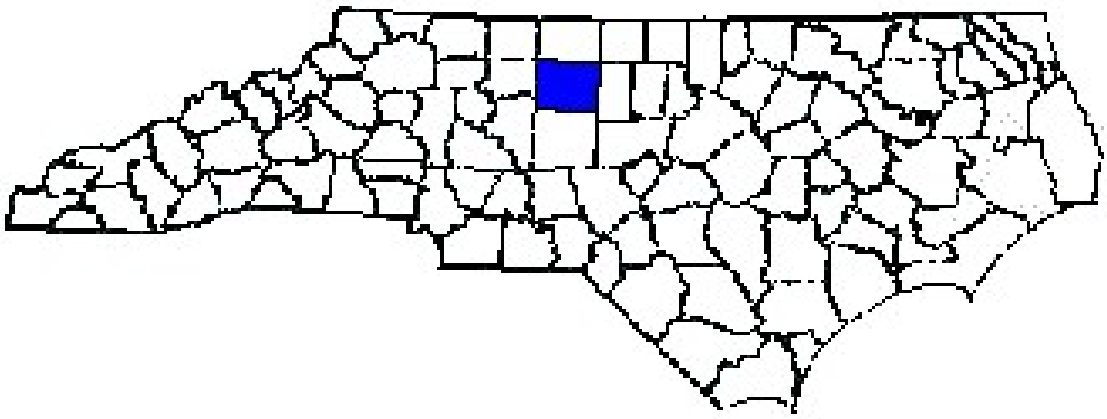
ANNUAL REPORT FOR 2020



U-2525B UT to North Buffalo Creek - Site #5
Guilford County
TIP No. U-2525B
USACE Action ID: SAW-2005-21386
DWR Project #: 20130918 v.8

Prepared By:
Environmental Analysis Unit & Roadside Environmental Unit
North Carolina Department of Transportation
December 2020

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SUMMARY

The following report summarizes the stream monitoring activities that have occurred during 2020 at UT to North Buffalo Creek Site #5 of Greensboro Eastern Loop project in Guilford County. The site was constructed during November 2015 by the North Carolina Department of Transportation (NCDOT). The site was designed as stream mitigation for impacts associated with the construction of Transportation Improvement Program (TIP) number U-2525B and was planted in February 2016. This report provides the monitoring results for the fifth formal year of monitoring (Year 2020). The Year 2020 monitoring period is the fifth of five scheduled years of monitoring on Site #5 (See Success Criteria Section 2.1). No hydrologic monitoring is required for this project; however, vegetation monitoring is required for five years.

Based on the overall conclusions of monitoring at Site #5, the site has met the required monitoring protocols for the fifth formal year of monitoring. Based on comparing the monitoring data to the as-built, the stream channel remains stable throughout the site at this time. The stream bank is heavily vegetated for the fourth year of vegetation monitoring. The vegetation in the stream buffer area was planted in February 2016.

NCDOT proposes to discontinue all monitoring activities at the UT to North Buffalo Creek Site #5.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during 2020 at UT to North Buffalo Creek Site #5 of the Greensboro Eastern Loop project in Guilford County. The site is situated about 2000 ft. east of the intersection of US-29 and the NC 68 Connector flowing from north to south (see Figure 1). The site was constructed to provide mitigation for stream impacts associated with construction of TIP number U-2525B. The site is composed of one reach of UT to North Buffalo Creek.

The mitigation project includes 362 linear feet of Priority II stream restoration. Construction was completed in November 2015 by NCDOT. Stream restoration involved the installation of rock cross vanes, boulder toe protection, constructed riffles, construction of a new stream channel and construction of the floodplain to allow for overbank flooding. It also included the installation of coir fiber matting and live stakes along the streambank and bareroot seedlings in the buffer area.

1.2 Purpose

For a mitigation site to be considered successful, it must meet the success criteria. This report details the monitoring in 2020 at the UT to North Buffalo Creek Site #5. Hydrologic monitoring was not required for the site.

1.3 Project History

November 2015	Construction Completed
September 2016	As-Built Survey Completed
December 2016	Stream Channel Monitoring (Year 1)
February 2017	Planted Live Stakes and Bareroot Seedlings
July 2017	Vegetation Monitoring (Year 1)
October 2017	Herbicide Application on Kudzu
November 2017	Stream Channel Monitoring (Year 2)
June 2018	Onsite Agency Meeting & Vegetation Monitoring (Year 2)
August 2018	Herbicide Application on Kudzu
November 2018	Stream Channel Monitoring (Year 3)
May 2019	Herbicide Application on Kudzu
June 2019	Vegetation Monitoring (Year 3)
November 2019	Stream Channel Monitoring (Year 4)
June 2020	Herbicide Application on Kudzu
June 2020	Vegetation Monitoring (Year 4)
December 2020	Stream Channel Monitoring (Year 5)

1.4 Debit Ledger

The entire UT to North Buffalo Creek Site #5 stream mitigation site was used for the U-2525B project to compensate for unavoidable stream impacts.

Figure 1: Project Vicinity Map
U-2525B UT to North Buffalo Site #5 Stream Mitigation
Guilford County, SC

2.0 STREAM ASSESSMENT

2.1 Success Criteria

The stream mitigation site shall be monitored for five years or until success criteria are satisfied. Monitoring protocols shall follow the Monitoring Level I outlined in the Stream Mitigation Guidelines, April 2003. NCDOT will evaluate the success of the stream relocation project based on guidance provided by the Stream Mitigation Guidelines disseminated by the United States Army Corps of Engineers-Wilmington District. The survey of channel dimension will consist of permanent cross sections placed at two cross sections (one riffle and one pool). Annual photographs showing both banks and upstream and downstream views will be taken from permanent, mapped photo points. The survey of the longitudinal profile will represent distinct areas of restoration and will cover a cumulative total of approximately 362 linear feet of channel. The entire restored length of stream will be investigated for channel stability and in-stream structure functionality. Any evidence of channel instability will be identified, mapped and photographed. Pebble counts shall not be conducted. The monitoring shall be conducted annually for a minimum of five (5) years after final planting. The monitoring results shall be submitted to DWR in a final report within sixty (60) days after completing monitoring. After 5 years, the NCDOT shall contact the DWR to schedule a site visit to “close out” the mitigation site.

Vegetation Success

The success of vegetation and plantings will be measured through stem counts. Permanent quadrants will be used to sample the riparian buffer and restoration wetlands. Survival of the live stakes will be determined by visual observation throughout the five-year monitoring period.

Bare root vegetation will be evaluated using one staked survival plots. Plots will be 50ft. by 50ft. If site conditions prevent a 50ft. by 50ft. plot, then the plot will have varying dimensions to encompass an area of 2,500 ft^2. All flagged stems will be counted in those plots. Success will be defined as 320 stems per acre after three years and 260 stems per acre after five years. All vegetation monitoring will be conducted during the growing season.

2.2 Stream Description

2.2.1 Post-Construction Conditions

The mitigation project covers approximately 362 linear feet of Priority II stream restoration. Construction was completed in November 2015 by NCDOT.

Stream restoration involved the installation of rock cross vanes, boulder toe protection, constructed riffles, construction of a new stream channel and construction of the floodplain to allow for overbank flooding. It also included the installation of coir fiber matting and live stakes along the streambank and bareroot seedlings in the buffer area.

2.2.2 Monitoring Conditions

The objective of the UT to North Buffalo Creek Site #5 restoration was to build a C5 stream type as identified in the Rosgen's Applied River Morphology. A total of two cross sections were surveyed. For this report, only the riffle cross section was used in the comparison of channel morphology in Table 1.

Table 1. Abbreviated Morphological Summary							
U-2525B - Site 5 Cross Section #2							
Variable	**Proposed**	**As-built**	**Monitoring Year 1 2016**	**Monitoring Year 2 2017**	**Monitoring Year 3 2018**	**Monitoring Year 4 2019**	**Monitoring Year 5 2020**
		Cross Section #2 (Riffle)	**Cross Section #2 (Riffle)**	**Cross Section #2 (Riffle)**	**Cross Section #2 (Riffle)**	**Cross Section #2 (Riffle)**	**Cross Section #2 (Riffle)**
Drainage Area (mi^2)	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Bankfull Width (ft)	13.7	13.02	12.92	12.81	12.8	14.88	9.33
Bankfull Mean Depth (ft)	1	0.89	0.92	0.9	0.97	0.86	1.14
Width/Depth Ratio	14.1	14.63	14.04	14.23	13.2	17.3	8.18
Bankfull Cross Sectional Area (ft^2)	13.3	11.6	11.87	11.51	12.4	12.77	10.67
Maximum Bankfull Depth (ft)	1.4	1.52	1.53	1.96	2.31	2.3	2.44
Floodprone Area (ft)	147	41	41	41	41	41.1	41.1
Entrenchment Ratio	10.7	3.15	3.16	3.18	3.21	2.76	4.41

*Drainage Area, Floodprone Width, and Slope are averaged values only.
*Riffle values are used for classification purposes.

2.3 Results of the Stream Assessment

2.3.1 Site Data

The assessment included the survey of two cross sections and the longitudinal profile of UT to North Buffalo Creek Site #5 established by the NCDOT after construction. The length of the surveyed profile of Site #5 was approximately 362 linear feet. Two cross sections were established during the 2016 as-built survey/monitoring. Cross section locations were subsequently based on the stationing of the longitudinal profile and are presented below. The locations of the cross sections and longitudinal profiles are shown in Appendix A.

- Cross Section #1: Station 501+52 linear feet, midpoint of riffle
- Cross Section #2: Station 501+91 linear feet, midpoint of pool

Based on visual assessment and comparisons of the as-built to the MY5 (2020) monitoring data, the channel and two cross sections appear stable with little or no active bank erosion except for the following areas: Noted in the MY4 (2019) report was minor bank erosion was noted downstream of the boulder toe wall and minor bank erosion was noted downstream of cross section #2 just upstream of the culvert. These areas do not appear to have changed from the previous monitoring year. Some of the cross sections show the channel slightly narrowing up since the project was constructed. XS-1 shows signs of aggradation when comparing this fifth year of monitoring to previous years. These changes lie within the acceptable threshold of morphological channel evolution and are due to natural processes. Graphs of the cross sections are presented in Appendix A. The 2020 longitudinal profile was not completed due to heavy planted vegetation along the streambank. Through visual observation and photos taken at the permanent photo point locations the channel bed remains stable at this time. Photo points 1 and 2 presented in Appendix B show steady growth of herbaceous and woody vegetation.

Based on field observations (sand deposits and wrack lines) at least one bankfull event has occurred during the 2019 monitoring year at Site #5. Pebble counts were not required per the permit conditions and therefore were not completed.

3.0 VEGETATION: UT TO NORTH BUFFALO CREEK - SITE #5 (YEAR 4 MONITORING)

3.1 Success Criteria

Mitigation Plan: All of the mitigation sites will be monitored according to the April 2003 Stream Mitigation Guidelines. The following components of the Level 1 monitoring will be performed each year of the 5-year monitoring period: reference photos, plant survival (identification of specific problem areas, estimated causes and proposed/required remedial action). Success for vegetation monitoring within the riparian buffer areas are based on the survival of at least 260 stems of five year old trees at year five.

3.2 Description of Species

The following live stake species were planted in the Streambank Area (Type I):

Salix nigra, Black Willow
Cornus amomum, Silky Dogwood

The following tree species were planted in the Buffer Area (Type II):

Liriodendron tulipifera, Tulip Poplar
Platanus occidentalis, American Sycamore
Prunus serotine, Black Cherry
Betula nigra, River Birch
Fraxinus pennsylvanica, Green Ash

3.3 Results of Vegetation Monitoring

Plot #	Tulip Poplar	Sycamore	Black Cherry	River Birch	Green Ash	Total (Year 4)	Total (at planting)	Density (Trees/Acre)
1	2	6	2	21	3	34	40	578
Year 4 Average Density (Trees/Acre)								**578**
Year 3 Average Density (Trees/Acre)								561
Year 2 Average Density (Trees/Acre)								578
Year 1 Average Density (Trees/Acre)								629

Site Notes: Black Willow and Silky Dogwood live stakes were noted surviving along the streambanks. Other species noted onsite included sweetgum, soft rush, woolgrass, lespedeza, alder, baccharis, kudzu, jewelweed, tear-thumb, elm, and various grasses. Kudzu noted onsite was treated with an herbicide application in June 2020.

3.4 Conclusions

There was one vegetation monitoring plot established throughout the buffer area. The 2020 vegetation monitoring of the site revealed an average tree density of 578 trees per acre. This average is above the minimum success criteria of 290 trees per acre for Year 4. NCDOT proposes to discontinue vegetation monitoring at the site.

4.0 OVERALL CONCLUSIONS AND RECOMMENDATIONS

The UT to North Buffalo Creek Site #5 has met the required monitoring protocols for the fifth formal year of monitoring. Based on comparing the monitoring data to the as-built, the stream channel remains stable throughout at this time. The streambank and buffer plantings are meeting the planted vegetation success criteria for the fourth year of monitoring.

NCDOT proposes to discontinue all monitoring activities at the UT to North Buffalo Creek Site #5.

5.0 REFERENCES

Mitigation Plan for Greensboro Eastern Loop; Guilford County, NC, T.I.P. Number U-2525B, WBS No's: 34821.1.1, August 12, 2013.

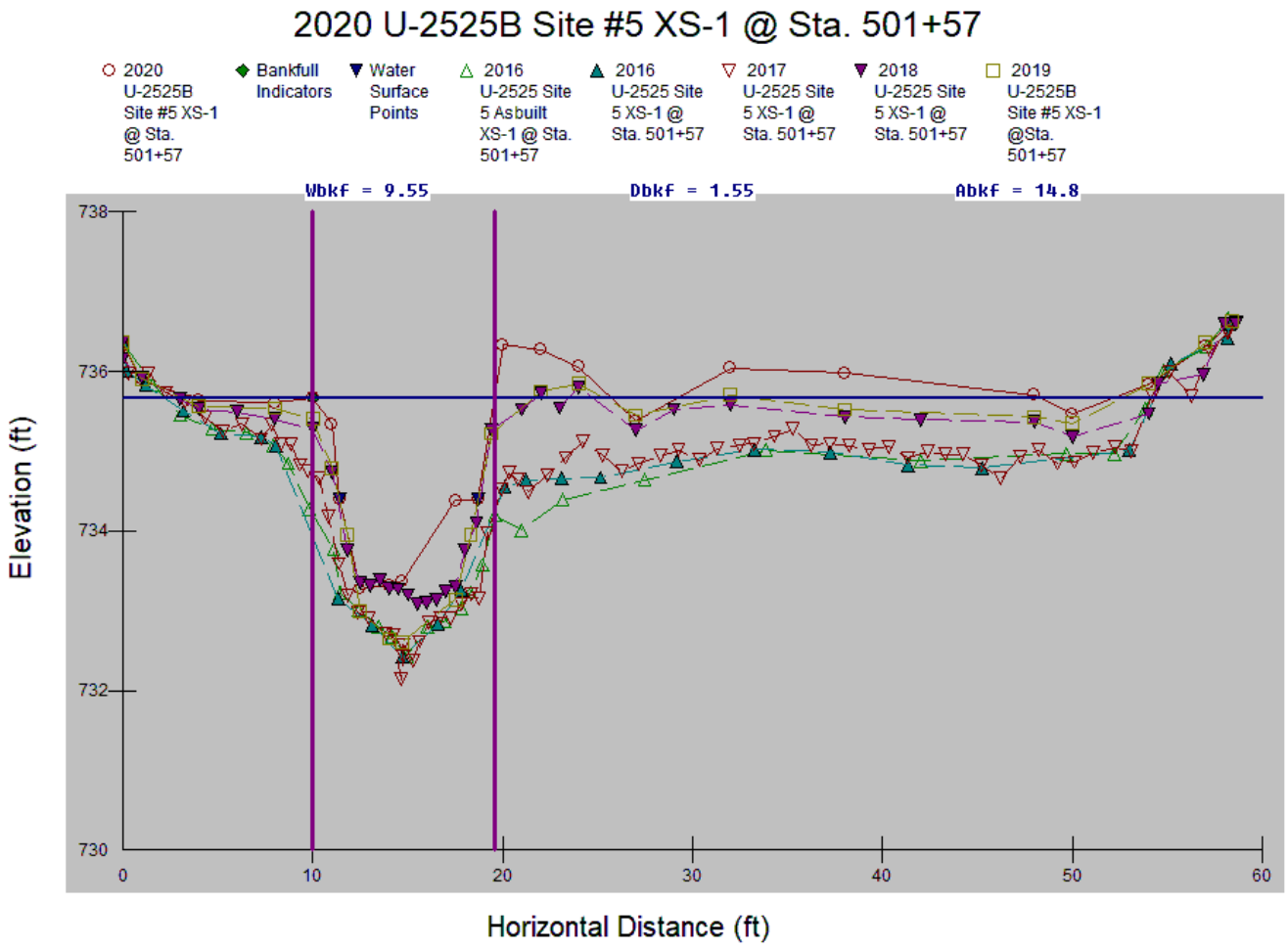
As-Built Report/Record Drawings for U-2525B Site #5 Mitigation Site, Guilford County, NC.

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.

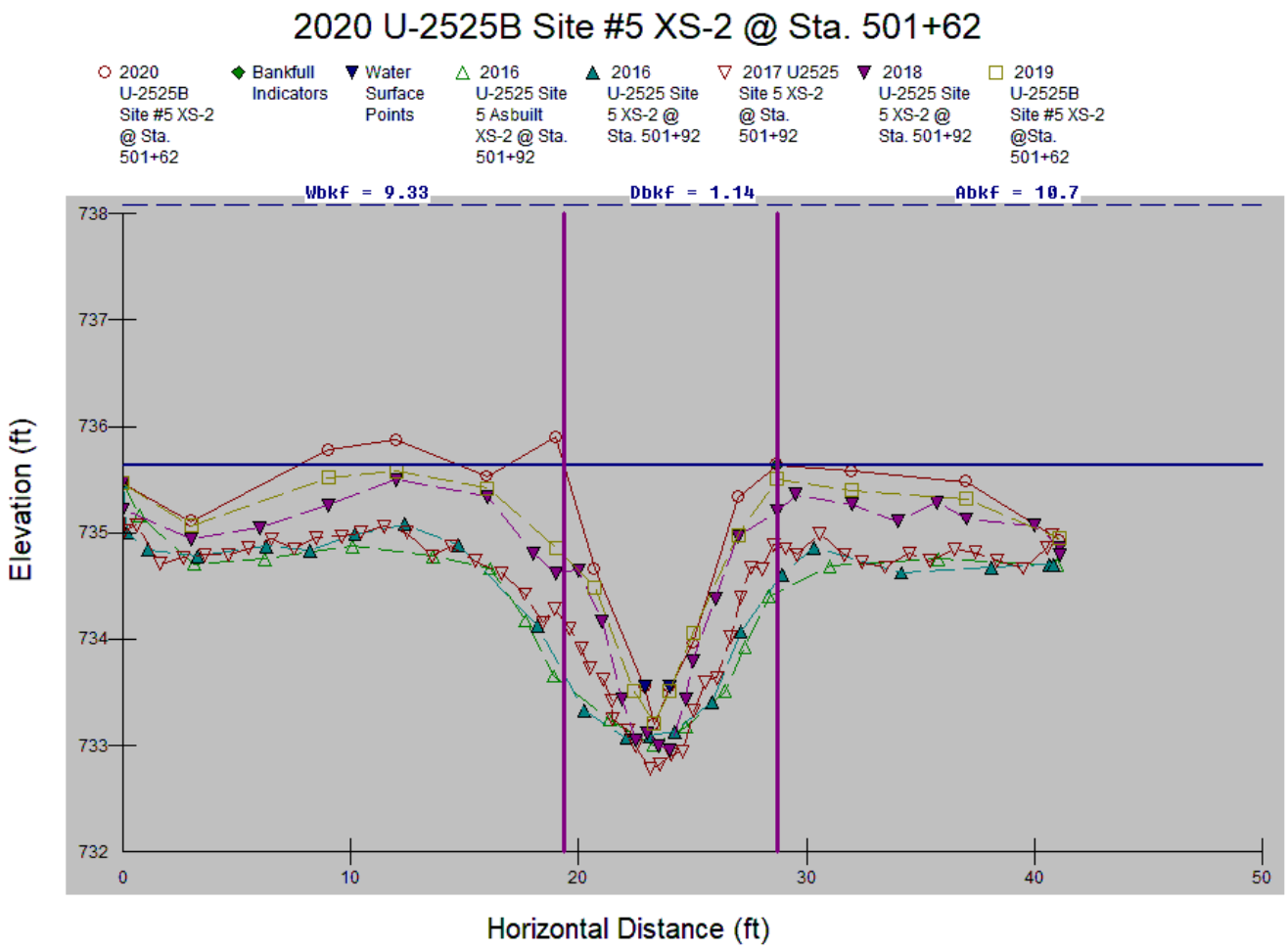
APPENDIX A

CROSS SECTION COMPARISONS



Site #5: Cross-Section #1 (Pool) Abbreviated Morphological Summary						
	As-built	**2016**	**2017**	**2018**	**2019**	**2020**
Bankfull Width (ft)	**13.68**	**13.00**	**12.55**	**12.16**	**12.95**	**9.55**
Bankfull Mean Depth (ft)	**0.97**	**1.20**	**1.20**	**1.30**	**1.5**	**1.55**
Bankfull Cross Sectional Area (ft^2)	**13.24**	**15.61**	**15.44**	**15.97**	**19.44**	**14.81**
Maximum Bankfull Depth (ft)	**1.96**	**2.22**	**2.59**	**2.31**	**2.93**	**2.4**

*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



Site #5: Cross-Section #2 (Riffle) Abbreviated Morphological Summary						
	As-built	2016	2017	2018	2019	2020
Bankfull Width (ft)	13.02	12.92	12.81	12.80	14.88	9.33
Bankfull Mean Depth (ft)	0.89	0.92	0.90	0.97	0.86	1.14
Width/Depth Ratio	14.63	14.04	14.23	13.20	17.3	8.18
Bankfull Cross Sectional Area (ft^2)	11.60	11.87	11.51	12.40	12.77	10.67
Maximum Bankfull Depth (ft)	1.52	1.53	1.96	2.31	2.3	2.44
Width of the Floodprone Area (ft)	41	41	41	41	41.1	41.1
Entrenchment Ratio	3.15	3.16	3.18	3.21	2.76	4.41

APPENDIX B

SITE PHOTOGRAPHS

U-2525B UT to North Buffalo Creek Site #5

Photo Point #1 (Upstream)

Photo Point #1 (Downstream)

Photo Point #2 (Upstream)

Photo Point #2 (Downstream)

U-2525B UT to North Buffalo Creek Site #5

Boulder Toe Wall Downstream of Ditch

Bank Erosion Downstream of Boulder Toe Wall

U-2525B UT to North Buffalo Creek Site #5

Minor Bank Erosion Downstream of XS #2

Minor Bank Erosion Upstream of Culvert

U-2525B UT to North Buffalo Creek Site #5

Vegetation Plot #1

Overview looking upstream from culvert inlet at I-840 off ramp

Streambank Vegetation

Streambank Vegetation

June 2020

APPENDIX C

CROSS SECTION, VEGETATION PLOT & PHOTO POINT LOCATIONS (AS-BUILT PLANS)

RECORD DRAWING

I, Michael D. Case, PLS, certify that the as-built information was from an actual field location under my direct supervision. The horizontal and vertical datum was referenced to the coordinate system supplied by NCDOT.

Michael D. Case, PLS — 10-12-2016 Date

NORTH CAROLINA PROFESSIONAL SEAL L-2828 LAND SURVEYOR MICHAEL D. CASE

DESC.	STATION (AS-BUILT)	ELEV. (AS-BUILT)
HR1	500+00.0	734.60
RAV1	500+29.2	734.89
HR2	500+59.0	734.31
HR3	501+18.5	733.45
RCV2	501+41.9	733.71
HR4	501+79.5	733.12
RCV3	502+05.9	733.46
HR5	502+35.2	732.47
RAV2	502+66.3	732.65
HR6	502+98.3	731.59
TIE IN	503+62.0	731.44

PREPARED IN THE OFFICE OF:

Kimley»Horn ©2016

NC LICENSE #F-0102
P.O. BOX 33068
RALEIGH, NORTH CAROLINA 27836
PHONE: (919) 677-2000

SITE 5
RECORD DRAWINGS

PROJECT REFERENCE NO.	SHEET NO.
U2525B	OSM-7

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 030000 ENGINEER DARREN M. PAUL

APPROVED BY:

DATE:

15 0 30

NAD 83

TAIL DITCH

TOP 743.09

PDE

CROSS VANE

NCDOT DB 4609 PG 2101

2 @ 8' X 8' RCBC

BARREL #2

BARREL #1

15" CSP

15" RCP-IV

12" RCP-IV

2004 2003 2002 2001 2005 2006 2007

ROCK CROSS VANE (RCV3)
AS-BUILT EL. = 733.46'
DESIGN EL. = 732.85' (LT.)
CONTRACTOR ADJUSTED ELEVATION UP TO MATCH PREVIOUSLY GRADED FLOODPLAIN AND TO TIE TO RAISED UPSTREAM AND DOWNSTREAM STRUCTURES.

PHOTO POINT 2

PHOTO POINT 1

ROCK CROSS VANE (RCV2)
AS-BUILT EL. = 733.71'
DESIGN EL. = 733.49'
RCV2 ELEVATION ADJUSTED UP TO BETTER TIE TO EXISTING BEDROCK. THE ARMS OF THE CROSS VANE WERE ALSO SHORTENED DUE TO BEDROCK WITHIN THE EXCAVATED CHANNEL BANKS.

ROCK CROSS VANE (RCV1) NOT CONSTRUCTED DUE TO EXISTING BEDROCK AT TARGET ELEVATION. BOULDER TOE PROTECTION ALONG RIGHT BANK WAS EXTENDED DOWNSTREAM TO PROTECT RIGHT BANK IN BEND.

CONCRETE WEIR ADDED TO HOLD BARREL #2 INVERT.
AS-BUILT EL. = 731.44'
DESIGN EL. = 731.25

S 61°03'23" W

BACKFILL, TYP.

NOTE: SHOTS TAKEN ON ACTUAL STEEL CASING. ALL INVERTS ARE UNATTAINABLE

STREAM PLUG, TYP.

BOULDER TOE PROTECTION

TIE IN DRAINAGE SWALE AS NECESSARY TO MAINTAIN POSITIVE DRAINAGE FROM ADJACENET FILL SLOPE

TOP OF BANK

END RELOCATION
STA 503+62

CONSTRUCTED RIFFLE ADDED TO CHANNEL.

503+00

502+00

XS-2

XS-1

VEG PLOT 1

501+00

500+00

ROCK A-VANE (RAV1)
AS-BUILT EL. = 734.89'
DESIGN EL. = 734.66'
THE HEADER ROCK ELEVATION OF RAV1 WAS ADJUSTED UP TO TIE TO EXISTING BEDROCK.

ALIGN SIDE TRIBUTARY TO TIE INTO PROPOSED RELOCATION AS SHOWN. ADD ROCK CROSS VANE STRUCTURE TO TIE TO EXISTING GRADE. MAXIMUM DROP OVER STRUCTURE SHALL NOT EXCEED 0.5 FOOT.

ROCK A-VANE (RAV2)
AS-BUILT EL. = 732.65'
DESIGN EL. = 732.24'
CONTRACTOR ADJUSTED ELEVATION UP TO LIMIT EXCAVATION UNDER SANITARY SEWER AERIAL CROSSING.

Harold A. Horton
DB 3461 PG 1283

TOP 753.22

BEGIN RELOCATION
STA 500+00