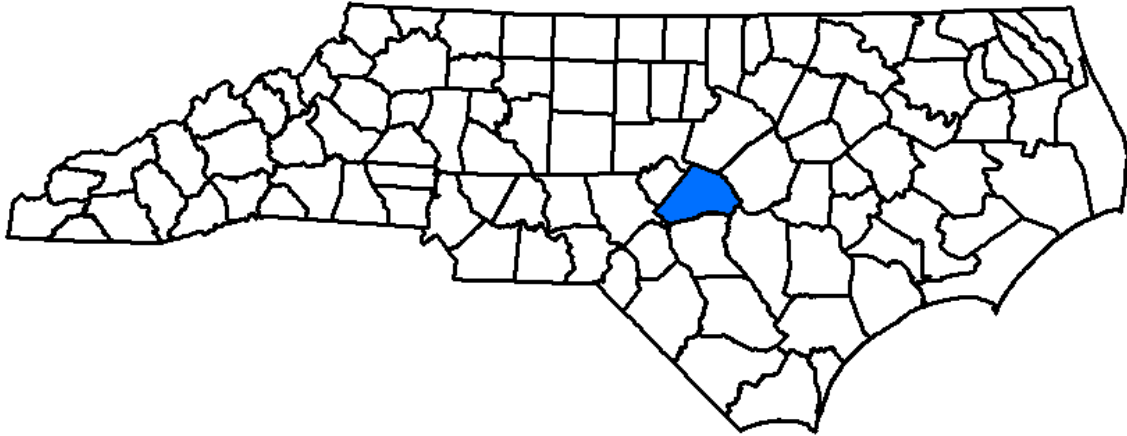


ANNUAL REPORT FOR 2020



B-4138WM UT to Cape Fear River
Harnett County
TIP No. B-4138WM
USACE Action ID: SAW-2003-00357
DWR Project #: 20091321



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

TABLE OF CONTENTS

SUMMARY	1
1.0 INTRODUCTION.....	2
1.1 Project Description.....	2
1.2 Purpose	2
1.3 Project History	2
1.4 Debit Ledger	4
2.0 STREAM ASSESSMENT	4
2.1 Success Criteria.....	4
2.2 Stream Description	4
2.2.1 Post-Construction Conditions	4
2.2.2 Monitoring Conditions	5
2.3 Results of the Stream Assessment.....	7
2.3.1 Site Data	7
3.0 OVERALL CONCLUSIONS AND RECOMMENDATIONS.....	8
4.0 REFERENCES.....	8

LIST OF FIGURES

Figure 1 – Vicinity Map.....	3
------------------------------	---

TABLES

Table 1 – Abbreviated Morphological Summary.....	6
--	---

APPENDICES

Appendix A – Cross Section Comparisons & Stream Gauge Data

Appendix B – Site Photographs

Appendix C – Cross Section & Photo Point Locations (As-Built Plans)

SUMMARY

The following report summarizes the stream monitoring activities that have occurred during 2020 at the UT to Cape Fear River mitigation site in Harnett County. The site was originally constructed in 2013 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 B-4138WM. Due to significant stream instability the stream was redesigned, and remediation was completed at the site during the fall of 2019. This report provides the monitoring results for the first formal year of monitoring (Year 2020). The Year 2020 monitoring period is the first of five scheduled years of monitoring (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, the site has met the required monitoring protocols for the first year of monitoring. Based on comparing the monitoring data to the as-built, the stream channel remains stable throughout at this time. The stream bank is vegetated for the first year of monitoring. During the 2020 monitoring evaluation, two beaver dams were noted on the site. USDA-APHIS has been contacted to remove the beaver and dams.

Vegetation monitoring results will be submitted in the 2021 monitoring report once the streambank and buffer restoration planting has been completed.

NCDOT will propose to continue stream monitoring at the UT to Cape Fear River site in 2021.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during 2020 at UT to Cape Fear River mitigation site. The site is situated directly adjacent to the southbound lanes of NC 210/401 (see Figure 1). The site was constructed to provide mitigation for stream impacts associated with construction of TIP number B-4138. The site is composed of one reach of a UT to Cape Fear River.

The mitigation project includes 606 linear feet of Priority II stream restoration. Construction was completed in fall of 2019 by NCDOT. Stream restoration involved the installation of rock cross vanes, rock sills, rock toe protection, constructed riffles, construction of a new stream channel, and construction of the floodplain through Priority II restoration to allow for overbank flooding. It also included the installation of coir fiber matting/roles along the stream banks. Live stakes will be installed along the streambanks and bareroot seedlings within the buffer area during the dormant season between December 2020 and March 2021.

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 UT to Cape Fear River. Hydrologic monitoring was not required.

1.3 Project History

June 2013	Initial Stream Construction Completed
June 2014	Stream Channel Monitoring (Year 1)
December 2019	Stream Remediation Completed
February 2020	As-Built Survey Completed
November 2020	Stream Channel Monitoring (Year 1 Restart)

1.4 Debit Ledger

The entire stream UT to Cape Fear River mitigation site was used for the B-4138WM project to compensate for unavoidable stream impacts.

ONEID: 043-001

2020 Stream Monitoring Site Map

HUC8: 03030004

TIP: B-4138

Site Name: UT to Cape Fear

County: Harnett

Division: 6



-78.812996
35.408714

0 60 120 180 240 Feet

Acreage: 1.738127

Figure 1-Vicinity Map

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 four cross sections (two riffles and two pools). 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 not be required. However, 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 resource agencies 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 stream buffer. Survival of the live stakes will be determined by visual observation throughout the five-year monitoring period.

Bare root vegetation will be evaluated using two 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 ft². 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 includes 606 linear feet of Priority II stream restoration. Construction was completed in December 2019 by NCDOT. Stream restoration involved the installation of rock cross vanes, rock sills, rock toe protection, constructed riffles,

construction of a new stream channel, and construction of the floodplain through Priority II restoration to allow for overbank flooding. It also included the installation of coir fiber matting/roles along the stream banks. Live stakes will be installed along the streambanks and bareroot seedlings within the buffer area during the dormant season between December 2020 and March 2021.

2.2.2 Monitoring Conditions

The objective of the UT to Cape Fear River restoration was to build a E4 stream type as identified in the Rosgen's Applied River Morphology. A total of four cross sections were surveyed. For this report, only the riffle cross sections were used in the comparison of channel morphology in Table 1.

Table 1. Abbreviated Morphological Summary B-4138WM - Cross Sections #1 and #3													
Variable	Proposed	As-Built		Monitoring Year 1 – 2020		Monitoring Year 2 – 2021		Monitoring Year 3 – 2022		Monitoring Year 4 – 2023		Monitoring Year 5 – 2024	
		Cross Section #1 (Riffle)	Cross Section #3 (Riffle)	Cross Section #1 (Riffle)	Cross Section #3 (Riffle)	Cross Section #1 (Riffle)	Cross Section #3 (Riffle)	Cross Section #1 (Riffle)	Cross Section #3 (Riffle)	Cross Section #1 (Riffle)	Cross Section #3 (Riffle)	Cross Section #1 (Riffle)	Cross Section #3 (Riffle)
Drainage Area (mi ²)	0.66	0.66	0.66	0.66	0.66								
Bankfull Width (ft)	10.5	10.00	8.5	8.00	8.2								
Bankfull Mean Depth (ft)	0.7	0.54	0.61	0.55	0.61								
Width/Depth Ratio	15.2	18.52	13.93	14.55	13.44								
Bankfull Cross Sectional Area (ft ²)	7.5	5.42	5.23	4.39	5.00								
Maximum Bankfull Depth (ft)	1.3	1.04	1.01	0.96	1.06								
Floodprone Area (ft)	36.0	34.89	39.84	34.79	40.88								
Entrenchment Ratio	3.4	3.49	4.69	4.35	4.98								

*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 4 cross sections and the longitudinal profile of UT to Cape Fear River established by the NCDOT after construction. Four 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: UT to Cape Fear River, Station 10+89 linear feet, midpoint of riffle
- ◆ Cross Section #2: UT to Cape Fear River, Station 11+85 linear feet, midpoint of pool
- ◆ Cross Section #3: UT to Cape Fear River, Station 13+85 linear feet, midpoint of riffle
- ◆ Cross Section #4: UT to Cape Fear River, Station 15+09 linear feet, midpoint of pool

Based on visual assessment and comparisons of the as-built to the MY1 monitoring data, the channel and all four cross sections appear stable with little or no active bank erosion. Graphs of the cross sections are presented in Appendix A. A survey of the longitudinal profile was not required. However, the entire restored length of stream was investigated for channel stability and in-stream structure functionality. Photo points 1 through 4 presented in Appendix B show continued growth and vigor of herbaceous and woody vegetation. Based on field observations (sand deposits and wrack lines) a recent bankfull event had occurred at the site. Pebble counts were not required per the permit conditions and therefore were not completed. All other monitoring activities will continue to be completed by NCDOT throughout the five-year monitoring period.

An on-site stream gauge was installed at the site in May 2020. Numerous bankfull events were documented by the on-site stream gauge at UT to Cape Fear River during the 2020 monitoring year. A graph of the stream gauge data is presented in Appendix A.

3.0 OVERALL CONCLUSIONS AND RECOMMENDATIONS

The UT to Cape Fear River has met the required monitoring protocols for the first formal year of monitoring. Based on comparing the monitoring data to the as-built, the stream channel remains stable throughout at this time. Vegetation monitoring results will be submitted in the 2021 monitoring report once the streambank and buffer restoration has been completed.

NCDOT proposes to continue stream and vegetation monitoring at UT to Cape Fear River mitigation site in 2021.

4.0 REFERENCES

B-4138WM On-Site Stream Mitigation Plan; Harnett County, NC, Project No. 33490.1.1, September 2009

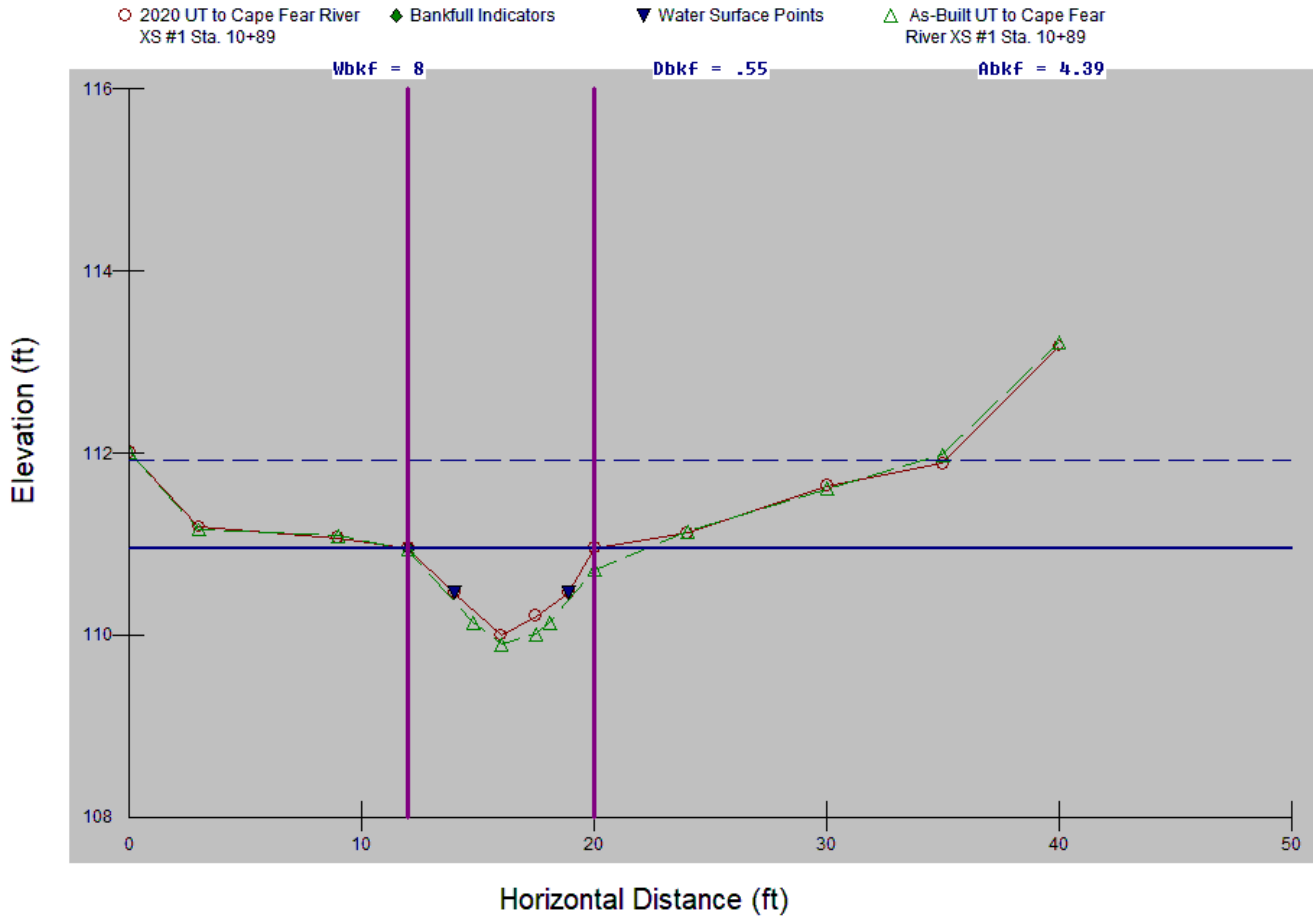
As-Built Report/Record Drawings for UT to Cape Fear River, Harnett County, NC, June 29,2020.

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.

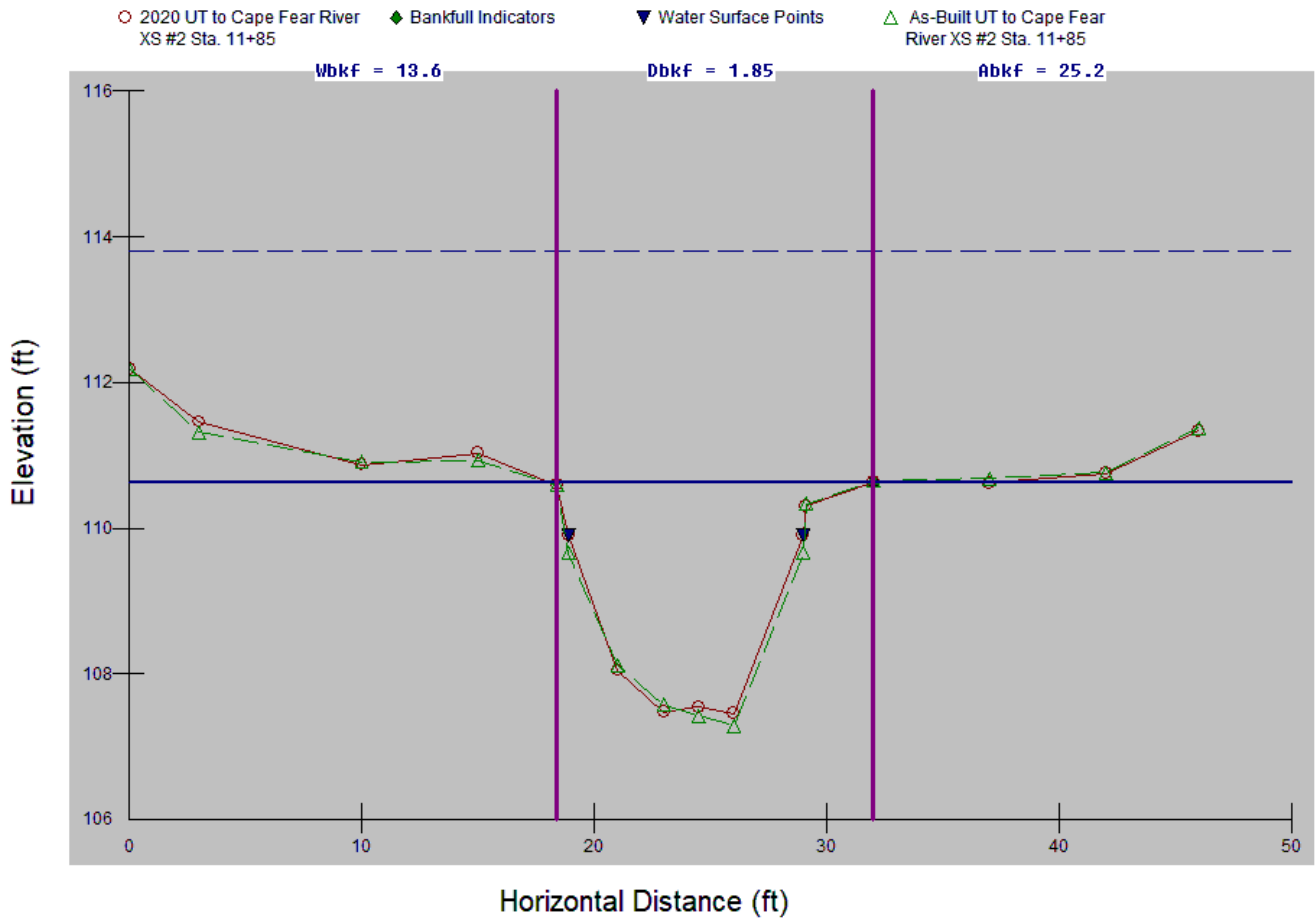
APPENDIX A
CROSS SECTION COMPARISONS
&
STREAM GAUGE DATA

2020 UT to Cape Fear River XS #1 Sta. 10+80



Cross-Section #1 (Riffle) Abbreviated Morphological Summary						
	As-built	2020	2021	2022	2023	2024
Bankfull Width (ft)	10.00	8.00				
Bankfull Mean Depth (ft)	0.54	0.55				
Width/Depth Ratio	18.52	14.55				
Bankfull Cross Sectional Area (ft ²)	5.42	4.39				
Maximum Bankfull Depth (ft)	1.04	0.96				
Width of the Floodprone Area (ft)	34.89	34.79				
Entrenchment Ratio	3.49	4.35				

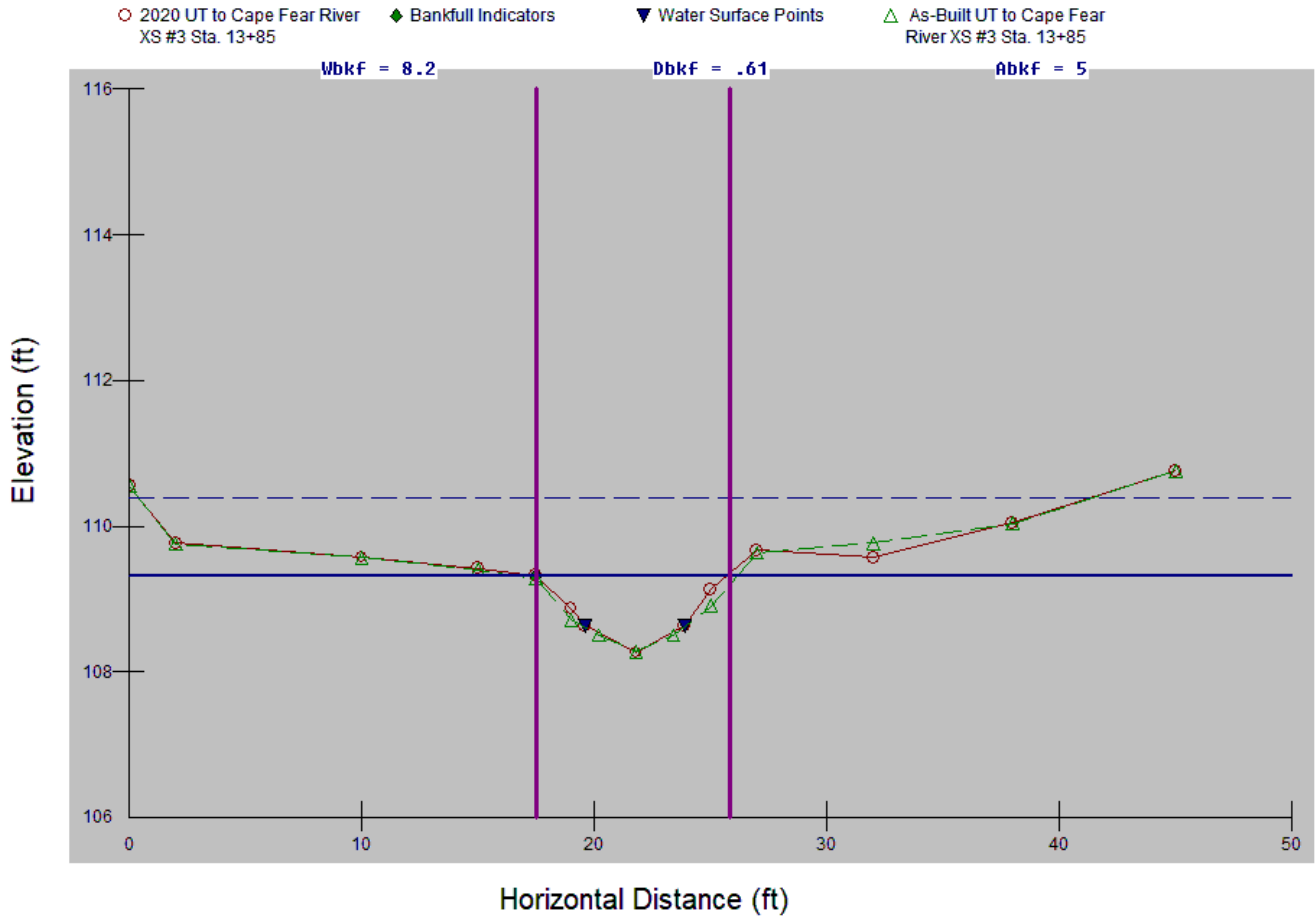
UT to Cape Fear River XS #2 Sta. 11+85



Cross-Section #2 (Pool) Abbreviated Morphological Summary						
	As-built	2020	2021	2022	2023	2024
Bankfull Width (ft)	14.2	13.6				
Bankfull Mean Depth (ft)	1.86	1.85				
Bankfull Cross Sectional Area (ft ²)	26.363	25.21				
Maximum Bankfull Depth (ft)	3.37	3.18				

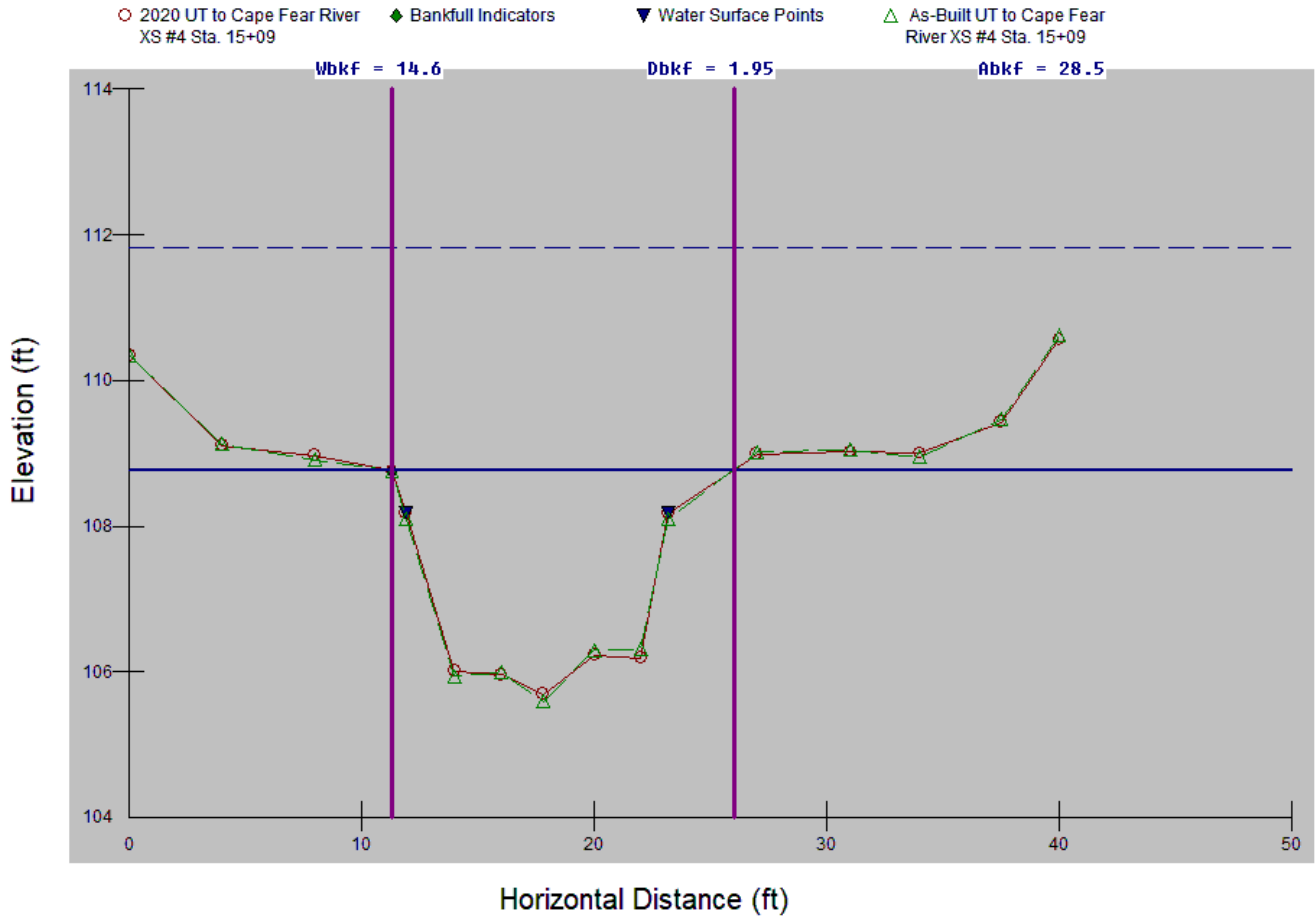
*According to the Rosgen Classification of Natural Rivers Floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features

2020 UT to Cape Fear River XS #3 Sta. 13+85



Cross-Section #3 (Riffle) Abbreviated Morphological Summary						
	As-built	2020	2021	2022	2023	2024
Bankfull Width (ft)	8.5	8.2				
Bankfull Mean Depth (ft)	0.61	0.61				
Width/Depth Ratio	13.93	13.44				
Bankfull Cross Sectional Area (ft²)	5.23	5.00				
Maximum Bankfull Depth (ft)	1.01	1.06				
Width of the Floodprone Area (ft)	39.84	40.88				
Entrenchment Ratio	4.69	4.98				

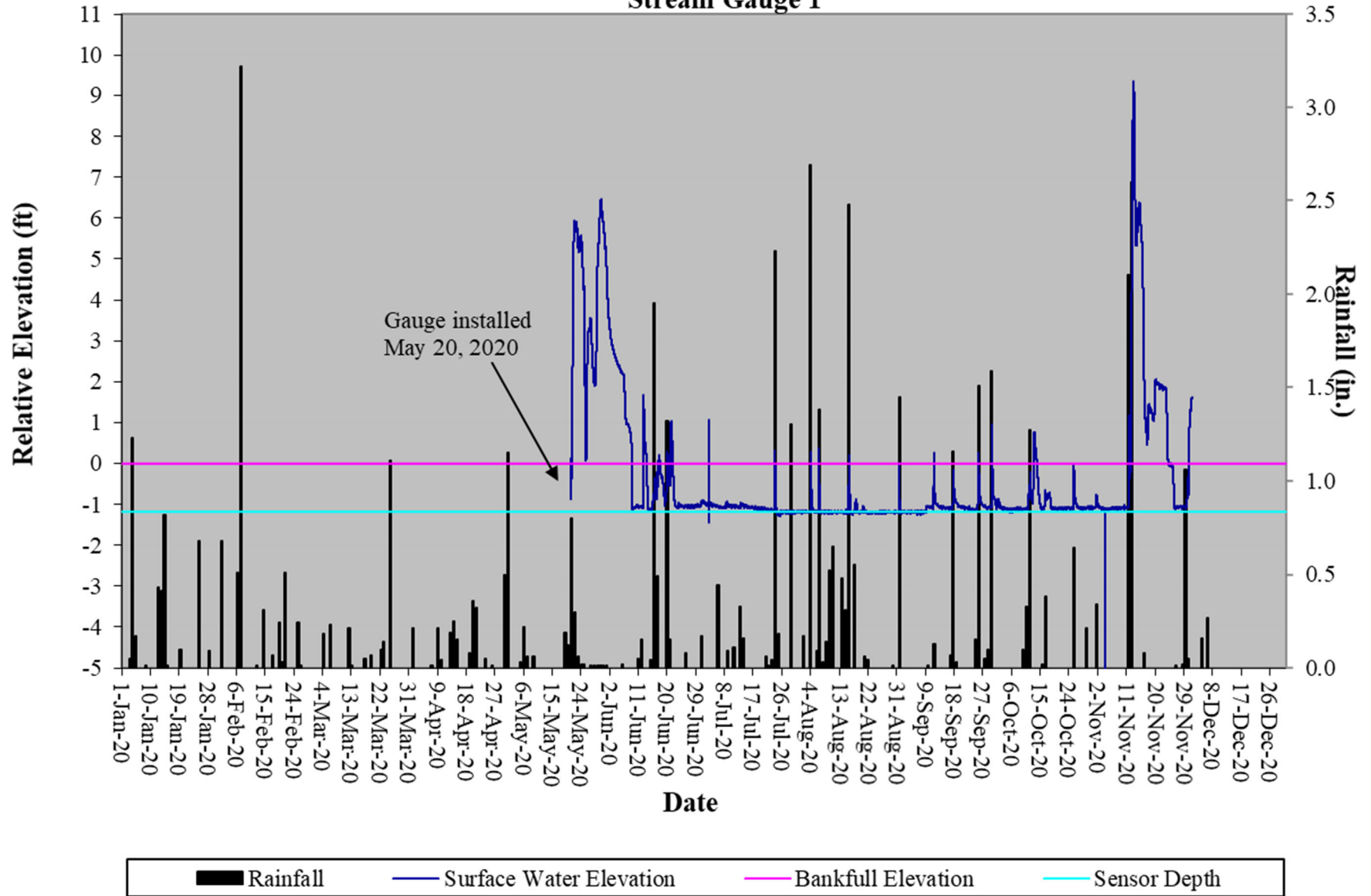
2020 UT to Cape Fear River XS #4 Sta. 15+09



Cross-Section #4 (Pool) Abbreviated Morphological Summary						
	As-built	2020	2021	2022	2023	2024
Bankfull Width (ft)	14.67	14.63				
Bankfull Mean Depth (ft)	1.96	1.95				
Bankfull Cross Sectional Area (ft ²)	28.74	28.48				
Maximum Bankfull Depth (ft)	3.17	3.07				

*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

UT Cape Fear River Restoration Site Hydrograph Stream Gauge 1



APPENDIX B

SITE PHOTOGRAPHS

UT to Cape Fear River



Photo Point #1 (Upstream)



Photo Point #1 (Downstream)



Photo Point #2 (Upstream)



Photo Point #2 (Downstream)



Photo Point #3 (Upstream)



Photo Point #3 (Downstream)

November 2020

UT to Cape Fear River



Photo Point #4 (Upstream)



Photo Point #4 (Downstream)



November 2020

APPENDIX C

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

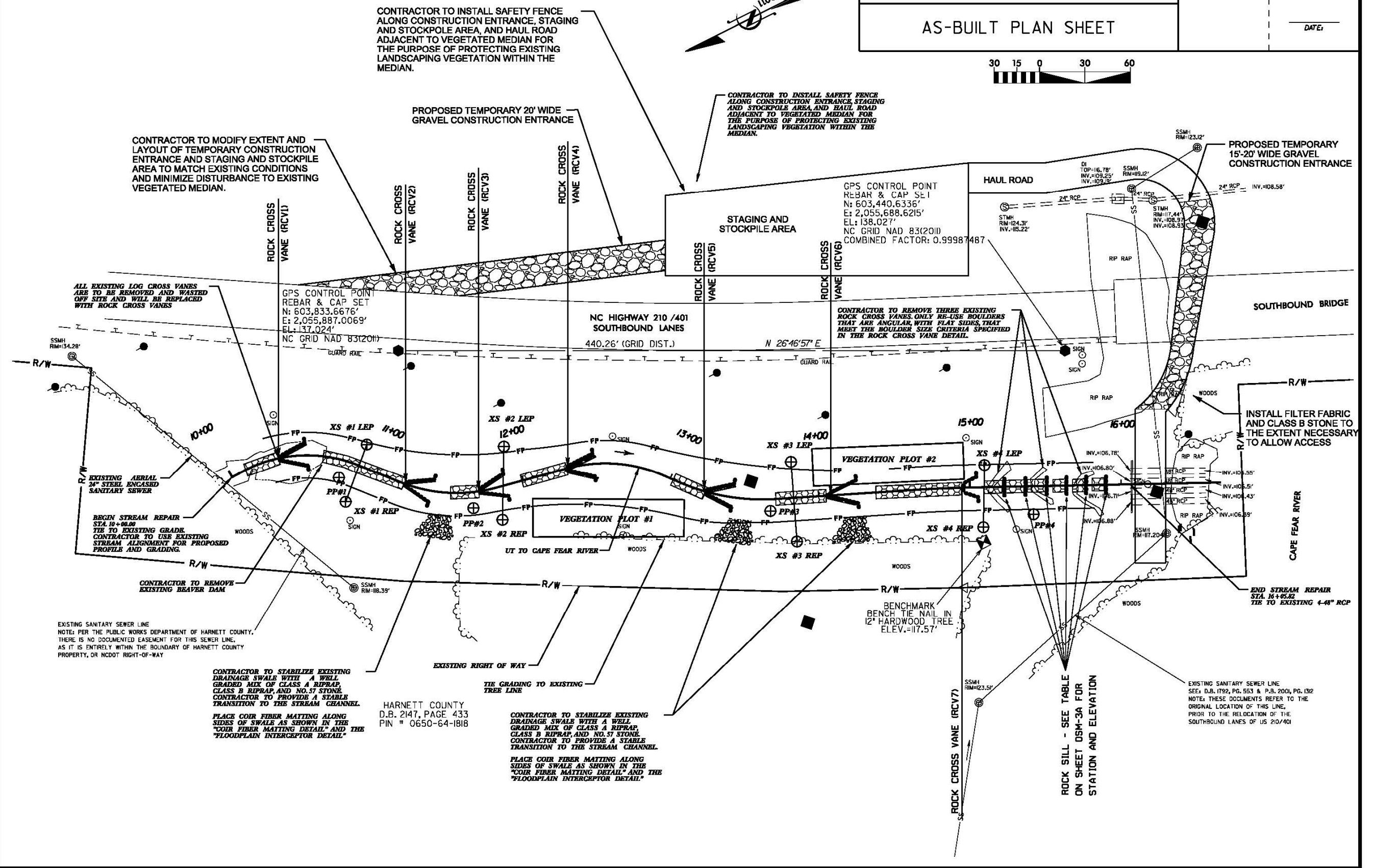
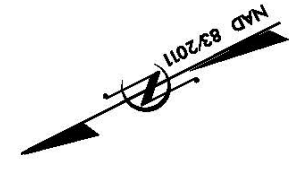
09/26/21

Kimley»Horn

NO LICENSE # 4112
P.O. BOX 3008
RALEIGH, NORTH CAROLINA 27688
PHONE: (919) 877-2000

PROJECT REFERENCE NO. B-4136WM	SHEET NO. OSM-4A
PROJECT ENGINEER	
APPROVED BY:	
DATE:	

AS-BUILT PLAN SHEET



CONTRACTOR TO INSTALL SAFETY FENCE ALONG CONSTRUCTION ENTRANCE, STAGING AND STOCKPILE AREA, AND HAUL ROAD ADJACENT TO VEGETATED MEDIAN FOR THE PURPOSE OF PROTECTING EXISTING LANDSCAPING VEGETATION WITHIN THE MEDIAN.

CONTRACTOR TO INSTALL SAFETY FENCE ALONG CONSTRUCTION ENTRANCE, STAGING AND STOCKPILE AREA, AND HAUL ROAD ADJACENT TO VEGETATED MEDIAN FOR THE PURPOSE OF PROTECTING EXISTING LANDSCAPING VEGETATION WITHIN THE MEDIAN.

CONTRACTOR TO MODIFY EXTENT AND LAYOUT OF TEMPORARY CONSTRUCTION ENTRANCE AND STAGING AND STOCKPILE AREA TO MATCH EXISTING CONDITIONS AND MINIMIZE DISTURBANCE TO EXISTING VEGETATED MEDIAN.

ALL EXISTING LOG CROSS VANES ARE TO BE REMOVED AND WASTED OFF SITE AND WILL BE REPLACED WITH ROCK CROSS VANES

CONTRACTOR TO REMOVE THREE EXISTING ROCK CROSS VANES, ONLY RE-USE BOULDERS THAT ARE ANGULAR, WITH FLAT SIDES, THAT MEET THE BOULDER SIZE CRITERIA SPECIFIED IN THE ROCK CROSS VANE DETAIL.

INSTALL FILTER FABRIC AND CLASS B STONE TO THE EXTENT NECESSARY TO ALLOW ACCESS

BEGIN STREAM REPAIR STA. 10+00.00 TIE TO EXISTING GRADE. CONTRACTOR TO USE EXISTING STREAM ALIGNMENT FOR PROPOSED PROFILE AND GRADING.

CONTRACTOR TO REMOVE EXISTING BEAVER DAM

EXISTING SANITARY SEWER LINE
NOTE: PER THE PUBLIC WORKS DEPARTMENT OF HARNETT COUNTY, THERE IS NO DOCUMENTED EASEMENT FOR THIS SEWER LINE, AS IT IS ENTIRELY WITHIN THE BOUNDARY OF HARNETT COUNTY PROPERTY, OR NCDOT RIGHT-OF-WAY

CONTRACTOR TO STABILIZE EXISTING DRAINAGE SWALE WITH A WELL GRADED MIX OF CLASS A RIPRAP, CLASS B RIPRAP, AND NO. 57 STONE. CONTRACTOR TO PROVIDE A STABLE TRANSITION TO THE STREAM CHANNEL.
PLACE COIR FIBER MATTING ALONG SIDES OF SWALE AS SHOWN IN THE "COIR FIBER MATTING DETAIL" AND THE "FLOODPLAIN INTERCEPTOR DETAIL."

HARNETT COUNTY
D.B. 2147, PAGE 433
PIN # 0650-64-1818

CONTRACTOR TO STABILIZE EXISTING DRAINAGE SWALE WITH A WELL GRADED MIX OF CLASS A RIPRAP, CLASS B RIPRAP, AND NO. 57 STONE. CONTRACTOR TO PROVIDE A STABLE TRANSITION TO THE STREAM CHANNEL.
PLACE COIR FIBER MATTING ALONG SIDES OF SWALE AS SHOWN IN THE "COIR FIBER MATTING DETAIL" AND THE "FLOODPLAIN INTERCEPTOR DETAIL."

EXISTING SANITARY SEWER LINE
SEE: D.B. 1792, PG. 553 & P.3, 2004, PG. 132
NOTE: THESE DOCUMENTS REFER TO THE ORIGINAL LOCATION OF THIS LINE, PRIOR TO THE RELOCATION OF THE SOUTHBOUND LANES OF US 210/401

ROCK SILL - SEE TABLE ON SHEET OSM-3A FOR STATION AND ELEVATION