As-Built Baseline Monitoring Report FINAL
Whittier Creek Mitigation Project

Surry County, North Carolina
DMS Project ID No. 100020
DEQ Contract No. 7182
DWR# 17-1044

Yadkin River Basin: 03040101-110040
DMS RFP #16-006993 (Issued: 9/16/16)
USACE Action ID No. SAW-2017-01503

Baseline Data Collection Period: Survey August 2021, Vegetation January 2022

Submitted to/Prepared for:

NC Department of Environmental Quality
Division of Mitigation Services (DMS)
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

Michael Baker
INTERNATIONAL

Submission Date: April 2022

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April 6, 2022

Matthew Reid, PM
NCDEQ, Division of Mitigation Services (DMS)
5 Ravenscroft Dr. – Suite 102
Asheville, NC 28801

Subject: Response to DMS Comments for Draft MY0 Report Review
Whittier Creek Mitigation Project, Surry County
Yadkin River Basin: 03040101
DMS Project #100020, DEQ Contract #7182

Mr. Reid:

Please find enclosed our responses to the NC Division of Mitigation Services' review comments dated March 28, 2022 in reference to the Whittier Creek Mitigation Project's Draft MY0 Report. We have revised the Draft document in response to the referenced review comments as outlined below.

General Report Comments

- DMS recommends using the most current templates for monitoring reports. It is understood that this project was contracted in May 2017 and therefore templates from that time period are applicable. However, the most current templates provide the IRT and DMS with the needed information in a more streamlined and less verbose format.

Response: Given that the project has already been set up using the older baseline template version from June 2017 (along with our experience using that version), we are electing to stick with that format for this project. However, we are certainly open to any tweaks or simple modifications to the existing format or tables that would be of any help in streamlining the report.

- Recommend displaying project information (county, basin, project #, etc.) on title page in a vertical list format as opposed to horizontally separated by commas. Reduce photo size if necessary.

Response: The project information was rearranged into a two-column tabular format beneath the title. It appears to be much clearer and easier to read.

- 1.1 Project Description: Please update stream mitigation credits to 3,059.667 in the second paragraph. This is the official credit amount for the site and what is used on debit ledgers.

Response: Text revised as recommended. I have tried to be consistent in my reporting of stream credit and length numbers to avoid confusion but clearly missed this one.

- Table 2: Please add "Institution Date – May-17" as the first entry on the table.

Response: Table revised as requested.

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- Table 2: Please add two lines below As-Built Baseline Monitoring Report (MY0) entry: "Vegetation Monitoring" and "Stream Survey" and the dates that these activities were completed. Please include this information for future monitoring reports.

Response: Table revised as requested.

- Table 5: Approved Mitigation Plan indicates CVS protocol will be used for vegetation monitoring. Please use the CVS output tables or the DMS vegetation tool and include all supporting data.

Response: The veg table provided is the required CVS output for this template version. However, we had revised it to remove the Volunteer and Total stem columns as there were no volunteers to be reported at this stage. In an attempt to streamline the table we inadvertently created confusion – our apologies. The veg table has been revised to replace the deleted columns so that it now looks like the standard output veg table we will use for the remaining monitoring period.

- Table 6: Please include grid lines in final submittal.

Response: Table 6 was revised to include grid lines.

- Table 7: Please include the baseline bankfull elevation used for the calculations. Include grid lines in final submittal. Consider using most current monitoring template. Only 6 parameters are required as opposed to the 11 currently shown.

Response: The baseline/as-built bankfull elevations are shown on the individual riffle cross-section graphs. In future monitoring years, these original as-built elevations will still be provided (both numerically and drawn onto the cross-section figure) along with the monitoring year bankfull elevations and the thalweg elevations. That allows the reviewer to do the calculations required to determine BHR as per DMS' methodology and to more easily compare changes from the baseline condition. We feel placing this information on the graphs as opposed to Table 7 is much more useful as you can visually see what the data is telling you. Grid lines have been added to the table as requested.

- Please review and revise cross-section entrenchment ratios. Cross-section 1, 3, 5 and 10 graphs show different values than shown on Table 7.

Response: Those values were reviewed and have been corrected so they now all match. Our apologies for the confusion.

DMS conducted a field visit on March 24, 2022. The following comments/observations are a result of that visit:

- Overall, the site is in excellent condition. All structures are performing as intended, boundary marking is excellent, and all fences are intact. No conservation easement encroachments were identified.

Response: We're glad you found in site in overall excellent condition!

- Please keep a watch on the right flood plain of UT4A near veg plot 3. There is an approximately 10-15' wide strip that extends approximately 200' of existing vegetation that contains of fescue and other pasture grasses. If this inhibits tree growth in this area, please consider ring spraying or other alternatives to prevent competition.

Response: We intend to treat the surviving fescue with ring-spraying around the planted stems this fall after the leaves have dropped and report as part of MY1 activities.

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- Invasive populations consisting mainly of multiflora rose was identified in areas of undisturbed trees and existing vegetation along the left bank of UT4A. Please be sure to map these areas for MY1 and treat accordingly throughout the monitoring period.

Response: Absolutely. We are aware of those multiflora rose populations that survived initial treatments conducted during the first construction phase in the autumn of 2020 and are regrowing this year. We intend to treat them again this spring and report as part of MY1 activities.

Digital Deliverable Comments

- The submitted vegetation data does not meet the 2016 IRT requirements (e.g. x,y, stem height, etc.). Please reference the DMS vegetation table tool and either use the tool to replicate the output and include the supporting data. (https://ncdms.shinyapps.io/Veg_Table_Tool/)

Response: I failed to include the CVS database with the draft e-submission files but will do so for the final submission. It contains all the standard vegetation data (x/y location, stem heights and vigor, etc) that we collected in the field.

- If available, please include features representing the mitigation plan stream lengths.

Response: GIS shapefiles for the streams showing the mitigation plan design lengths have been included with the final e-submission.

As requested, one hardcopy of the final revised Baseline/MY0 report has been included with this response along with a full electronic copy on a USB drive. Please do not hesitate to contact me further should have any additional questions regarding our response submittal.

Sincerely,

Scott King, LSS, PWS
Project Manager

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APPENDICES

1.0 PROJECT SUMMARY

1.1 Project Description

Michael Baker Engineering, Inc. (Michael Baker) restored approximately 2,844 linear feet of existing jurisdictional stream and enhanced 328 linear feet of stream along both the main stem of, and unnamed tributaries to, Whittier Creek. The project also reestablished roughly 5.5 acres of riparian buffer, though not for buffer credit. The project is located in the Yadkin River Basin, within the Hydrologic Unit Code (HUC) 03040101-110040 (the Bull Creek – Ararat River Watershed), which is identified as a Targeted Local Watershed (TLW) in DMS's 2009 *Upper Yadkin Pee-Dee River Basin Restoration Priorities* (RBRP) report.

The Whittier Creek Mitigation Project is located on an active cattle farm in Surry County, North Carolina, approximately 7 miles west of the Town of Pilot Mountain (Figure 1). Historic agriculture uses on the project site have been predominantly cattle pasture and crop production (tobacco and hay). These activities had negatively impacted both water quality and streambank stability along the project streams and their tributaries (Table 4). The project is being conducted as part of the NCDMS Full Delivery In-Lieu Fee Program and is anticipated to generate at close-out a total of 3,059.667 cool stream mitigation credits (Table 1) and is protected by a 6.9-acre permanent conservation easement.

1.2 Goals and Objectives

The goals of this project are identified below:

- Reconnect stream reaches to their floodplains
- Improve stream stability
- Improve aquatic habitat
- Reestablish forested riparian buffers
- Permanently protect the project

To accomplish these goals, the following objectives were identified:

- To raise channel beds or excavate bankfull floodplains by utilizing either a Priority I or Priority II Restoration approach, or through an Enhancement Level I approach.
- To construct streams of appropriate dimensions, pattern, and profile in restored reaches, slope stream banks and provide bankfull benches on enhanced streams, and utilize bio-engineering to provide long-term stability.
- Construct an appropriate channel morphology for all streams, increasing the number and depths of pools, increasing the amount of woody debris with structures including geo-lifts, brush-toe, log vanes/weirs, root wads, woody riffles, and/or log J-hooks.
- Establish riparian buffers at a 30-foot minimum width along all stream reaches, planted with native tree and shrub species.
- Establish a permanent conservation easement restricting land use in perpetuity. This will prevent site disturbance and allow the project to mature and stabilize.

1.3 Project Success Criteria

The success criteria and performance standards for the project will follow the North Carolina Interagency Review Team (NCIRT) guidance document *Wilmington District Stream and Wetland Compensatory Mitigation Update* dated October 24, 2016 and as described in Section 7 of the approved Mitigation Plan. All specific monitoring activities will follow those outlined in detail in Section 8 of the approved Mitigation Plan and will be conducted for a period of 7 years unless otherwise noted. Annual monitoring reports will follow the DMS document *Annual Monitoring Report Format, Data Requirements, and Content Guidance* from June 2017.

1.4 Mitigation Component Summary

The project involved the restoration or enhancement of 4 reaches. Reach R7 (Whittier Creek) was restored to a Rosgen C-Type stream using a Priority Level II approach. The stream had been straightened and relocated, which caused it to become deeply incised with steep, bare, and heavily eroding banks. It also had substantial impacts from cattle access and lacked a forested riparian buffer. The channel was restored by excavating a wide new floodplain at the bankfull depth and by restoring an appropriate pattern back to the channel. Multiple in-stream structures were also installed throughout the reach to control grade, dissipate energy, protect streambanks, and create more diverse bedform/habitat diversity. Fencing was then installed to exclude cattle from the entire system.

Reach UT4a was improved using an Enhancement Level I approach to increase bank stability and promote bedform diversity of the channel. Sections of the reach had bankfull benches excavated while other sections of steep banks were graded back and stabilized. A few in-stream structures were also installed to control grade, protect streambanks, and promote habitat diversity. A full riparian buffer was then planted on both sides of the reach, though mature existing trees growing along the reach bank were preserved to the maximum extent possible.

Reach UT4b was restored to a Rosgen C-type stream using a Priority Level I approach. This reach was deeply incised, had been straightened, had substantial impacts from cattle access, and lacked a forested riparian buffer. The channel was raised to reconnect it with the adjacent floodplain, tying into an existing bedrock knickpoint at the top, and had a meandering riffle-pool morphology restored. Numerous in-stream structures were installed throughout the reach to control grade, promote bedform/habitat diversity, and protect streambanks. Fencing was then installed to exclude cattle from the reach.

Reach UT5 was restored to a Rosgen B-type stream using a Priority Level I approach. This reach was incised, had substantial impacts from cattle access, and lacked any forested riparian buffer. Due to existing valley slope and valley floor widths, the channel was restored with an appropriate riffle-step-pool morphology with minor pattern adjustments incorporated to ensure stability and promote habitat diversity. Overall, the valley acts to confine the stream, though there are a couple of exceptions; towards the top around the gated crossing, and at the bottom near its confluence with UT4b. In these locations the valley does flatten out or open up a bit for short sections (which increases the entrenchment ratio greater than 2.2) but given their relatively short lengths this will not cause any detrimental effects and the stream will function as designed. Channel dimensions and banks were graded to appropriate sizes and slopes, reconnecting the stream to the adjacent floodplain. Numerous in-stream structures were installed throughout the reach to control grade, promote bedform/habitat diversity, and protect streambanks. Fencing was then installed to exclude cattle from the reach, which included a gated rock ford crossing located at a break in the easement for an existing powerline.

A full, minimum 30-ft width riparian buffer was established around all project streams, resulting in the ultimate re-establishment of 5.5 acres of forested riparian buffer that had previously been used for pasture or crop production. The entire project area will be preserved in perpetuity in a 6.9-acre permanent conservation easement. A full summary of the project components and mitigation assets/credits is presented in Table 1 and shown in Figure 2.

1.5 Project Timeline

Project construction was originally initiated in April 2020 and was very close to completion in October 2020, before the remnants of Hurricane Zeta hit the site on October 29, 2020, dropping a substantial amount of rainfall over a relatively short timeframe. The resulting regional flooding blew out the two-lane NCDOT bridge at the top of the main stem (Reach R7) which resulted in substantial scouring and sediment deposition, leaving large sections of newly built channel buried (see photographs in Appendix B). Relatively minor damage was also observed along sections of the tributaries as well, particularly to lower portion of UT4b. The NCDOT requested that Michael Baker delay repair work until they could rebuild the bridge at the top of the project as well as remove the large chunks of the old bridge that had been washed down onto the project's floodplain. This request, along with the subsequent very wet winter and spring season delayed project repair work by several months, ultimately beginning in April and finishing up in June of 2021. The fencing and conservation boundary marking was completed shortly thereafter in July of 2021. All easement monuments were located at this time to confirm none had been lost or damaged during construction. The As-Built survey was completed in August of 2021. All 11 cross-sections (6 riffle and 5 pool) and 3 in-stream gauges were installed in June of 2021. Bareroot stems and livestakes were fully planted in January of 2022, while the vegetation plots (4 permanent and 1 random) were installed and vegetation data collected immediately thereafter, also in January of 2022. Thus, Monitoring Year 1 was delayed and is now scheduled for 2022 as shown in Table 2.

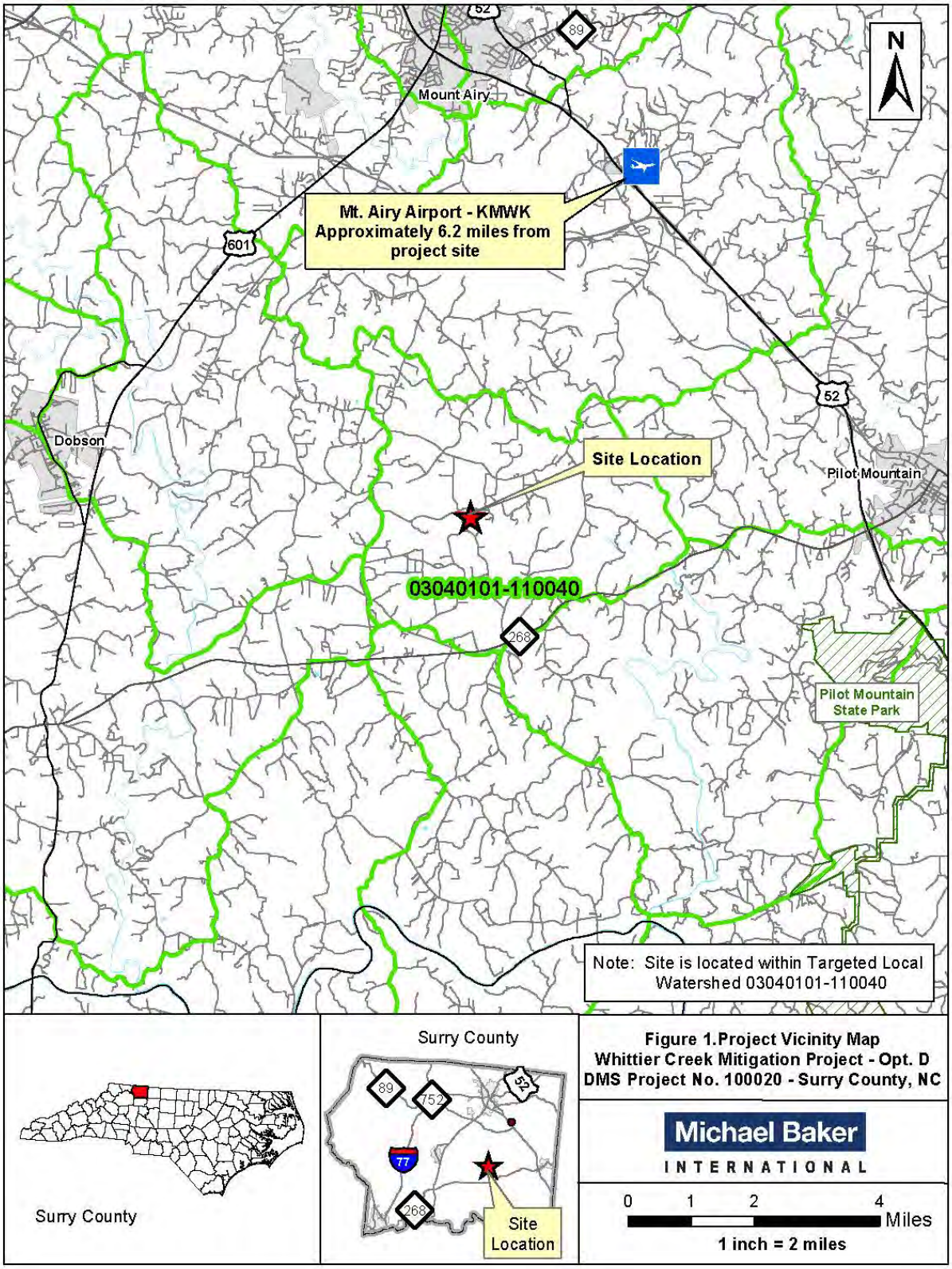
1.6 Design Change Deviations

During project construction, there were several relatively minor deviations from the original design plans as marked in red in the as-built plan sheets (Appendix E). They were mostly structure substitutions made in the field due to recent IRT feedback on this and other projects requesting more wood structures in the stream. In many locations, rock vanes were substituted with log vanes, rock sills with log sills, boulder-toe bank protection with brush/wood-toe, etc. The presence of bedrock in the bank and channel bed on Reach UT4a resulted in minor adjustments to the exact structure placement location. The pipe culvert crossing in upper Reach UT5 was replaced with a rock ford crossing to keep the stream daylighted. Additionally, after the damage caused by the storm in October of 2020 it was deemed prudent to install boulder-toe bank protection at the top of project along the outer banks of the first two meander bends (located outside of the conservation easement), and on the meander bend of UT4b at approximately Station 19+50. In each of those locations the extreme flooding had scoured the banks in these bends, thus additional protection was deemed prudent. But none of the changes described here should ultimately affect stream performance, function, or credit.

Additionally, after planting was completed in January of 2022, Michael Baker staff was informed by the contractor that their crew had planted a few extra stems leftover from another project. These were installed in addition to (not in substitution for) the proposed species list and density. There were approximately 50 stems each of swamp chestnut oak (*Quercus michauxii*), blackgum (*Nyssa sylvatica*), serviceberry (*Amelanchier arborea*), and sugarberry (*Celtis laevigata*) planted on site. This equates to just 1% each of the total planted stem numbers as shown on the revised planting plan tables on Sheet 1-A of the as-built plan sheets (Appendix E).

1.7 Vicinity Map

Project Coordinates: 36.3779 N, -80.5999 W



1.8 Technical and Methodological Descriptions and References

Stream survey data was collected to a minimum of Class C Vertical and Class A Horizontal Accuracy using a Leica TS06 Total Station and was georeferenced to the NAD83 State Plane Coordinate System, FIPS3200 in US Survey Feet. The survey data from the permanent project cross-sections were collected and classified using the Rosgen Stream Classification System to confirm design stream type (Rosgen 1994).

The vegetation-monitoring quadrants (plots) were installed across the site in accordance with the CVS-DMS Protocol for Recording Vegetation, Version 4.1 (Lee 2007) and the data collected from each was input into the CVS-DMS Data Entry Tool v. 2.3.1 (CVS 2012).

Three automated, in-stream continuous stage recorders were installed in Reaches UT4b, UT5, and R7 following suggestions and guidance from DMS Science and Analysis Section (G. Melia, personal communication, August 21, 2019). The gauges themselves are all In-Situ brand Rugged Troll 100 data loggers. The gauges will record flow depth to determine bankfull and near-bankfull events within each reach.

References:

Carolina Vegetation Survey (CVS) and NC Division of Mitigation Services (DMS). CVS-DMS Data Entry Tool v. 2.3.1. University of North Carolina, Raleigh, NC. 2012.

Lee, M., Peet R., Roberts, S., Wentworth, T. 2007. CVS-DMS Protocol for Recording Vegetation, Version 4.1.

North Carolina Division of Mitigation Services. 2009. Upper Yadkin Pee-Dee River Basin Restoration Priorities. NC Department of Environmental Quality. Raleigh, NC.

North Carolina Interagency Review Team (NCIRT). 2016. Guidance document "*Wilmington District Stream and Wetland Compensatory Mitigation Update*". October 24, 2016

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

Rosgen, D.L. 1996. Applied River Morphology. Wildlands Hydrology. Pagosa Springs, CO.

APPENDIX A

Background Tables and Figures

Table 1.0 Project Components and Mitigation Credits
Whittier Creek Mitigation Project - NCDMS Project No. 100020

Project Component (reach ID, etc.)	Wetland Position and HydroType	Existing Footage or Acreage	Stationing	As-Built Restored Footage[1]	Mitigation Plan Designed Footage	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Plan Credits [2]
Reach R7 (Whittier Creek)		1,462	11+36 - 15+50, 15+62 - 24+91	1,343	1,332	R	P2	1	1,332.000
Reach UT4a		338	10+00 -13+27	328	328	E	L1	1.5	218.667
Reach UT4b		764	13+76 - 21+30	754	761	R	P1	1	761.000
Reach UT5		765	10+00 - 12+46, 12+91 - 17+92	747	748	R	P1	1	748.000
Wetland Group 1									
Buffer Group 1 (BG1)									

[1] All stream stationing and restored footage numbers reported here and shown in the as-built plan sheets use *thalweg* survey values and have had easement breaks removed.

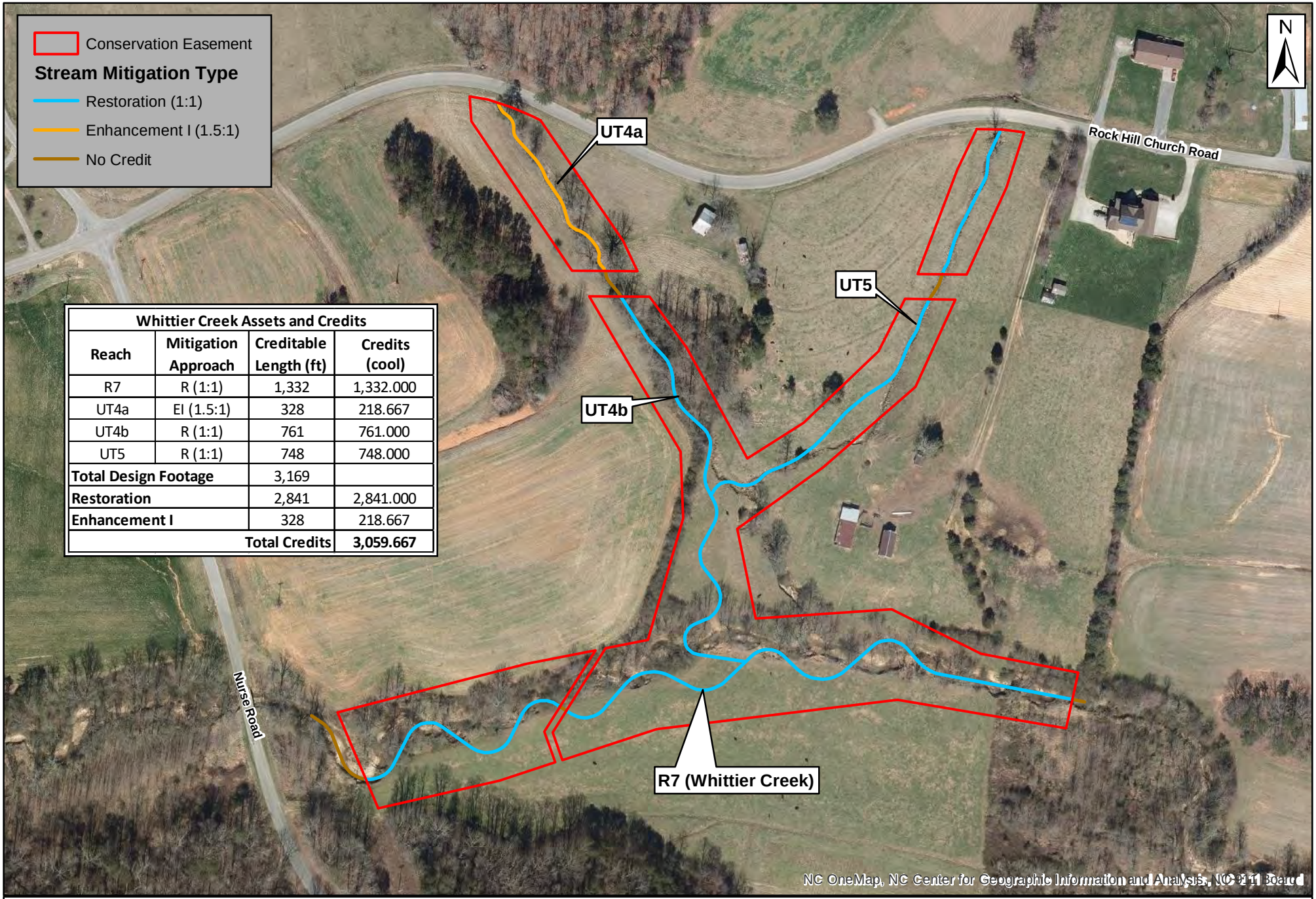
[2] Credits reported here are derived from the design lengths as taken from the approved mitigation plan Table 11.1

Table 1.1
As-Built Centerline Length and Area Summations by Mitigation Category

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Credited Buffer (ft^2)
		Riverine	Non-Riverine		
Restoration	2,844				
Enhancement					
Enhancement I	328				
Enhancement II					
Creation					
Preservation					
High Quality Pres					

Table 1.2
Overall Assets Summary

Asset Category	Overall Credits
Stream (cool)	**3,059.667**
RP Wetland	
NR Wetland	
Buffer	



Whittier Creek Assets and Credits			
Reach	Mitigation Approach	Creditable Length (ft)	Credits (cool)
R7	R (1:1)	1,332	1,332.000
UT4a	EI (1.5:1)	328	218.667
UT4b	R (1:1)	761	761.000
UT5	R (1:1)	748	748.000
Total Design Footage		3,169	
Restoration		2,841	2,841.000
Enhancement I		328	218.667
		Total Credits	**3,059.667**

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0 125 250 500 Feet

Figure 2. Project Asset and Credit Map
Whittier Creek Mitigation Project
DMS Project No. 100020

Table 2. Project Activity and Reporting History
Whittier Creek Mitigation Project - NCDMS Project No. 100020

Grading Completed in June 2021	
Elapsed Time Since grading complete:	**8 months**
All Planting Completed in January 2022	
Elapsed Time Since planting complete:	**1 month**
Number of Reporting Years[1]:	**0**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Institution date	N/A	May-17
404 permit date	N/A	May-20
Mitigation Plan	N/A	Mar-20
Final Design – Construction Plans	N/A	Jul-20
Construction Grading Completed	N/A	Jun-21
As-Built Survey	Aug-21	Aug-21
Livestake and Bareroot Planting Completed	N/A	Jan-22
As-Built Baseline Monitoring Report (MY0)	Jan-22	Feb-22
As-Built Stream Survey	Aug-21	N/A
As-Built Vegetation Monitoring	Jan-22	N/A
Year 1 Monitoring (anticipated)	Oct-22	Dec-22
Year 2 Monitoring (anticipated)	Oct-23	Dec-23
Year 3 Monitoring (anticipated)	Oct-24	Dec-24
Year 4 Monitoring (anticipated)	Oct-25	Dec-25
Year 5 Monitoring (anticipated)	Oct-26	Dec-26
Year 6 Monitoring (anticipoated)	Oct-27	Dec-27
Year 7 Monitoring (anticipated)	Oct-28	Dec-28

[1] = The number of monitoring reports excluding the as-built/baseline report

Table 3. Project Contacts
Whittier Creek Mitigation Project - NCDMS Project No. 100020

Designer	797 Haywood Rd, Suite 201
Michael Baker Engineering, Inc.	Asheville, NC 28806 Contact: Scott King, Tel. 828-412-6102
Construction Contractor	5616 Coble Church Rd
KBS Earthworks, Inc.	Julian, NC 27283 Contact: Kory Strader, Tel. 336-362-0289
Survey Contractor	88 Central Avenue
Kee Mapping and Surveying	Asheville, NC 28801 Contact: Brad Kee, Tel. 828-575-9021
Planting Contractor	5616 Coble Church Rd
KBS Earthworks, Inc.	Julian, NC 27283 Contact: Kory Strader, Tel. 336-362-0289
Seeding Contractor	5616 Coble Church Rd
KBS Earthworks, Inc.	Julian, NC 27283 Contact: Kory Strader, Tel. 336-362-0289
Seed Mix Sources	
Green Resources	Telephone: 336-855-6363
Nursery Stock Suppliers	
Mellow Marsh Farm	Telephone: 919-742-1200
Bruton Natural Systems	Telephone: 919-242-6555
Monitoring Performers	
Michael Baker Engineering, Inc.	797 Haywood Rd, Suite 201 Asheville, NC 28806
Stream Monitoring POC	Scott King, Tel. 828-412-6102
Vegetation Monitoring POC	Scott King, Tel. 828-412-6102

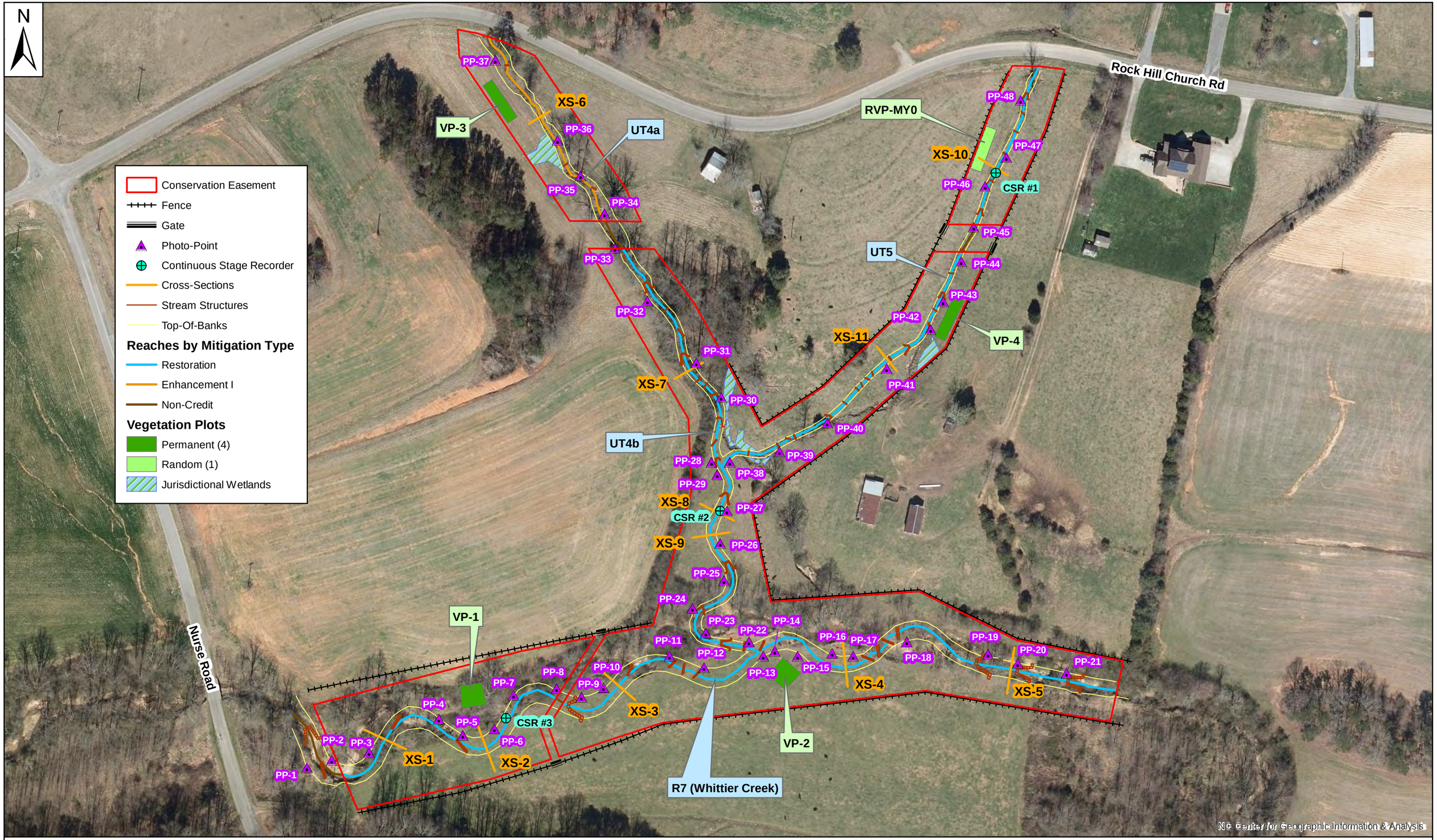
Table 4. Project Attributes for Existing Conditions

Whittier Creek Mitigation Project – NCDMS Project No. 100020

Project Information				
Project Name	Whittier Creek Site – Option D Mitigation Project			
County	Surry			
Project Area (acres)	6.97			
Project Coordinates (lat. and long.)	36.3779 N, -80.5999 W			
Project Watershed Summary Information				
Physiographic Province	Northern Inner Piedmont			
River Basin	Yadkin Pee-Dee			
USGS Hydrologic Unit 8-digit	3040101	USGS Hydrologic Unit 14-digit	03040101-110040	
DWR Sub-basin	03-07-03			
Project Drainage Area (acres)	1,722 acres / 2.69 square miles (at downstream end of R7)			
Stream Temperature Regime	cool			
Project Drainage Area Percentage of Impervious Area	0.95% impervious area			
USGS National Land Cover Database (NLCD) for 2011	8.2% developed (predominantly rural residential), 41.6% cultivated crops and hay, 6.9% grass/pasture, 4.8% shrub/scrub, and 38.3% forested.			
Reach Summary Information				
Parameters	**Reach R7**	**UT4a**	**UT4b**	**UT5**
Existing length of reach (linear feet)	1,462	338	764	765
Valley confinement (Confined, moderately confined, unconfined)	Unconfined	Moderately Confined	Unconfined	Moderately Confined
Drainage area (acres)	1,722	225	305	72
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification	C	C	C	C
Stream Classification (existing / proposed)	G4&F4/C4	E4&B4/B4b	E4&G4c/C4	B4/B4
Evolutionary trend (Simon)	IV – Degradation and Widening	III – Degradation	IV – Degradation and Widening	III – Degrading
FEMA classification	Zone X	Zone X	Zone X	Zone X
Regulatory Considerations				
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**	
Water of the United States - Section 404	Yes	Yes	PCN	
Water of the United States - Section 401	Yes	Yes	PCN	
Endangered Species Act	Yes	Yes	Categorical Exclusion	
Historic Preservation Act	Yes	Yes	Categorical Exclusion	
Coastal Zone Management Act (CAMA)	No	N/A	N/A	
FEMA Floodplain Compliance	No	N/A	N/A	
Essential Fisheries Habitat	No	N/A	N/A	

APPENDIX B

Visual Assessment Data



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0 125 250 500 Feet

NCDEQ: Division of Mitigation Services

Figure 3. Current Conditions Plan View
As-Built MY0
Whittier Creek Mitigation Project (#100020)
Surry County, NC

Whittier Creek: As-Built MY0 Stream Station Photo-Points (taken 6/15/21)

PP-1: Reach 7, looking down valley from top of project

PP-2: Reach 7, downstream, Station 11+00

PP-3: Reach 7, downstream, Station 12+00

PP-4: Reach 7, downstream, Station 13+25

PP-5: Reach 7, downstream, Station 13+75

PP-6: Reach 7, downstream, Station 14+25

Whittier Creek: As-Built MY0 Stream Station Photo-Points (taken 6/15/21)

PP-7: Reach 7, downstream, Station 14+75

PP-8: Reach 7, downstream, Station 15+50

PP-9: Reach 7, downstream, Station 16+00

PP-10: Reach 7, downstream, Station 16+50

PP-11: Reach 7, downstream, Station 17+50

PP-12: Reach 7, downstream, Station 18+00

Whittier Creek: As-Built MY0 Stream Station Photo-Points (taken 6/15/21)

PP-13: Reach 7, upstream, Station 19+00 at confluence with Reach UT4B

PP-14: Reach 7, downstream, Station 19+25

PP-15: Reach 7, downstream, Station 19+75

PP-16: Reach 7, downstream, Station 20+25

PP-17: Reach 7, downstream, Station 20+75

PP-18: Reach 7, downstream, Station 21+50

Whittier Creek: As-Built MY0 Stream Station Photo-Points (taken 6/15/21)

PP-19: Reach 7, upstream, Station 22+75

PP-20: Reach 7, downstream, Station 23+25

PP-21: Reach 7, downstream, Station 24+00

PP-22: Reach UT4B, upstream, Station 21+10

PP-23: Reach UT4B, upstream, Station 20+50

PP-24: Reach UT4B, upstream, Station 20+00

Whittier Creek: As-Built MY0 Stream Station Photo-Points (taken 6/15/21)

PP-25: Reach UT4B, upstream, Station 19+25

PP-26: Reach UT4B, upstream, Station 18+75

PP-27: Reach UT4B, upstream, Station 18+00

PP-28: Reach UT4B, Station 17+50 at confluence with Reach UT5

PP-29: Reach UT4B, upstream, Station 17+25

PP-30: Reach UT4B, upstream, Station 16+50

Whittier Creek: As-Built MY0 Stream Station Photo-Points (taken 6/15/21)

PP-31: Reach UT4B, upstream, Station 15+75

PP-32: Reach UT4B, upstream, Station 15+50

PP-33: Reach UT4B, upstream, Station 13+75

PP-34: Reach UT4A, upstream, Station 13+25

PP-35: Reach UT4A,upstream, Station 12+50

PP-36: Reach UT4A, upstream, Station 11+75

Whittier Creek: As-Built MY0 Stream Station Photo-Points (taken 6/15/21)

PP-37: Reach UT4A, upstream, Station 10+25

PP-38: Reach UT5, upstream, Station 17+75

PP-39: Reach UT5, upstream, Station 17+00

PP-40: Reach UT5, upstream, Station 16+15

PP-41: Reach UT5, upstream, Station 15+00

PP-42: Reach UT5, upstream, Station 14+00

Whittier Creek: As-Built MY0 Stream Station Photo-Points (taken 6/15/21)

PP-43: Reach UT5, upstream, Station 13+60

PP-44: Reach UT5, upstream, Station 13+00 at ford crossing

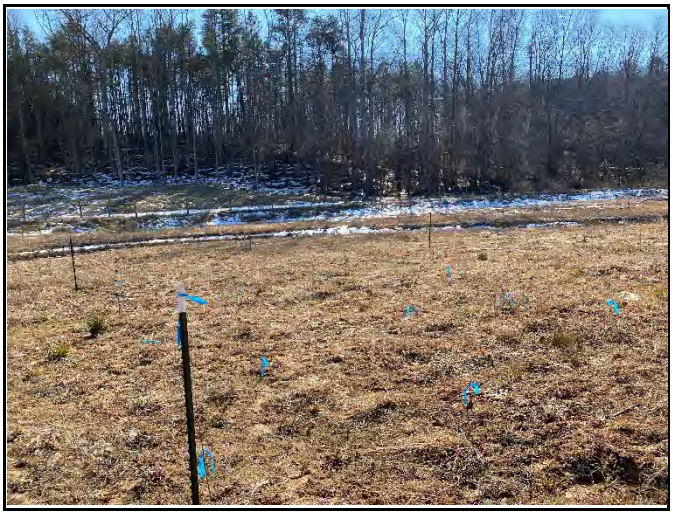
PP-45: Reach UT5, upstream, Station 12+50

PP-46: Reach UT5, upstream, Station 11+75

PP-47: Reach UT5, upstream, Station 11+25

PP-48: Reach UT5, upstream, Station 10+50

Whittier Creek: As-Built MY0 Vegetation Plot Photos (taken 1/31/2022)



Vegetation Plot 1

Vegetation Plot 2

Vegetation Plot 3

Vegetation Plot 4

Random Vegetation Plot – MY0

Whittier Creek: As-Built MY0 Additional Project Photos

Continuous Stage Recorder #1 on UT5 (7/22/21)

Continuous Stage Recorder #2 on UT4b (7/22/21)

Continuous Stage Recorder #3 on R7 (7/22/21)

UT5 Rock Ford Crossing (6/15/21)

UT5 Rock Ford Crossing after fencing/gates installed (7/22/21)

UT5 Rock Ford Crossing after fencing/gates installed, looking upstream with interior wire (7/22/21)

Whittier Creek: As-Built MY0 Additional Project Photos

Fencing with CE marker (1/31/22)

Fencing with CE marker located inside (1/31/22)

Fencing with CE marker (1/31/22)

Fencing with CE marker located inside (by the gate at the break on R7) 1/31/22

Fencing with CE marker located inside (1/31/22)

Standalone CE marker on UT4b right bank (1/31/22)

Whittier Creek: As-Built MY0 Additional Project Photos

Flooding from Hurricane Zeta remnants on Upper R7 (10/29/20)

Flooding from Hurricane Zeta remnants on Upper R7 just below bridge (10/29/20)

Flooding from Zeta remnants above the bridge upstream of R7 (10/29/20)

Flooding from Zeta remnants collapsed the bridge immediately upstream of R7 (10/29/20)

The bridge after the flooding subsided (11/4/20)

Looking upstream of the bridge (11/4/20)

Whittier Creek: As-Built MY0 Additional Project Photos

Upper R7 Before Storm (10/14/20)

Upper R7 After Storm (11/4/20)

Upper R7 Before Storm (10/14/20)

Upper R7 After Storm (11/4/20)

Middle R7 Before Storm (10/14/20)

Middle R7 After Storm (11/4/20)

APPENDIX C

Vegetation Plot Data

Table 5. As-Built Planted Stem Counts by Plot and Species
Whittier Creek Mitigation Project - NCDMS Project No. 100020

Scientific Name	Common Name	Whittier Creek Vegetation Plots (MY0 2022)															Annual Means
		Veg Plot 1			Veg Plot 2			Veg Plot 3			Veg Plot 4			RVP-MY0 [1]			MY0 (2022)
		P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P
Acer negundo	Box Elder				6		6							3		3	9
Betula nigra	River Birch	4		4	6		6				1		1				11
Carpinus caroliniana	Iron Wood	1		1										1		1	2
Celtis laevigata	Sugarberry										1		1				1
Diospyros virginiana	Persimmon	5		5				2		2	1		1				8
Fraxinus pennsylvanica	Green Ash										2		2				2
Hamamelis virginiana	Witch Hazel				4		4				3		3	2		2	9
Juglans nigra	Black Walnut				1		1							1		1	2
Lindera benzoin	Northern Spicebush							1		1	1		1	2		2	4
Liriodendron tulipifera	Tulip Poplar	7		7	8		8	2		2				7		7	24
Nyssa sylvatica	Blackgum										1		1				1
Platanus occidentalis	Sycamore	3		3				2		2	1		1	1		1	7
Quercus lyrata	Overcup Oak	1		1	5		5	4		4	6		6	2		2	18
Quercus michauxii	Swamp Chestnut Oak							3		3							3
Quercus phellos	Willow Oak	4		4	1		1	6		6	9		9	3		3	23
Ulmus americana	American Elm	1		1										1		1	2
	Stems/Plot	26		26	31		31	20		20	26		26	23		23	126
	Plots (ares)	1			1			1			1			1			5
	Plot Size (Acres)	0.025			0.025			0.025			0.025			0.025			0.124
	Species Count	8		8	7		7	7		7	10		10	10		10	16
	Stems/Acre	1,052		1,052	1,255		1,255	809		809	1,052		1,052	931		931	1,020

Color for Stem Density
Exceeds requirements by >10%

P = Planted Stem
V = Volunteer Stem
T = Total Stems

[1] RVP-MY0 is a random vegetation plot that will move locations each monitoring year.

APPENDIX D

Stream Measurement and Geomorphology Data

Table 6. Baseline Stream Data Summary
Whittier Creek Restoration Project: DMS Project No ID. 100020
Reach 7 (Whittier Creek)

Parameter	Pre-Existing Condition			Reference Reach(es) Data			Design			As-built		
				Composite								
Dimension and Substrate - Riffle	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
BF Width (ft)	18.5	20.1	21.7	-----	-----	-----	-----	22.2	----	20.5	22.0	22.9
Floodprone Width (ft)	22	23.0	24	-----	-----	-----	50	100	150	75	130	155
BF Mean Depth (ft)	1.8	1.8	1.8	-----	-----	-----	-----	1.8	----	1.6	1.7	1.8
BF Max Depth (ft)	2.2	2.3	2.3	-----	-----	-----	-----	2.3	----	2.4	2.5	2.6
BF Cross-sectional Area (ft^2)	33.5	36.2	38.8	-----	-----	-----	-----	41.0	----	36.2	37.7	40.0
Width/Depth Ratio	10.2	11.2	12.1	12.0	13.5	15.0	-----	12.3	----	11.6	12.9	14.2
Entrenchment Ratio	1.1	1.2	1.2	-----	-----	-----	2.3	4.6	6.8	3.3	5.4	7.1
Bank Height Ratio	2.8	3.0	3.2	1.0	1.0	1.0	-----	1.0	----	1.0	1.0	1.0
d50 (mm)	6.4	16	26	-----	-----	-----	-----	-----	-----	44	48	50
Pattern												
Channel Beltwidth (ft)	45	55	65	-----	-----	-----	80	100	120	70	97	120
Radius of Curvature (ft)	25	39	53	-----	-----	-----	36	48	60	41	46	59
Rc/Bankfull width (ft/ft)	1.2	1.8	2.3	2.0	2.5	3.0	1.6	2.4	3.1	1.7	2.1	2.7
Meander Wavelength (ft)	61	125	188	-----	-----	-----	160	180	200	165	183	200
Meander Width Ratio	2.1	2.5	2.8	3.5	5.8	8.0	3.6	4.5	5.4	3.2	4.2	6.2
Profile												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	21	37	55
Riffle Slope (ft/ft)	0.0030	0.0075	0.0120	-----	-----	-----	0.0057	0.0073	0.0089	0.0028	0.0072	0.0116
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	37	65	91
Pool to Pool Spacing (ft)	36	104	172	-----	-----	-----	78	117	155	45	91	144
Pool Max Depth (ft)	3.3	4.15	5	-----	-----	-----	-----	4.0	-----	3.3	4.2	5.3
Substrate and Transport Parameters												
SC% / Sa% / G% / C% / Bo%	0% / 9% / 86% / 5% / 0%			-----	-----	-----	-----	-----	-----	0% / 2% / 63% / 33% / 2%		
d16 / d35 / d50 / d84 / d95	11 / 19 / 26 / 51 / 64			----	-----	-----	-----	-----	-----	21 / 34 / 48 / 103 / 151		
Additional Reach Parameters												
Drainage Area (SM)	-----	2.69	-----	-----	-----	-----	-----	2.69	---	-----	2.69	-----
Impervious cover estimate (%)	-----	0.95%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	G4/F4	-----	-----	C4	-----	-----	C4	-----	-----	C4	-----
BF Velocity (fps)	4.9	5.3	5.7	3.5	4.3	5.0	-----	4.6	-----	-----	-----	-----
BF Discharge (cfs)	-----	190	-----	-----	-----	-----	-----	190	-----	-----	190	-----
Valley Length	-----	1,153	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Length (ft)	-----	1,488	-----	-----	-----	-----	-----	1,484	-----	-----	1,495	-----
Sinuosity	-----	1.29	-----	-----	-----	-----	-----	1.21	-----	-----	1.22	-----
Water Surface Slope (Channel) (ft/ft)	-----	0.0051	-----	-----	-----	-----	-----	0.0056	-----	-----	0.0053	-----

Table 6. Baseline Stream Data Summary
Whittier Creek Restoration Project: DMS Project No ID. 100020
Reach UT4a

Parameter	Pre-Existing Condition			Reference Reach(es) Data			Design			As-built		
				Composite								
Dimension and Substrate - Riffle	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
BF Width (ft)	-----	7.3	-----	-----	-----	-----	-----	11.0	----	-----	10.6	-----
Floodprone Width (ft)	-----	20	-----	-----	-----	-----	-----	30	----	-----	18	-----
BF Mean Depth (ft)	-----	1.4	-----	-----	-----	-----	-----	0.9	----	-----	0.9	-----
BF Max Depth (ft)	-----	1.6	-----	-----	-----	-----	-----	1.2	----	-----	1.5	-----
BF Cross-sectional Area (ft^2)	-----	9.9	-----	-----	-----	-----	-----	10.0	----	-----	9.9	-----
Width/Depth Ratio	-----	5.4	-----	10.0	12.5	15.0	-----	12.2	----	-----	12.0	-----
Entrenchment Ratio	-----	2.7	-----	-----	-----	-----	-----	2.7	----	-----	1.7	-----
Bank Height Ratio	-----	1.3	-----	-----	1.0	-----	-----	1.0	----	-----	1.0	-----
d50 (mm)	----	27	----	-----	-----	-----	-----	-----	-----	-----	42	-----
Pattern												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc/Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	----	6	13	18
Riffle Slope (ft/ft)	0.026	0.035	0.043	-----	-----	-----	0.026	0.035	0.043	-----	0.031	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	----	17	33	48
Pool to Pool Spacing (ft)	35	58	80	35	53	70	38	58	77	30	33	35
Pool Max Depth (ft)	1.1	1.9	2.7	----	-----	----	-----	2.0	----	---	1.6	---
Substrate and Transport Parameters												
SC% / Sa% / G% / C% / B%	0% / 1% / 77% / 22% / 0%			-----	-----	-----	-----	-----	-----	0% / 1% / 69% / 29% / 1%		
d16 / d35 / d50 / d84 / d95	12 / 18 / 27 / 80 / 128						-----	-----	-----	16 / 32 / 42 / 97 / 141		
Additional Reach Parameters												
Drainage Area (SM)	-----	0.35	-----	-----	-----	-----	-----	0.35	-----	-----	0.35	-----
Impervious cover estimate (%)	-----	1.28%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	E4/B4	-----	-----	C4/B4	-----	-----	B4	-----	-----	B4	-----
BF Velocity (fps)	-----	5.0	-----	4.0	5.0	6.0	-----	5.0	-----	-----	-----	-----
BF Discharge (cfs)	-----	50	-----	-----	-----	-----	-----	50	-----	-----	50	-----
Valley Length	-----	316	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Length (ft)	-----	338	-----	-----	-----	-----	-----	328	-----	-----	334	-----
Sinuosity	-----	1.1	-----	1.1	1.2	1.2	-----	1.1	-----	-----	1.1	-----
Water Surface Slope (Channel) (ft/ft)	-----	0.024	-----	-----	-----	-----	-----	0.024	-----	-----	0.021	-----

* The As-Built parameters shown here apply only to those surveyed sections of Reach UT4a where the channel was improved in its cross-section, profile, and in-stream structures.

Table 6. Baseline Stream Data Summary
Whittier Creek Restoration Project: DMS Project No ID. 100020
Reach UT4b

Parameter	Pre-Existing Condition			Reference Reach(es) Data			Design			As-built		
				Composite								
Dimension and Substrate - Riffle	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
BF Width (ft)	9.5	9.8	10.1	-----	-----	-----	-----	12.7	----	-----	13.7	-----
Floodprone Width (ft)	13	18.0	23	-----	-----	-----	30	45	60	-----	49	-----
BF Mean Depth (ft)	1.0	1.2	1.4	-----	-----	-----	-----	1.0	----	-----	1.1	-----
BF Max Depth (ft)	1.2	1.7	2.2	-----	-----	-----	-----	1.2	----	-----	1.6	-----
BF Cross-sectional Area (ft^2)	9.5	11.8	14.0	-----	-----	-----	-----	13.0	----	-----	14.9	-----
Width/Depth Ratio	7.3	8.5	9.6	12.0	13.5	15.0	-----	12.7	----	-----	12.6	-----
Entrenchment Ratio	1.3	1.8	2.3	-----	-----	-----	2.4	3.6	4.7	-----	3.6	-----
Bank Height Ratio	2.0	2.1	2.1	-----	1.0	-----	-----	1.0	----	-----	1.0	-----
d50 (mm)	----	26	----	-----	-----	-----	-----	-----	-----	-----	46	-----
Pattern												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	45	48	50	36	46	53
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	25	51	77	26	33	54
Rc/Bankfull width (ft/ft)	-----	-----	-----	2.0	2.5	3.0	2.0	4.1	6.1	2.0	3.1	4.1
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	119	142	165	120	126	145
Meander Width Ratio	-----	-----	-----	3.5	5.8	8.0	3.5	3.7	3.9	2.8	3.6	4.1
Profile												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	----	19	24	36
Riffle Slope (ft/ft)	0.015	0.028	0.040	-----	-----	-----	0.011	0.018	0.025	0.007	0.016	0.022
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	----	13	39	62
Pool to Pool Spacing (ft)	30	60	90	-----	-----	-----	45	67	89	28	60	94
Pool Max Depth (ft)	2.4	3.4	4.3	----	-----	----	-----	2.5	----	2.4	2.8	3.7
Substrate and Transport Parameters												
SC% / Sa% / G% / C% / B%	0% / 9% / 83% / 8% / 0%			-----	-----	-----	-----	-----	-----	0% / 3% / 66% / 27% / 4%		
d16 / d35 / d50 / d84 / d95	8.4 / 16 / 26 / 52 / 76						-----	-----	-----	22 / 36 / 46 / 101 / 179		
Additional Reach Parameters												
Drainage Area (SM)	-----	0.48	-----	-----	-----	-----	-----	0.48	-----	-----	0.48	-----
Impervious cover estimate (%)	-----	1.30%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	E4/G4	-----	-----	C4	-----	-----	C4	-----	-----	C4	-----
BF Velocity (fps)	4.7	5.8	6.9	3.5	4.3	5.0	-----	5.0	-----	-----	-----	-----
BF Discharge (cfs)	-----	65	-----	-----	-----	-----	-----	65	-----	-----	65	-----
Valley Length	-----	675	-----	-----	-----	-----	-----	622	-----	-----	622	-----
Channel Length (ft)	-----	764	-----	-----	-----	-----	-----	801	-----	-----	803	-----
Sinuosity	-----	1.13	-----	-----	-----	-----	-----	1.29	-----	-----	1.29	-----
Water Surface Slope (Channel) (ft/ft)	-----	0.0165	-----	-----	-----	-----	-----	0.0141	-----	-----	0.0136	-----

Table 6. Baseline Stream Data Summary

Whittier Creek Restoration Project: DMS Project No ID. 100020

Reach UT5

Parameter	Pre-Existing Condition			Reference Reach(es) Data Composite			Design			As-built		
Dimension and Substrate - Riffle	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
BF Width (ft)	7.8	7.9	8.0	-----	-----	-----	-----	8.1	----	-----	9.1	-----
Floodprone Width (ft)	15	17.0	19	-----	-----	-----	14	17	20	-----	31	-----
BF Mean Depth (ft)	0.7	0.7	0.7	-----	-----	-----	-----	0.6	----	-----	0.6	-----
BF Max Depth (ft)	2.3	2.6	2.8	1.2	1.4	1.5	-----	1.2	----	-----	0.9	-----
BF Cross-sectional Area (ft²)	5.1	5.3	5.5	-----	-----	-----	-----	5.0	----	-----	5.9	-----
Width/Depth Ratio	11.1	11.3	11.4	12	15	18	-----	13.0	----	-----	14.3	-----
Entrenchment Ratio	2.0	2.2	2.4	-----	-----	-----	1.7	2.1	2.5	-----	3.3	-----
Bank Height Ratio	1.4	1.8	2.2	-----	1.0	-----	-----	1.0	----	-----	1.0	-----
d50 (mm)	----	21	----	-----	-----	-----	-----	-----	-----	-----	44	-----
Pattern												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	15	16	20
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc/Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	90	124	150
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	----	7	24	57
Riffle Slope (ft/ft)	0.026	0.034	0.041	-----	-----	-----	0.013	0.025	0.037	0.011	0.020	0.039
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	----	7	13	33
Pool to Pool Spacing (ft)	22	81	139	-----	-----	-----	15	28	40	24	33	44
Pool Max Depth (ft)	1.6	2.0	2.3	----	-----	----	-----	1.5	----	0.8	1.7	2.7
Substrate and Transport Parameters												
SC% / Sa% / G% / C% / B%	3% / 11% / 72% / 14% / 0%			-----	-----	-----	-----	-----	-----	0% / 0% / 65% / 34% / 1%		
d16 / d35 / d50 / d84 / d95	5.6 / 12 / 21 / 57 / 104						-----	-----	-----	23 / 33 / 44 / 109 / 169		
Additional Reach Parameters												
Drainage Area (SM)	-----	0.11	-----	-----	-----	-----	-----	0.11	-----	-----	0.11	-----
Impervious cover estimate (%)	-----	1.47%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	B4	-----	-----	B4	-----	-----	B4	-----	-----	B4	-----
BF Velocity (fps)	3.6	3.8	3.9	4.0	5.0	6.0	-----	4.0	-----	-----	-----	-----
BF Discharge (cfs)	-----	20	-----	-----	-----	-----	-----	20	-----	-----	20	-----
Valley Length	-----	740	-----	-----	-----	-----	-----	740	-----	-----	740	-----
Channel Length (ft)	-----	765	-----	-----	-----	-----	-----	787	-----	-----	792	-----
Sinuosity	-----	1.03	-----	1.10	1.15	1.20	-----	1.06	-----	-----	1.07	-----
Water Surface Slope (Channel) (ft/ft)	-----	0.0250	-----	0.020	0.025	0.030	-----	0.024	-----	-----	0.024	-----

Table 7. Cross-Section Morphology Data Summary

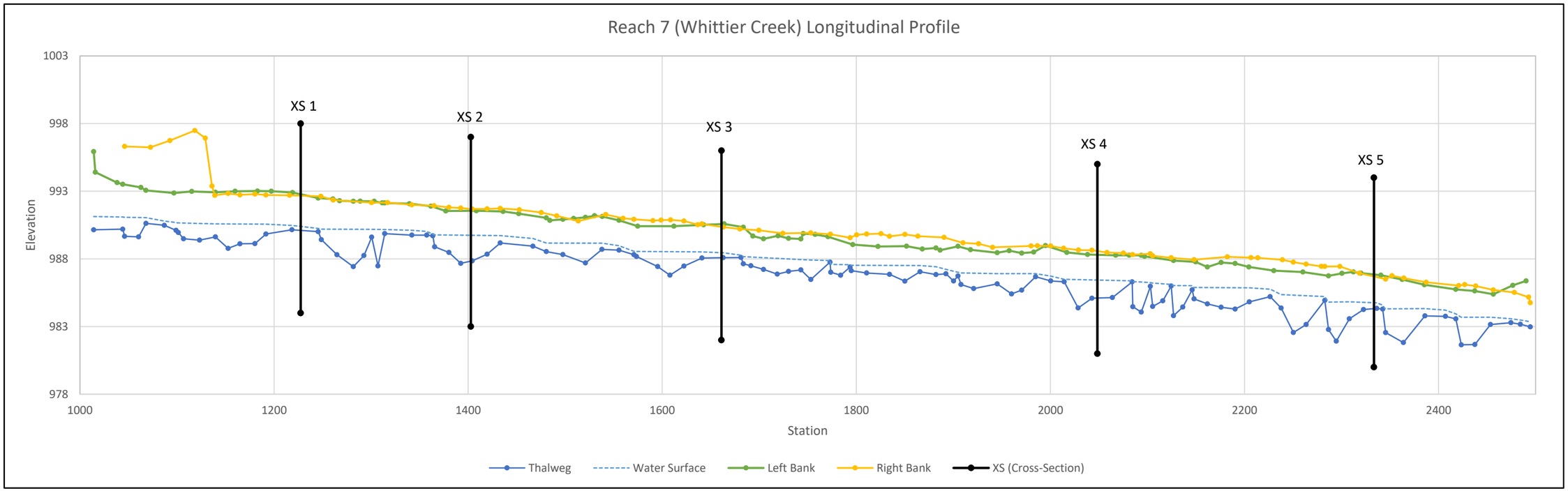
Whittier Creek Restoration Project: DMS Project No ID. 100020

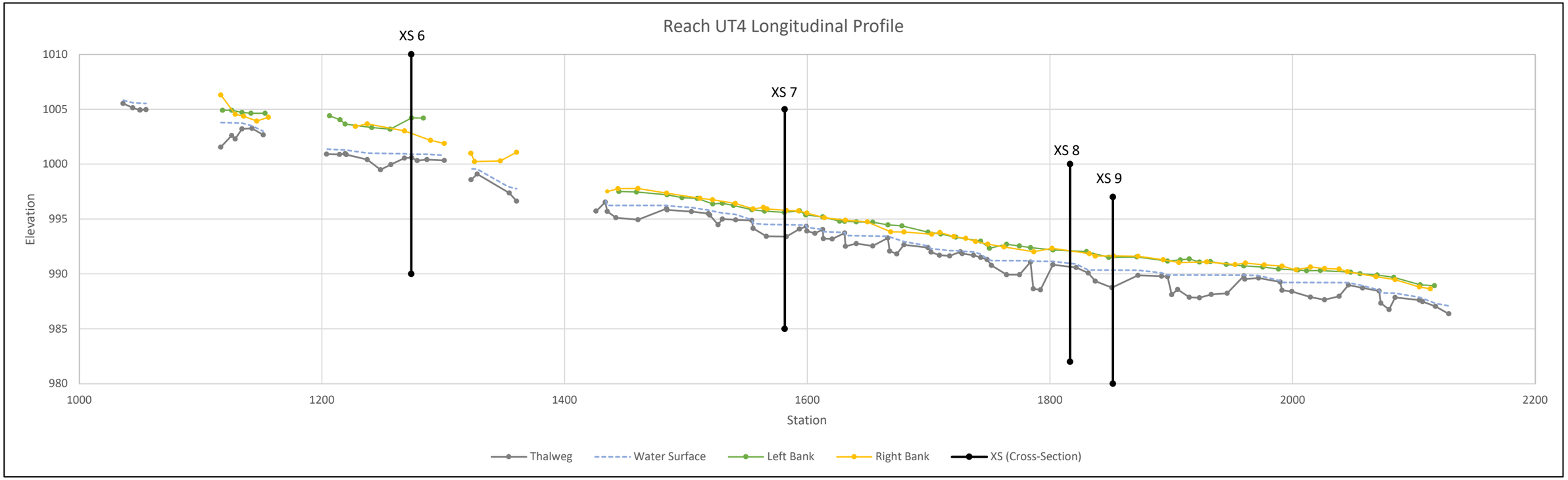
Stream Reach	**Reach 7 (Whittier Creek)**																									
	Cross-section X-1 (Riffle)							**Cross-section X-2 (Pool)**							**Cross-section X-3 (Riffle)**							**Cross-section X-4 (Pool)**						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	20.5							26.4							22.9							23.7						
BF Mean Depth (ft)	1.8							1.9							1.6							1.8						
Width/Depth Ratio	11.6							14.0							14.2							13.0						
BF Cross-sectional Area (ft²)	36.2							49.5							36.9							43.0						
BF Max Depth (ft)	2.5							3.8							2.4							3.1						
Width of Floodprone Area (ft)	145							155							135							140						
Entrenchment Ratio	7.1							-							5.9							-						
Bank Height Ratio	1.0							-							1.0							-						
Wetted Perimeter (ft)	21.5							28.0							23.8							25.3						
Hydraulic Radius (ft)	1.7							1.8							1.6							1.7						
d50 (mm)	49							-							44							-						

Stream Reach	**Reach 7 (Whittier Creek)**							**Reach UT4a**							**Reach UT4b**													
	Cross-section X-5 (Riffle)							**Cross-section X-6 (Riffle)**							**Cross-section X-7 (Pool)**							**Cross-section X-8 (Riffle)**						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	22.6							10.6							14.6							13.7						
BF Mean Depth (ft)	1.8							0.9							1.5							1.1						
Width/Depth Ratio	12.8							12.0							9.9							12.6						
BF Cross-sectional Area (ft²)	40.0							9.9							21.5							14.9						
BF Max Depth (ft)	2.6							1.5							2.4							1.6						
Width of Floodprone Area (ft)	75							18							48							49						
Entrenchment Ratio	3.3							1.7							-							3.6						
Bank Height Ratio	1.0							1.0							-							1.0						
Wetted Perimeter (ft)	23.6							11.2							16.0							14.3						
Hydraulic Radius (ft)	1.7							0.9							1.4							1.0						
d50 (mm)	50							42							-							46						

Stream Reach	**Reach UT4b**							**Reach UT5**																				
	Cross-section X-9 (Pool)							**Cross-section X-10 (Riffle)**							**Cross-section X-11 (Pool)**													
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+							
Based on fixed baseline bankfull elevation																												
BF Width (ft)	13.5							9.1							7.9													
BF Mean Depth (ft)	1.6							0.6							1.3													
Width/Depth Ratio	8.4							14.3							6.0													
BF Cross-sectional Area (ft²)	21.7							5.9							10.4													
BF Max Depth (ft)	2.7							0.9							1.9													
Width of Floodprone Area (ft)	54							30							46													
Entrenchment Ratio	-							3.3							-													
Bank Height Ratio	-							1.0							-													
Wetted Perimeter (ft)	15.3							9.5							9.3													
Hydraulic Radius (ft)	1.4							0.6							1.1													
d50 (mm)	-							44							-													

Figure 4. Longitudinal Profiles




Reach UT4 Longitudinal Profile
XS 6
XS 7
XS 8
XS 9
Elevation
1010
1005
1000
995
990
985
980
1000
1200
1400
1600
1800
2000
2200
Station
Thalweg
Water Surface
Left Bank
Right Bank
XS (Cross-Section)

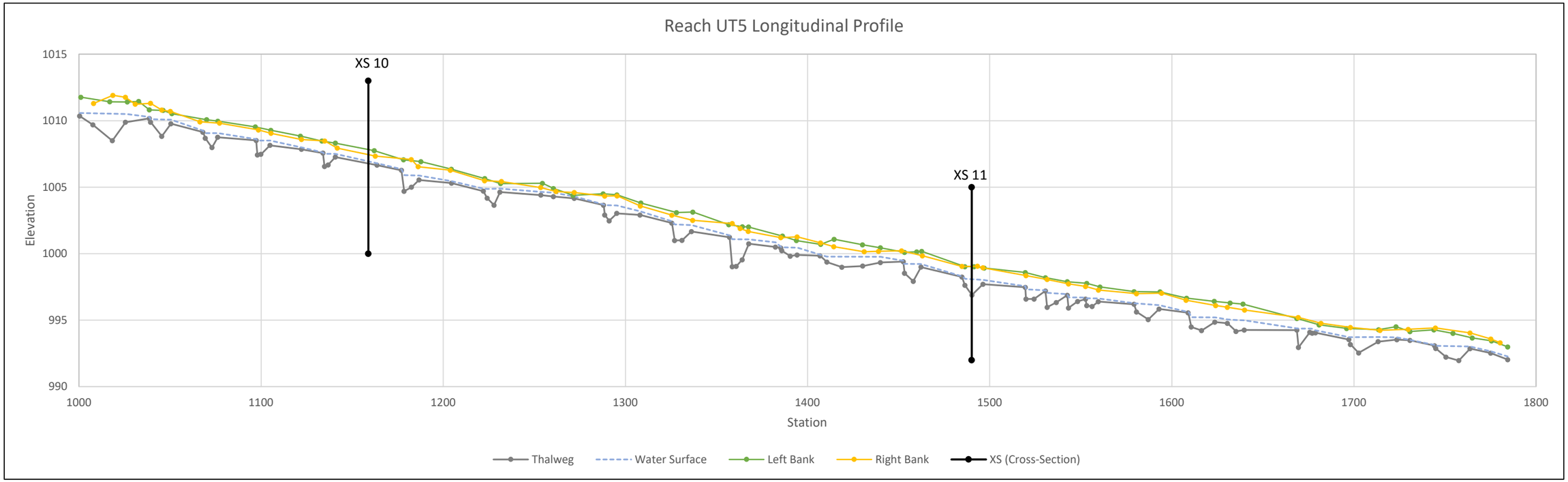

Reach UT5 Longitudinal Profile
XS 10
XS 11
Elevation
1015
1010
1005
1000
995
990
1000
1100
1200
1300
1400
1500
1600
1700
1800
Station
Thalweg
Water Surface
Left Bank
Right Bank
XS (Cross-Section)

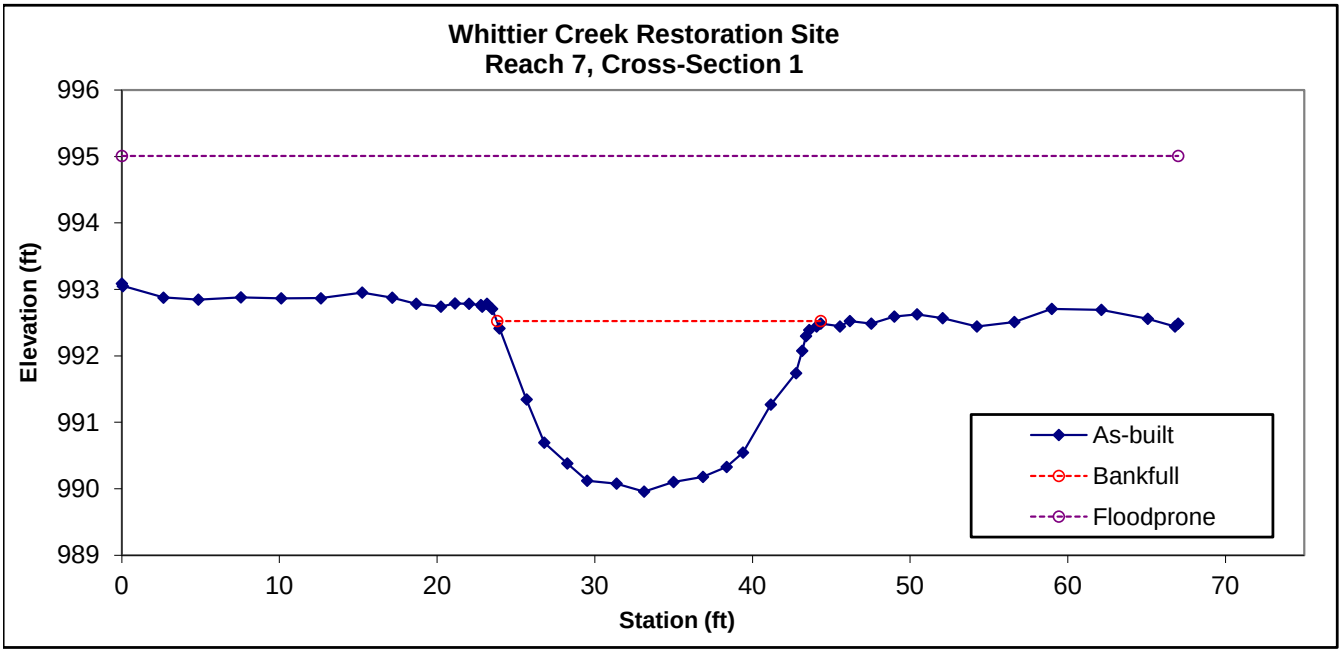
Figure 5. MY0 Cross-Sections

Permanent Cross-Section 1
(As-built Survey Data Collected: August 2021)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	36.2	20.5	1.8	2.5	11.6	1.0	7.1	992.48	992.48



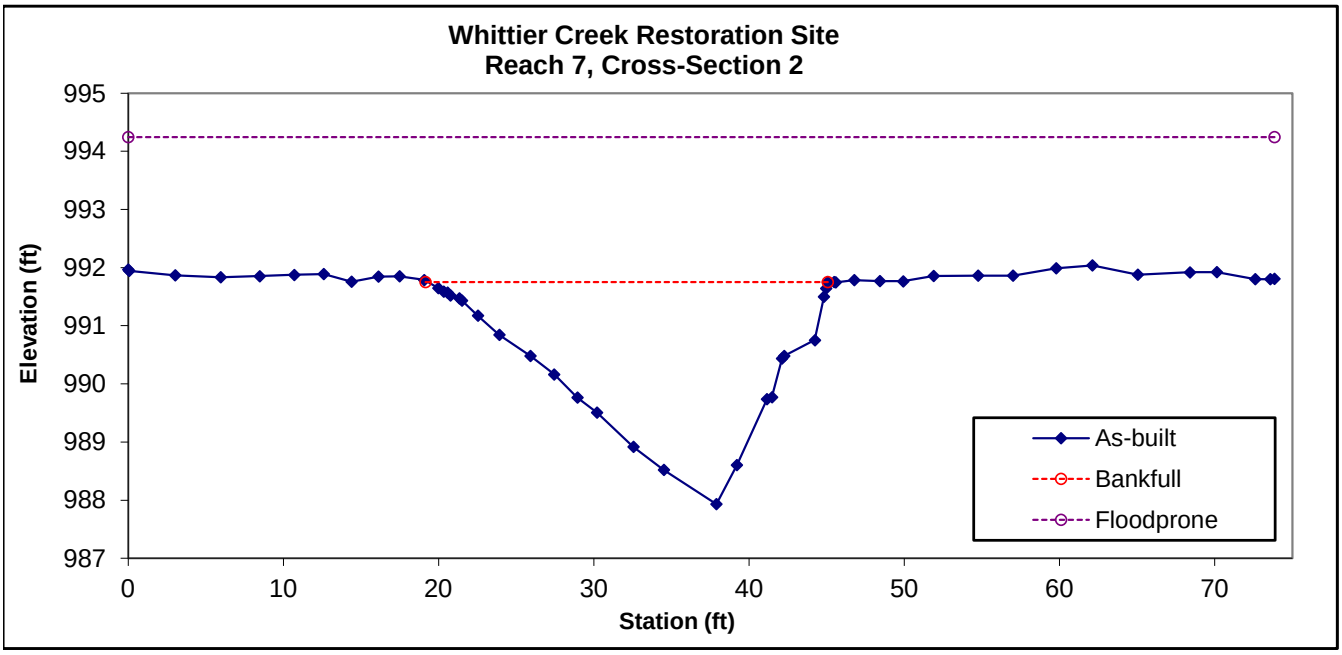
Permanent Cross-Section 2

(As-built Survey Data Collected: August 2021)

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	-	49.5	26.4	1.9	3.8	14.0	-	-	991.75	991.75



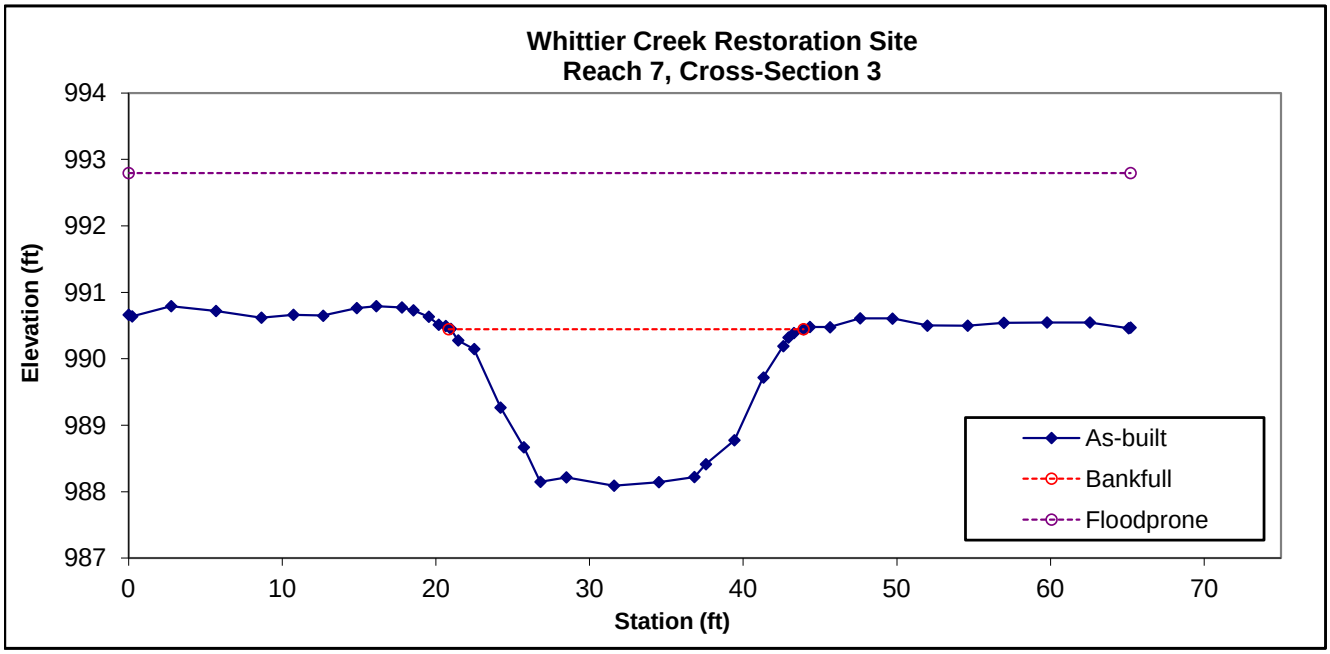
Permanent Cross-Section 3

(As-built Survey Data Collected: August 2021)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	36.9	22.9	1.6	2.4	14.2	1.0	5.9	990.44	990.44



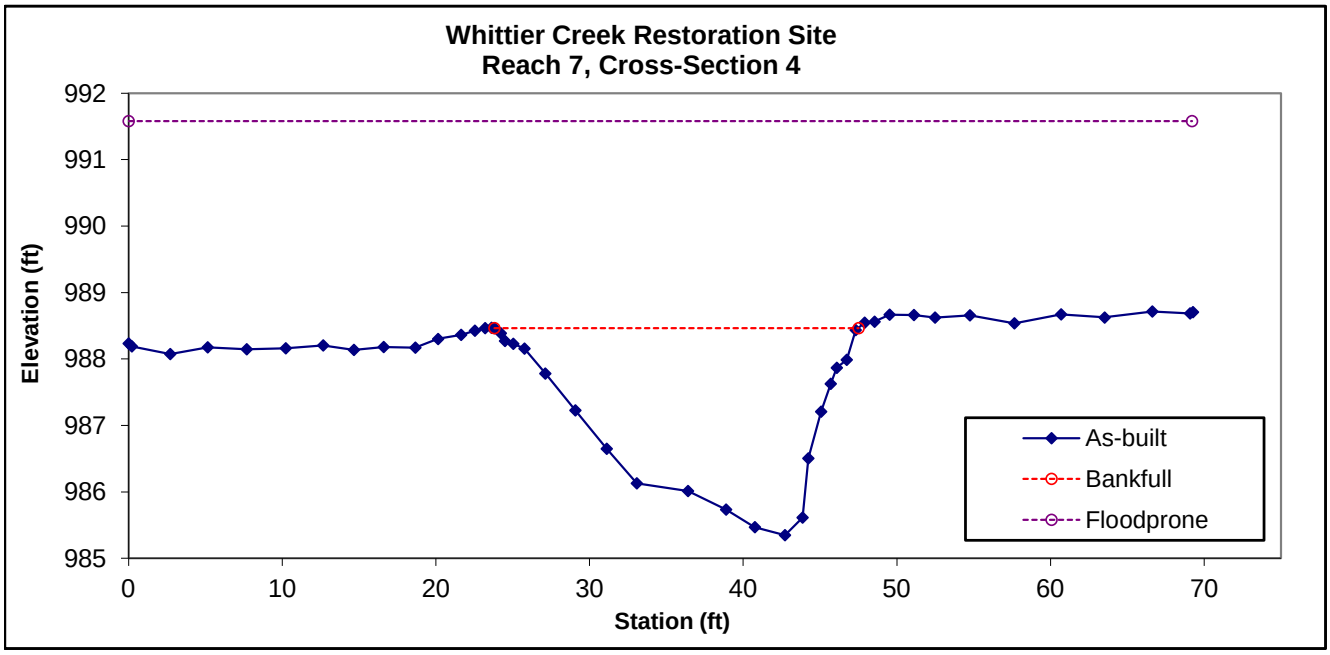
Permanent Cross-Section 4

(As-built Survey Data Collected: August 2021)

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	-	43	23.7	1.8	3.1	13.0	-	-	988.47	988.47



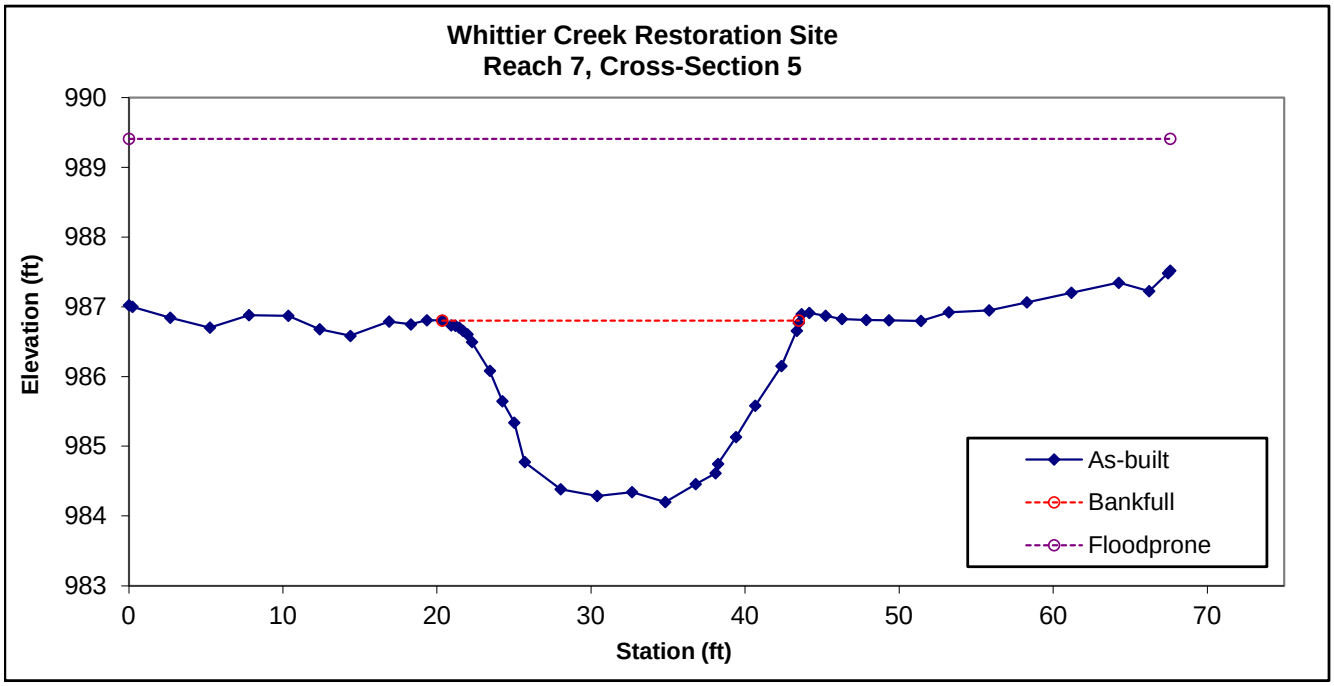
Permanent Cross-Section 5

(As-built Survey Data Collected: August 2021)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	40	22.6	1.8	2.6	12.8	1.0	3.3	986.8	986.8



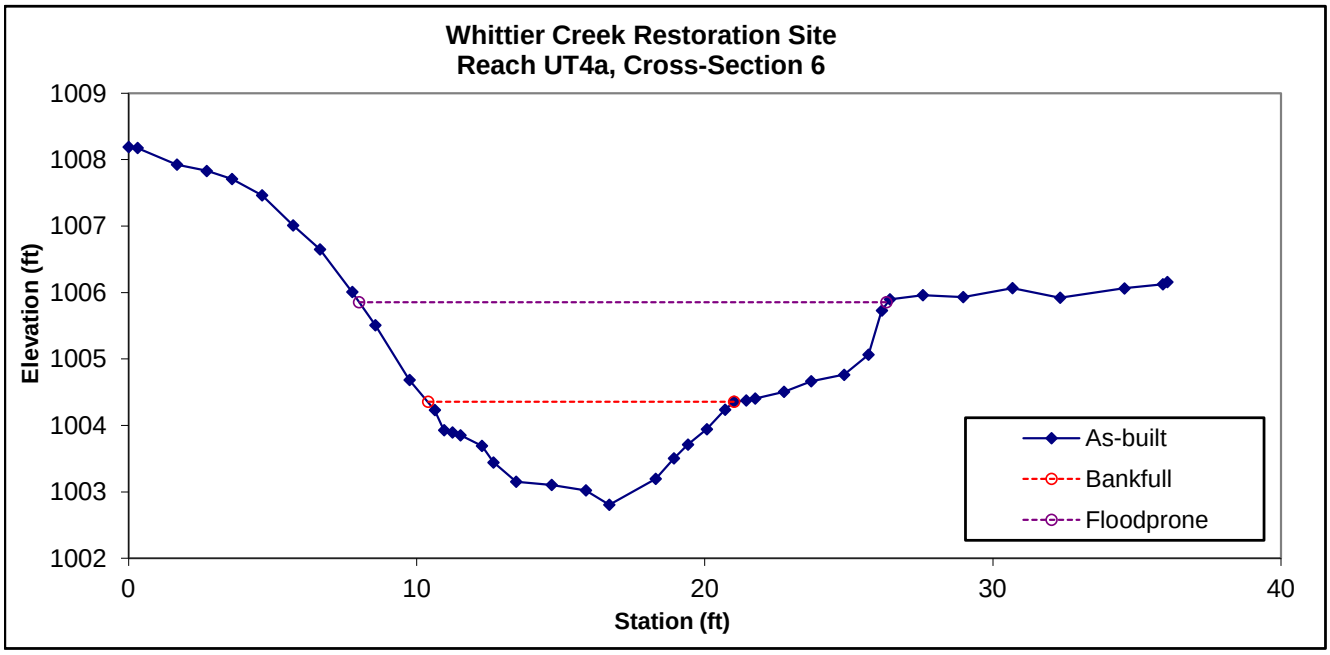
Permanent Cross-Section 6

(As-built Survey Data Collected: August 2021)

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	B	9.9	10.6	0.9	1.5	12	1.0	1.7	1004.36	1004.36



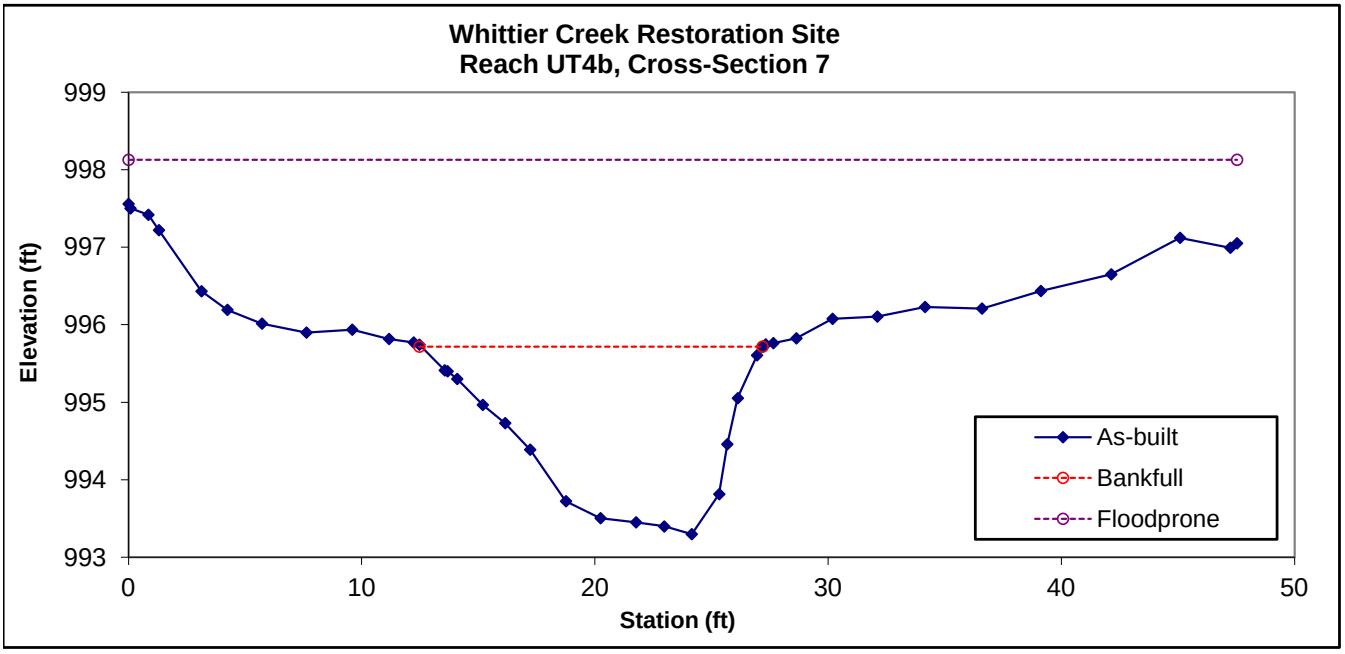
Permanent Cross-Section 7

(As-built Survey Data Collected: August 2021)

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	-	21.5	14.6	1.5	2.4	9.9	-	-	995.72	995.72



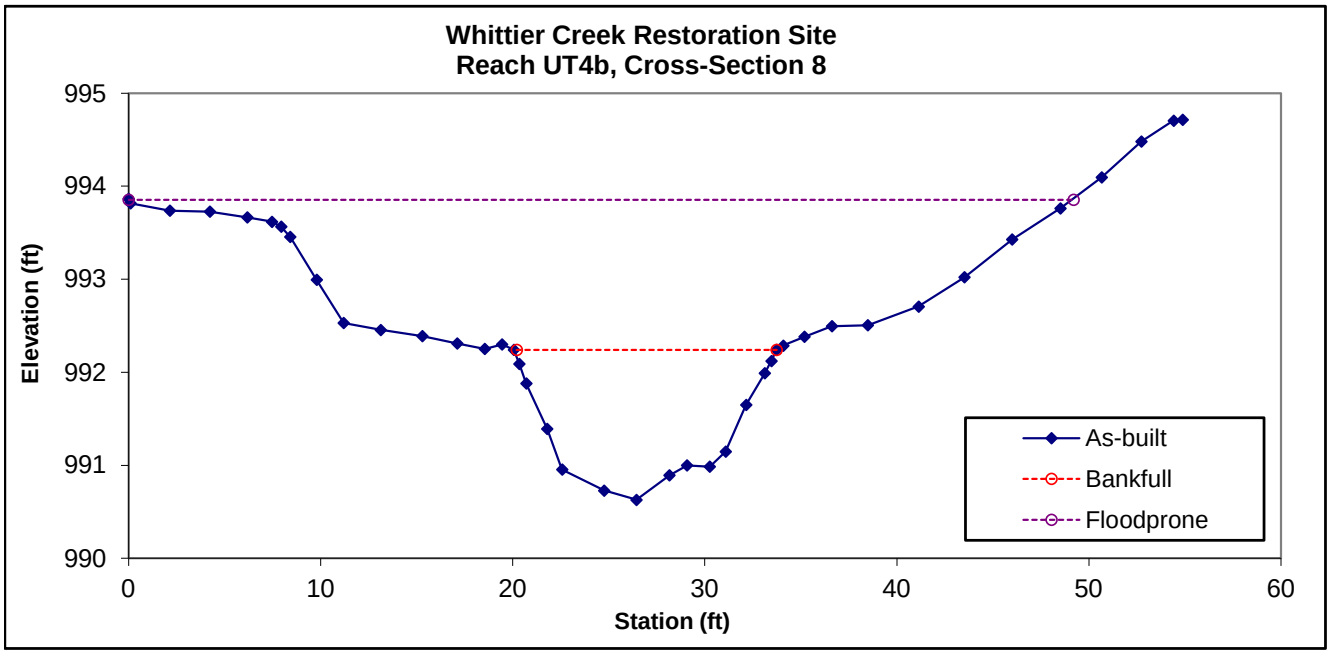
Permanent Cross-Section 8

(As-built Survey Data Collected: August 2021)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	14.9	13.7	1.1	1.6	12.6	1.0	3.6	992.24	992.24



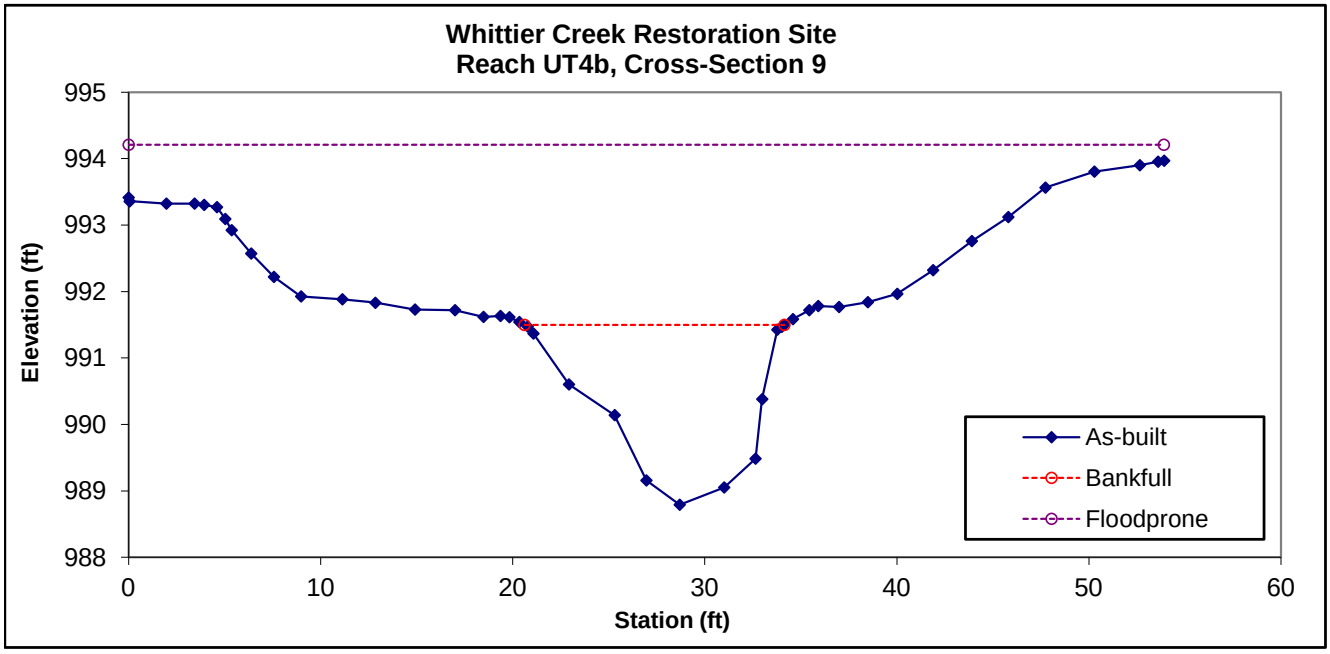
Permanent Cross-Section 9

(As-built Survey Data Collected:August 2021)

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	-	21.7	13.5	1.6	2.7	8.4	-	-	991.50	991.50



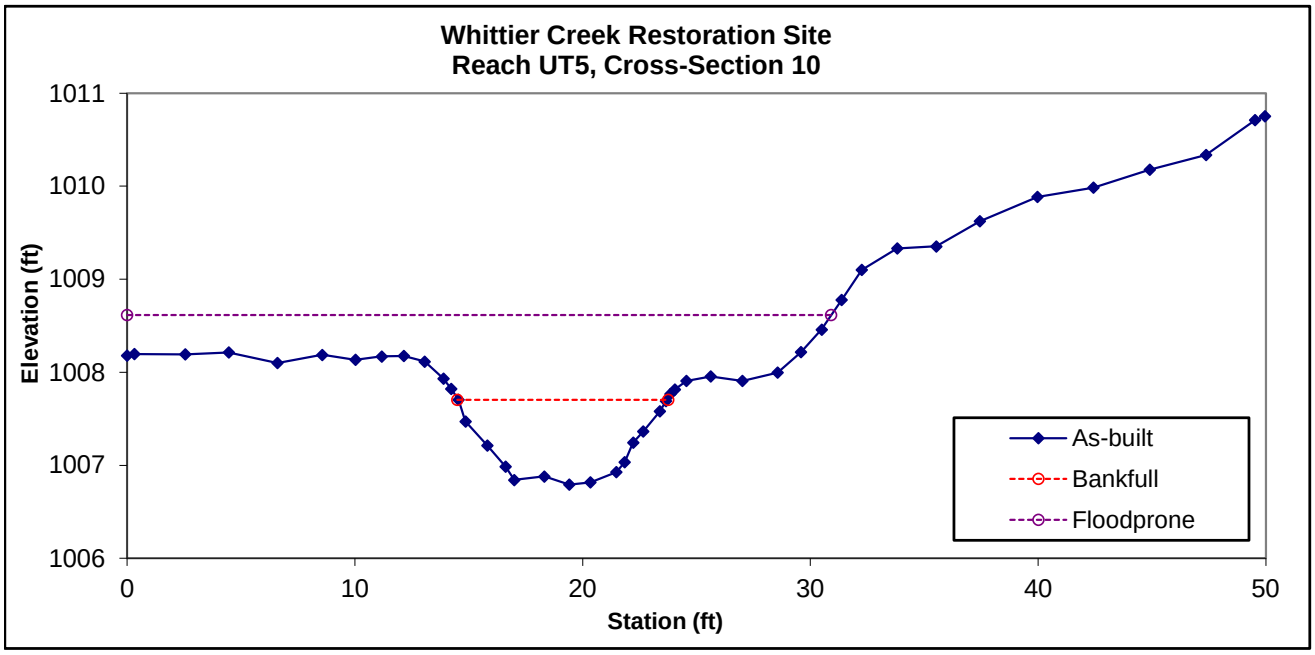
Permanent Cross-Section 10

(As-built Survey Data Collected: August 2021)

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	B	5.9	9.1	0.6	0.9	14.3	1.0	3.3	1007.70	1007.70



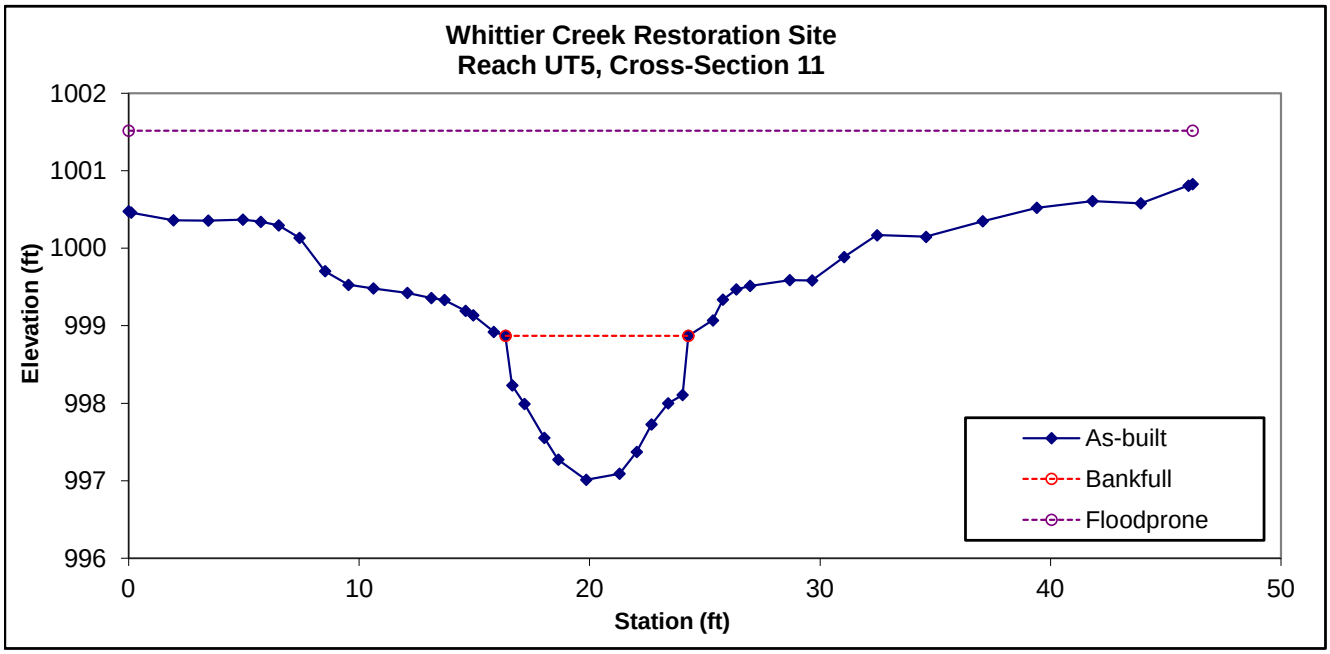
Permanent Cross-Section 11

(As-built Survey Data Collected: August 2021)

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	-	10.4	7.9	1.3	1.9	6.0	-	-	998.87	998.87



APPENDIX E

As-Built Plan Sheets

STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	162039	1	19

NORTH CAROLINA
DIVISION OF MITIGATION SERVICES

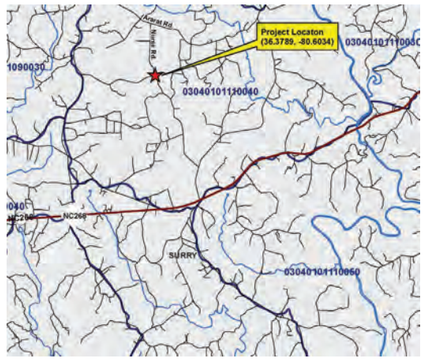
SURRY COUNTY

LOCATION: ROCK HILL CHURCH ROAD & NURSE ROAD

TYPE OF WORK: AS – BUILT PLAN

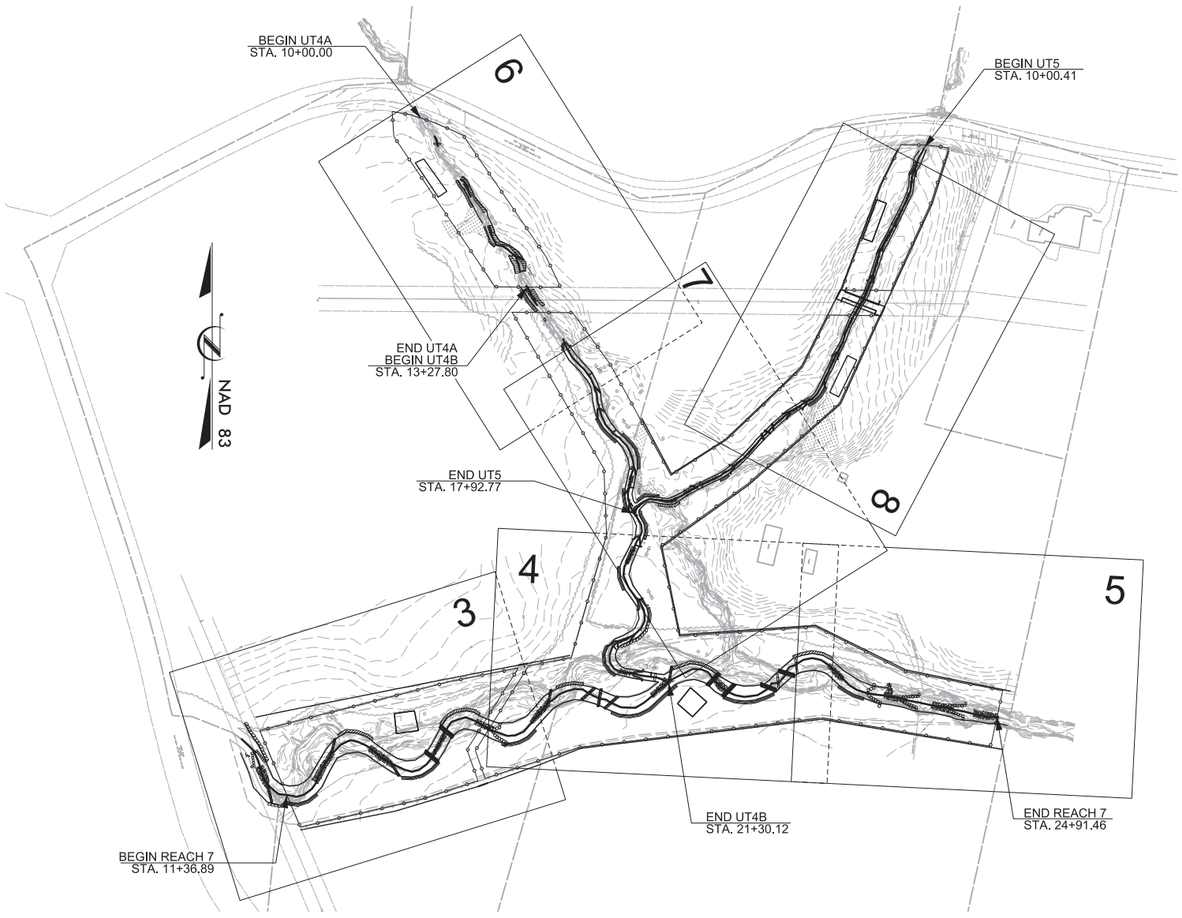
PROJECT: 162039

WHITTIER CREEK



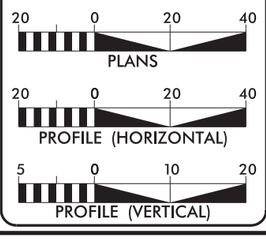
VICINITY MAP

INDEX OF SHEETS



NCDMS ID NO. 100020

GRAPHIC SCALES



REACH SUMMARY

REACH	AS–BUILT LENGTHS
UT4A	327.80 LF
UT4B	753.57 LF
UT5	747.21 LF
R7	1,342.56 LF

PREPARED FOR THE OFFICE OF:

NCDEQ
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NC 27699–1652

CONTACT: MATTHEW REID
PROJECT MANAGER

Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
8000 Regency Parkway, Suite 600
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

SPRING 2020
LETTING DATE:

KATHLEEN M. MCKEITHAN, PE
PROJECT ENGINEER

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M. MCKEITHAN

2/22/2022

DocuSigned by:
Kathleen M. McKeithan
247E8AEF4181473...
P.E.
SIGNATURE:

2/26/03

STREAM CONVENTIONAL SYMBOLS

SUPERCEDES SHEET 1-B

- J-HOOK VANE
- ROCK VANE
- OUTLET PROTECTION
- ROCK CROSS VANE
- DOUBLE DROP ROCK CROSS VANE
- SINGLE WING DEFLECTOR
- DOUBLE WING DEFLECTOR
- TEMPORARY SILT CHECK
- ROOT WAD
- GRADE CONTROL LOG J-HOOK VANE
- LOG VANE
- LOG WEIR
- LOG CROSS VANE
- LOG ROLLER
- GRADE CONTROL LOG JAM
- CONSTRUCTED RIFFLE
- BOULDER CLUSTER
- BOULDER STEP
- S — SAFETY FENCE
- TF — TAPE FENCE
- FP — 100 YEAR FLOOD PLAIN
- CE — CONSERVATION EASEMENT
- PHOTO POINT
- MONITORING WELL
- FLOW GAUGE
- IN-STREAM GAUGE
- 435 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- LIMITS OF DISTURBANCE
- PROPERTY LINE
- FOOT BRIDGE
- TEMPORARY STREAM CROSSING
- ROCK FORD STREAM CROSSING
- TRANSPLANTED VEGETATION
- TREE REMOVAL
- TREE PROTECTION
- CHANNEL PLUG
- CHANNEL FILL
- BRUSH TOE WITH LIVE STAKES
- GEOLIFT WITH BRUSH TOE
- PROPOSED WETLAND RESTORATION
- PROPOSED WETLAND ENHANCEMENT
- WLB — JURISDICTIONAL WETLAND BOUNDARY

**NOTE: ALL ITEMS ABOVE MAY NOT BE USED ON THIS PROJECT

STANDARD SPECIFICATIONS

NORTH CAROLINA
EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL
MARCH 2009 (REV 2013)

6.06 TEMPORARY GRAVEL CONSTRUCTION ENTRANCE
6.24 RIPARIAN AREA SEEDING
6.62 TEMPORARY SILT FENCE
6.63 TEMPORARY ROCK DAM

PROJECT REFERENCE NO.	SHEET NO.
162039	1-A

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M. MCKEITHAN

DocuSigned by: Kathleen M. McKeithan 247E84DF4161473...

APPROVED BY:

2/22/2022

DATE:

Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
8000 Regency Parkway, Suite 600
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

NCDMS ID NO. 100020

GENERAL NOTES

1. THE CONTRACTOR IS REQUIRED TO INSTALL IN-STREAM STRUCTURES USING A TRACK HOE WITH A HYDRAULIC THUMB OF SUFFICIENT SIZE TO PLACE BOULDERS, LOGS AND ROOTWADS.
2. WORK IS BEING PERFORMED AS AN ENVIRONMENTAL RESTORATION PLAN. THE CONTRACTOR SHOULD MAKE ALL REASONABLE EFFORTS TO REDUCE SEDIMENT LOSS AND MINIMIZE DISTURBANCE OF THE SITE WHILE PERFORMING THE CONSTRUCTION WORK.
3. CONSTRUCTION IS SCHEDULED FOR THE SUMMER OF 2020.
4. CONTRACTOR SHOULD CALL NORTH CAROLINA "ONE-CALL" BEFORE EXCAVATION STARTS. (1-800-632-4949)
5. ALL ON-SITE ALLUVIUM SHALL BE HARVESTED AND STOCKPILED PRIOR TO FILLING ABANDONED CHANNELS.
6. TOPSOIL SHALL BE EXCAVATED TO A DEPTH OF 8" AND STOCKPILED SEPARATELY FROM UNDERCUT SOIL. 8" OF TOPSOIL SHALL BE PLACED ON ALL BANKFULL BENCHES AND AS DIRECTED BY THE ENGINEER.
7. ALL DISTURBED EMBANKMENTS SHALL BE MATTED WITH COIR FIBER MATTING OR AS DIRECTED BY THE ENGINEER.
8. ALL STREAM BANKS SHALL BE LIVE STAKED.
9. UNLESS THE ALIGNMENT IS BEING ALTERED, THE EXISTING CHANNEL DIMENSIONS ARE TO REMAIN UNLESS OTHERWISE NOTED.
10. CONTRACTOR WILL ENSURE THAT FENCING IS INSTALLED OUTSIDE THE CONSERVATION EASEMENT AS SHOWN ON THE PLANS BUT NO MORE THAN 1' OUTSIDE.
11. WHERE PROPOSED FENCE CROSSES EXISTING STREAMS, THE CONTRACTOR SHALL UTILIZE A SECTION OF BREAK AWAY FENCE, A FLOOD GATE, OR ELECTRIFIED CHAINS AS DIRECTED BY THE ENGINEER.

PLANTING PLAN VEGETATION SELECTION

Scientific Name	Common Name	% Planted by Species	Wetland Tolerance
All Buffer Plantings at 680 stems/acre using 8' X 8' spacing Riparian Zone – Overstory Species			
Betula nigra	River Birch	10%	FACW
Juglans nigra	Black Walnut	5%	FACU
Platanus occidentalis	Sycamore	14%	FACW
Liriodendron tulipifera	Tulip Poplar	14%	FACU
Fraxinus pennsylvanica	Green Ash	5%	FACW
Quercus lyrata	Overcup Oak	10%	OBL
Quercus phellos	Willow Oak	10%	FAC
Ulmus americana	American Elm	5%	FACW
Diospyros virginiana	Persimmon	5%	FAC
Nyssa sylvatica	Blackgum	1%	FAC
Quercus michauxii	Swamp Chestnut Oak	1%	FACW
Celtis laevigata	Sugarberry	1%	FACW

Riparian Zone – Overstory Species			
Betula nigra	River Birch	10%	FACW
Juglans nigra	Black Walnut	5%	FACU
Platanus occidentalis	Sycamore	15%	FACW
Liriodendron tulipifera	Tulip Poplar	15%	FACU
Fraxinus pennsylvanica	Green Ash	5%	FACW
Quercus lyrata	Overcup Oak	10%	OBL
Quercus phellos	Willow Oak	10%	FAC
Ulmus americana	American Elm	5%	FACW
Diospyros virginiana	Persimmon	5%	FAC
.			
Hamamelis virginiana	Witch Hazel	5%	FACU
Lindera benzoin	Spicebush	5%	FAC
Carpinus caroliniana	American Hornbeam	5%	FAC
Acer negundo	Box Elder	5%	FAC
Amelanchier arborea	Serviceberry	1%	FAC

Permanent seed mixtures for the project site shall be planted throughout the floodplain and riparian buffer areas except the vernal pools. Permanent seed mixtures shall be applied with temporary seed, as defined in the construction specifications.

Scientific Name	Common Name	Percent of Mixture	Seeding Density (lbs/acre)	Wetness Tolerance
Agrostis alba	Redtop	10%	1.5	FACW
Elymus virginicus	Virginia Wildrye	15%	2.25	FACW
Panicum virgatum	Switchgrass	15%	2.25	FAC
Tripsacum dactyloides	Eastern Gamma Grass	5%	0.75	FACW
Polygonum pennsylvanicum	Pennsylvania Smartweed	5%	0.75	FACW
Schizachyrium scoparium	Little Blue Stem	5%	0.75	FACU
Juncus effusus	Soft Rush	5%	0.75	FACW
Bidens frondosa (or aristosa)	Beggars Tick	5%	0.75	FACW
Coreopsis lanceolata	Lance-Leaved Tick Seed	10%	1.5	FACU
Dichanthelium clandestinum	Tioga Deer Tongue	15%	2.25	FAC
Andropogon gerardii	Big Blue Stem	5%	0.75	FAC
Sorghastrum nutans	Indian Grass	5%	0.75	FACU

TEMPORARY SEEDING SELECTION AND APPLICATION RATES

Common Name	Scientific Name	Application Time	Application Rate	Total (lbs/acre)
Cereal rye	*Secale cereale*	Sept - March	3 lb/1,000 sq ft.	130 lbs/acre
Browntop millet	*Panicum ramosum*	April - Aug	1 lb/1,000 sq ft.	44 lbs/acre

2/8/2022
R:\162039_Whittier_Creek\Design\As-Built\Plans\162039_ASB-PSH-01A.dgn
mcneely

PROJECT REFERENCE NO.	SHEET NO.
162039	1-B

NCDMS ID NO. 100020

SEAL 028432 NORTH CAROLINA PROFESSIONAL ENGINEER KATHLEEN M. MCKEITHAN

Kathleen M. McKeithan
APPROVED BY:
2/22/2022
DATE:

2/26/03

*S.U.E = SUBSURFACE UTILITY ENGINEER

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

CONVENTIONAL SYMBOLS

BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin — EIP
- Property Corner
- Property Monument — ECM
- Parcel/Sequence Number — 123
- Existing Fence Line
- Proposed Woven Wire Fence
- Proposed Chain Link Fence
- Proposed Barbed Wire Fence
- Existing Wetland Boundary — WLB
- Proposed Wetland Boundary — WLB
- Existing Endangered Animal Boundary — EAB
- Existing Endangered Plant Boundary — EPB

BUILDINGS AND OTHER CULTURE:

- Gas Pump Vent or U/G Tank Cap
- Sign — S
- Well — W
- Small Mine
- Foundation
- Area Outline
- Cemetery
- Building
- School
- Church
- Dam

HYDROLOGY:

- Stream or Body of Water
- Hydro, Pool or Reservoir
- Jurisdictional Stream — JS
- Buffer Zone 1 — BZ 1
- Buffer Zone 2 — BZ 2
- Flow Arrow
- Disappearing Stream
- Spring
- Wetland
- Proposed Lateral, Tail, Head Ditch — FLOW
- False Sump

RAILROADS:

- Standard Gauge — CSX TRANSPORTATION
- RR Signal Milepost — MILEPOST 35
- Switch — SWITCH
- RR Abandoned
- RR Dismantled

RIGHT OF WAY:

- Baseline Control Point
- Existing Right of Way Marker
- Existing Right of Way Line
- Proposed Right of Way Line — R/W
- Proposed Right of Way Line with Iron Pin and Cap Marker — R/W
- Proposed Right of Way Line with Concrete or Granite Marker — R/W
- Existing Control of Access — C/A
- Proposed Control of Access — C/A
- Existing Easement Line — E
- Proposed Temporary Construction Easement — E
- Proposed Temporary Drainage Easement — TDE
- Proposed Permanent Drainage Easement — PDE
- Proposed Permanent Utility Easement — PUE
- Proposed Temporary Utility Easement — TUE
- Proposed Permanent Easement with Iron Pin and Cap Marker

ROADS AND RELATED FEATURES:

- Existing Edge of Pavement
- Existing Curb
- Proposed Slope Stakes Cut — C
- Proposed Slope Stakes Fill — F
- Proposed Wheel Chair Ramp — WCR
- Existing Metal Guardrail
- Proposed Guardrail
- Existing Cable Guiderail
- Proposed Cable Guiderail
- Equality Symbol
- Pavement Removal

VEGETATION:

- Single Tree
- Single Shrub
- Hedge
- Woods Line
- Orchard
- Vineyard — Vineyard

EXISTING STRUCTURES:

MAJOR:

- Bridge, Tunnel or Box Culvert — CONC
- Bridge Wing Wall, Head Wall and End Wall — CONC WW

MINOR:

- Head and End Wall — CONC HW
- Pipe Culvert
- Footbridge
- Drainage Box: Catch Basin, DI or JB — CB
- Paved Ditch Gutter
- Storm Sewer Manhole — S
- Storm Sewer — S

UTILITIES:

POWER:

- Existing Power Pole
- Proposed Power Pole
- Existing Joint Use Pole
- Proposed Joint Use Pole
- Power Manhole — P
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole — HH
- H-Frame Pole
- Recorded U/G Power Line — P
- Designated U/G Power Line (S.U.E.*) — P

TELEPHONE:

- Existing Telephone Pole
- Proposed Telephone Pole
- Telephone Manhole — T
- Telephone Booth
- Telephone Pedestal — T
- Telephone Cell Tower
- U/G Telephone Cable Hand Hole — HH
- Recorded U/G Telephone Cable — T
- Designated U/G Telephone Cable (S.U.E.*) — T
- Recorded U/G Telephone Conduit — TC
- Designated U/G Telephone Conduit (S.U.E.*) — TC
- Recorded U/G Fiber Optics Cable — T FO
- Designated U/G Fiber Optics Cable (S.U.E.*) — T FO

WATER:

- Water Manhole — W
- Water Meter
- Water Valve
- Water Hydrant
- Recorded U/G Water Line
- Designated U/G Water Line (S.U.E.*)
- Above Ground Water Line — A/G Water

TV:

- TV Satellite Dish
- TV Pedestal — C
- TV Tower
- U/G TV Cable Hand Hole — HH
- Recorded U/G TV Cable — TV
- Designated U/G TV Cable (S.U.E.*) — TV
- Recorded U/G Fiber Optic Cable — TV FO
- Designated U/G Fiber Optic Cable (S.U.E.*) — TV FO

GAS:

- Gas Valve
- Gas Meter
- Recorded U/G Gas Line — G
- Designated U/G Gas Line (S.U.E.*) — G
- Above Ground Gas Line — A/G Gas

SANITARY SEWER:

- Sanitary Sewer Manhole
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line — SS
- Above Ground Sanitary Sewer — A/G Sanitary Sewer
- Recorded SS Forced Main Line — FSS
- Designated SS Forced Main Line (S.U.E.*) — FSS

MISCELLANEOUS:

- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box — S
- Utility Unknown U/G Line — ?UTL
- U/G Tank; Water, Gas, Oil
- A/G Tank; Water, Gas, Oil
- U/G Test Hole (S.U.E.*)
- Abandoned According to Utility Records — AATUR
- End of Information — E.O.I.

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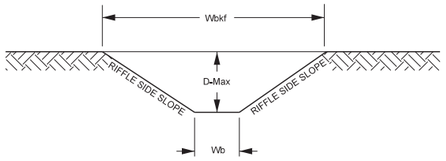
11/1/2021

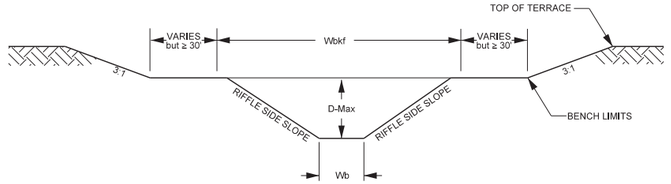
revised 02/02/00

2/26/03

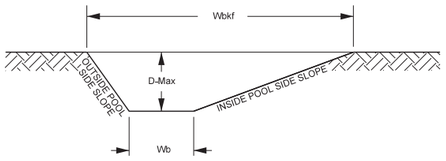
TYPICAL RIFFLE, POOL, AND BANKFULL BENCH CROSS SECTIONS



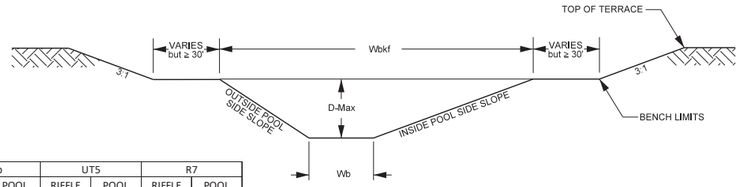
RIFFLE



RIFFLE WITH BANKFULL BENCH



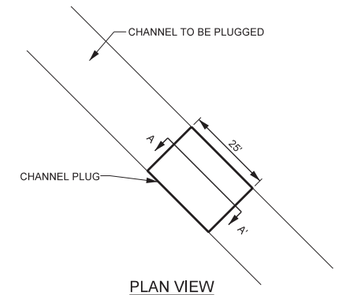
POOL



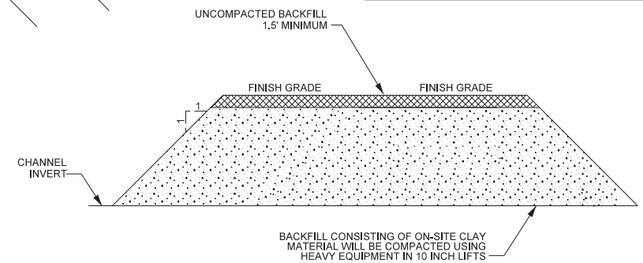
POOL WITH BANKFULL BENCH

	UT4a		UT4b		UT5		R7	
	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL
WIDTH OF BANKFULL (Wbkf)	11.0	15.0	12.7	18.0	8.1	10.5	22.2	30.0
MAXIMUM DETPH (Dmax)	1.2	2.0	1.2	2.5	1.2	1.5	2.3	4.0
W/D (Wbkf/Dbkf)	12.2	N/A	12.7	N/A	13.0	N/A	12.3	N/A
BANKFULL AREA (Abkf)	10.0	18.0	13.0	26.3	5.0	9.0	41.0	75.0
BOTTOM WIDTH (Wb)	6.3	3.0	7.9	3.0	5.0	1.5	12.8	6.0
RIFFLE SIDE SLOPE (X:1)	2.0	N/A	2.0	N/A	2.0	N/A	2.0	N/A
INSIDE POOL SIDE SLOPE	N/A	3.0	N/A	3.0	N/A	3.0	N/A	4.0
OUTSIDE POOL SIDE SLOPE	N/A	3.0	N/A	3.0	N/A	3.0	N/A	2.0

CHANNEL PLUG



PLAN VIEW



NOTE:
1. BACKFILL CONSISTING OF ON-SITE CLAY MATERIAL WILL BE COMPACTED USING HEAVY EQUIPMENT IN 10 INCH LIFTS.
2. THE REMAINDER OF THE EXISTING CHANNEL TO BE PLUGGED WILL BE COMPLETED FILLED TO THE NEW TOP-OF-BANK ELEVATION.

PROJECT REFERENCE NO.	SHEET NO.
162039	2

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKEITHAN

DocuSigned by: Kathleen M. McKeithan 247E84DF4161473...

APPROVED BY:

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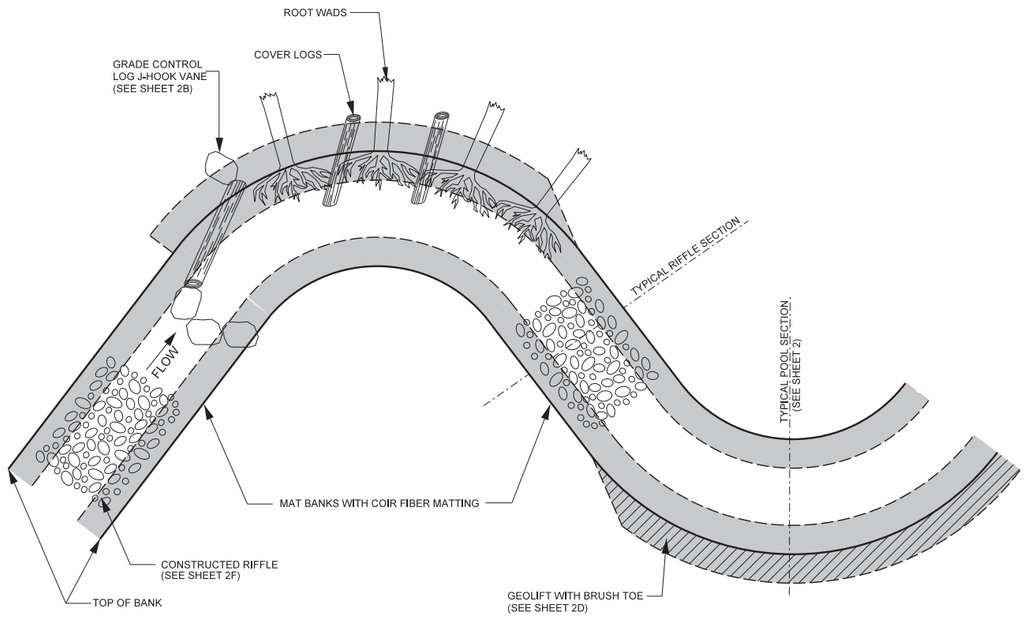
NCDMS ID NO. 100020

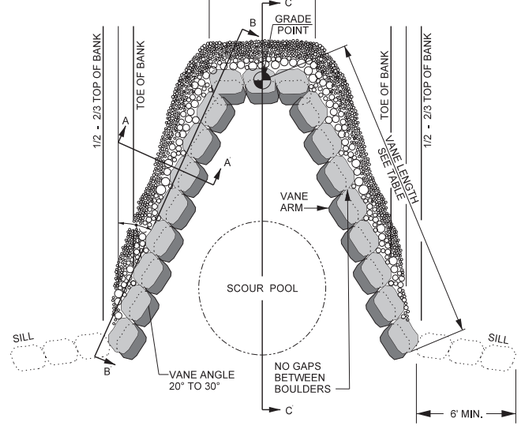
TYPICAL STRUCTURE PLACEMENT



STRUCTURE NOTES:

1. GENERALLY CONSTRUCTED RIFFLES, ROOT WADS, LOG VANES AND COIR FIBER MATTING WILL BE INSTALLED IN THE LOCATION AND SEQUENCE AS SHOWN.
2. ANY CHANGES TO NUMBER OR LOCATION OF STRUCTURES DURING CONSTRUCTION MUST BE APPROVED BY THE DESIGN ENGINEER.
3. COIR FIBER MATTING TO BE INSTALLED ON ALL RESTORED STREAMBANKS, FLOODPLAIN BENCHING, AND TERRACE SLOPES AS DESCRIBED IN THE TECHNICAL SPECIFICATIONS.
4. ROOTWADS MAY BE REPLACED WITH GEOLIFT.

ROCK CROSS VANE

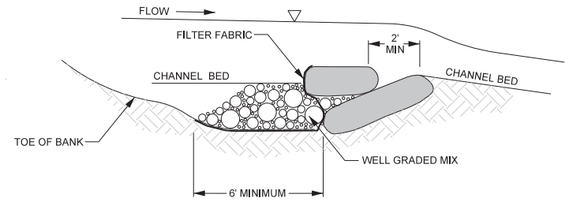


PLAN VIEW

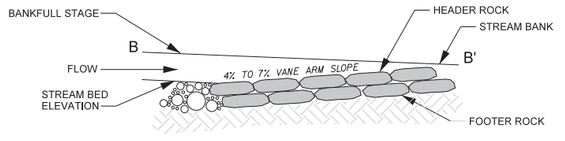
REACH	VANE LENGTH	BOULDER SIZE
UT4A	9'	1'x2'x3'
UT4B	10'	1'x2'x3'
UT5	7'	1'x2'x3'
REACH 7	18'	2'x3'x4'

NOTES FOR ALL VANE STRUCTURES:

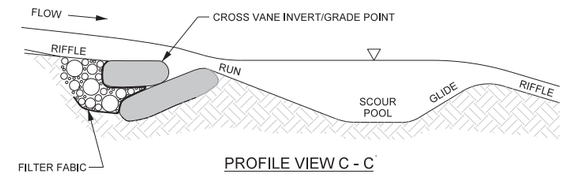
1. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF SIX FEET.
2. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBANK.
3. CONSTRUCT ANGLE AND SLOPE SPECIFICATIONS AS SHOWN.
4. BACKFILL VANE ARMS AND INVERT WITH A WELL GRADED MIX OF CLASS B, A, AND #57 STONE.
5. ON-SITE ALLUVIUM SHALL BE INCORPORATED INTO THE STONE BACKFILL WHERE AVAILABLE.
6. BOULDER SILL MUST BE A MINIMUM OF 6' AND WILL INCLUDE FOOTER ROCKS.



SECTION A - A'



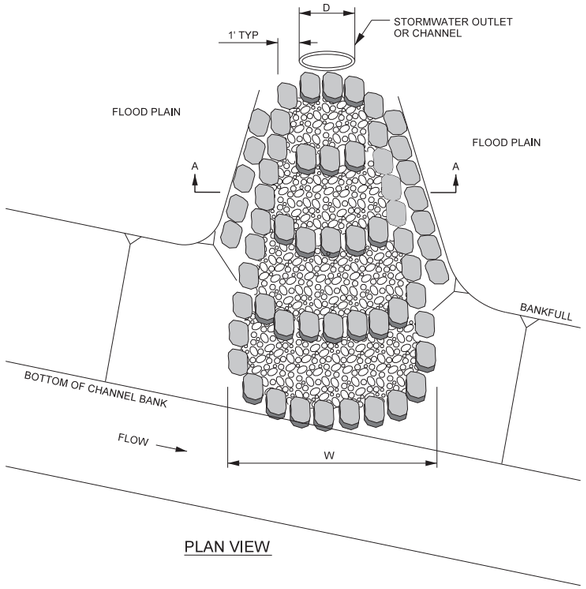
PROFILE VIEW B - B'
VANE ARM



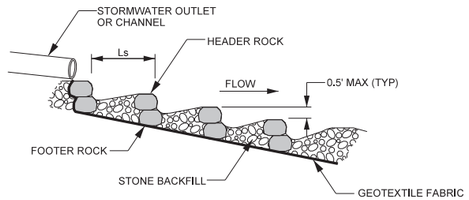
PROFILE VIEW C - C'

2/26/03

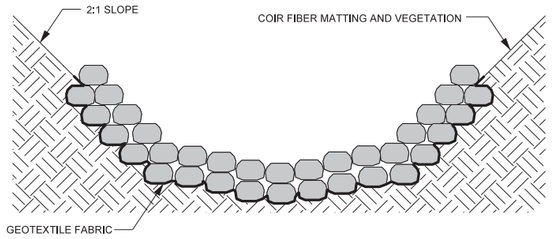
OUTLET PROTECTION



PLAN VIEW

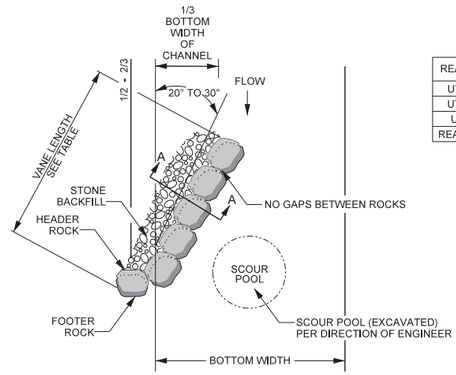


PROFILE VIEW



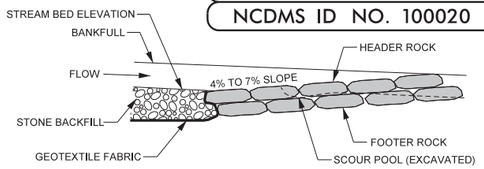
CROSS SECTION A - A

ROCK VANE



REACH	VANE LENGTH	BOULDER SIZE
UT4A	9'	1'x2'x3'
UT4B	10'	1'x2'x3'
UT5	7'	1'x2'x3'
REACH 7	18'	2'x3'x4'

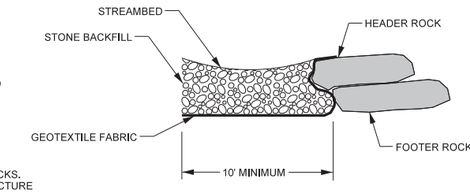
PLAN VIEW



PROFILE VIEW

NOTES FOR ALL VANE STRUCTURES:

1. INSTALL GEOTEXTILE FABRIC BEGINNING AT THE TOP OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF TEN FEET.
2. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBANK.
3. START AT BANK AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
4. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
5. AN EXTRA ROCK CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
6. USE HAND PLACED STONE TO FILL GAPS ON UPSTREAM SIDE OF HEADER AND FOOTER ROCKS.
7. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH WELL GRADED MIX OF CLASS B, CLASS A, & #57 STONE TO THE ELEVATION OF THE TOP OF THE HEADER ROCK. INCORPORATE ON-SITE ALLUVIUM WHERE AVAILABLE.
8. START SLOPE AT 2/3 TO 3/4 TIMES THE BANKFULL STAGE.



SECTION A - A

PROJECT REFERENCE NO.	SHEET NO.
162039	2A

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKEITHAN

DocuSigned by: Kathleen M. McKeithan 247E84DF4161473...

APPROVED BY:

2/22/2022

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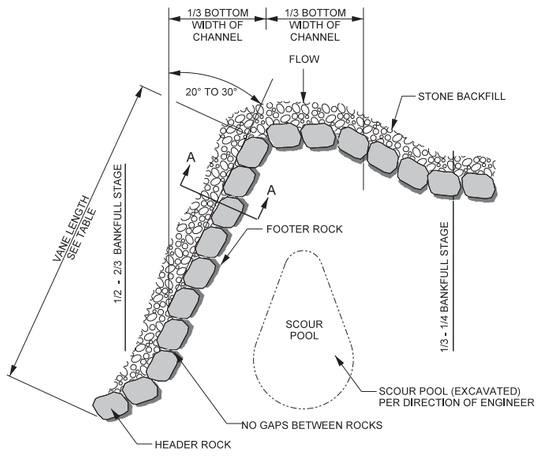
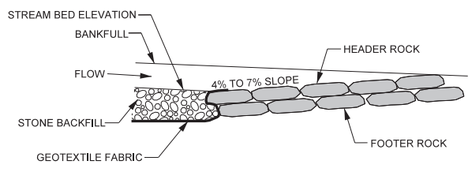
License #: F-1054

NCDMS ID NO. 100020

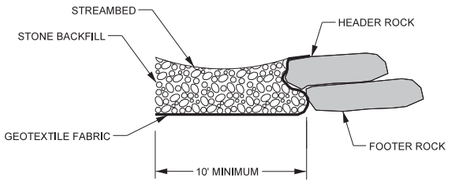
GRADE CONTROL J-HOOK VANE



PLAN VIEW



PROFILE VIEW



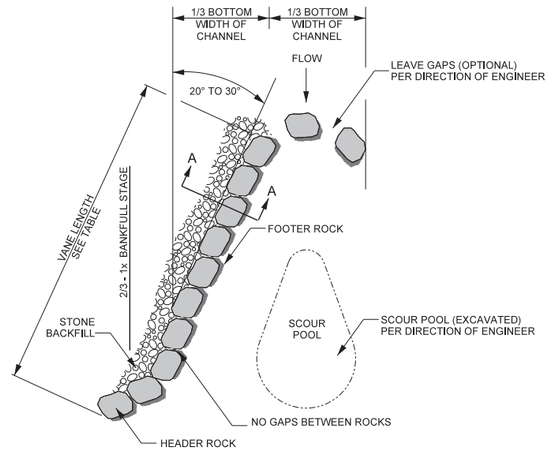
SECTION A - A

NOTES FOR ALL VANE STRUCTURES:

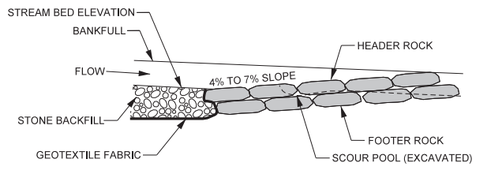
1. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF SIX FEET.
2. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBANK.
3. CONSTRUCT ANGLE AND SLOPE SPECIFICATIONS AS SHOWN.
4. BACKFILL VANE ARMS AND INVERT WITH A WELL GRADED MIX OF CLASS B, A, AND #57 STONE.
5. ON-SITE ALLUVIUM SHALL BE INCORPORATED INTO THE STONE BACKFILL WHERE AVAILABLE.
6. BOULDER SILL MUST BE A MINIMUM OF 6'.

REACH	VANE LENGTH	BOULDER SIZE
UT4A	9'	1'x2'x3'
UT4B	10'	1'x2'x3'
UT5	7'	1'x2'x3'
REACH 7	18'	2'x3'x4'

J-HOOK VANE



PLAN VIEW



PROFILE VIEW

REACH	VANE LENGTH	BOULDER SIZE
UT4A	9'	1'x2'x3'
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UT5	7'	1'x2'x3'
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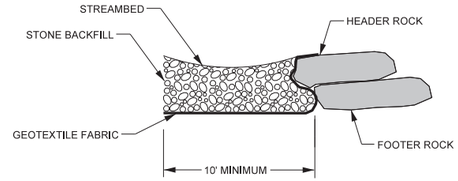


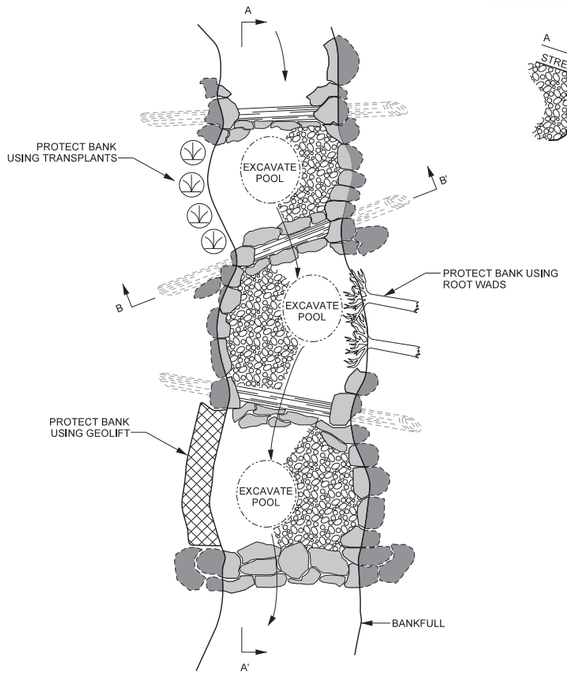
SECTION A - A

NOTES FOR ALL VANE STRUCTURES:

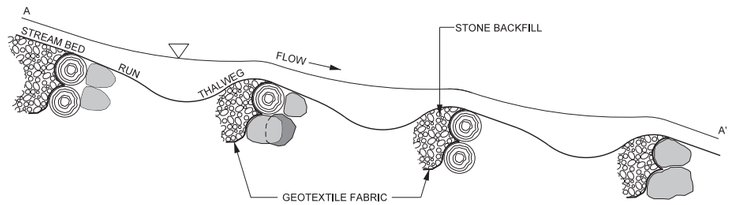
1. INSTALL GEOTEXTILE FABRIC BEGINNING AT THE TOP OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF TEN FEET.
2. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBANK.
3. START AT BANK AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
4. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
5. AN EXTRA ROCK CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
6. USE HAND PLACED STONE TO FILL GAPS ON UPSTREAM SIDE OF HEADER AND FOOTER ROCKS.
7. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.

2/26/03

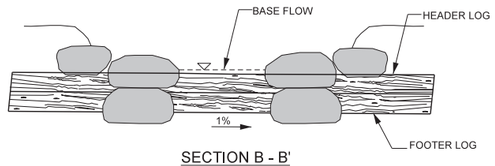
LOG AND ROCK STEP / POOL



PLAN VIEW



SECTION A - A'



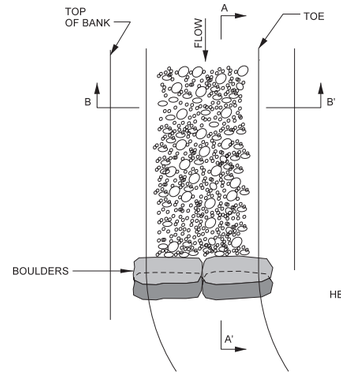
SECTION B - B'

REACH	BOULDER SIZE
UT4A	1'x2'x3'
UT4B	1'x2'x3'
UT5	1'x2'x3'
REACH 7	2'x3'x4'

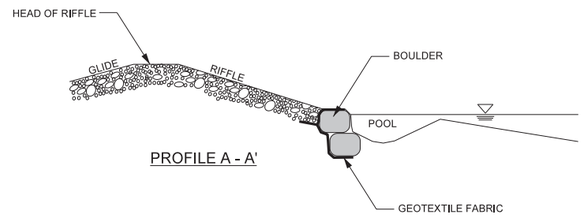
NOTES:

1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED AND EXTENDING INTO THE BANK 5' ON EACH SIDE.
2. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
3. GEOTEXTILE FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
4. BOULDERS SHOULD BE PLACED ON TOP OF HEADER LOG FOR ANCHORING.
5. TRANSPLANTS CAN BE USED INSTEAD OF BOUDERS, PER DIRECTION OF ENGINEER.
6. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH WELL GRADED MIX OF CLASS B, CLASS A, & #57 STONE TO THE ELEVATION OF THE TOP OF THE HEADER ROCK. INCORPORATE ON-SITE ALLUVIUM WHERE AVAILABLE.

BOULDER STEP



PLAN VIEW



PROFILE A - A'

NOTES:

1. FOOTERS SHALL BE INSTALLED SUCH THAT 1/4 TO 1/3 OF THE LENGTH IS DOWNSTREAM OF THE HEADER.
2. SOIL SHALL BE WELL COMPACTED AROUND BURIED PORTION OF FOOTERS WITH THE BUCKET OF EXCAVATOR.
3. INSTALL NON-WOVEN FILTER FABRIC UNDERNEATH FOOTER BOULDERS.
4. UNDERCUT THE RIFFLE ELEVATION 12 INCHES TO ALLOW FOR A LAYER OF STONE.
5. INSTALL EROSION CONTROL MATTING ALONG COMPLETED BANKS SUCH THAT THE EROSION CONTROL MATTING AT THE TOE OF THE BANK EXTENDS DOWN TO THE UNDERCUT ELEVATION.
6. FILL TRENCH WITH GRADED MIX OF CLASS A, CLASS B, AND #57 STONE TO THE BED ELEVATION OF THE CHANNEL.
7. BOULDER STEPS MUST BE EXTENDED TO A MINIMUM OF 2' INTO THE BANK. USE SILL BOULDERS IF NECESSARY.
8. THALWEG AND STEP INVERT WILL BE CONCAVE AND SHAPED PER DIRECTION OF THE DESIGNER.

REACH	BOULDER SIZE
UT4A	1'x2'x3'
UT4B	1'x2'x3'
UT5	1'x2'x3'
REACH 7	2'x3'x4'

PROJECT REFERENCE NO.	SHEET NO.
162039	2B

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKEITHAN

DocuSigned by: Kathleen M. McKeithan 247E84DF4161473...

APPROVED BY:

2/22/2022

DATE:

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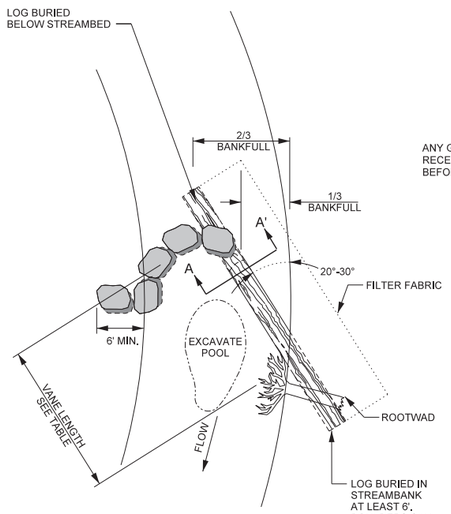
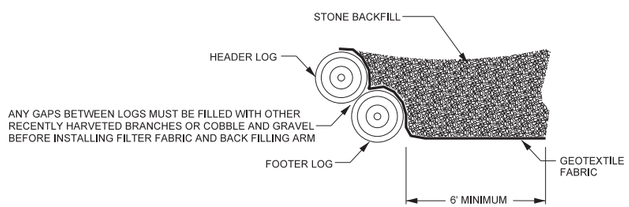
NCDMS ID NO. 100020

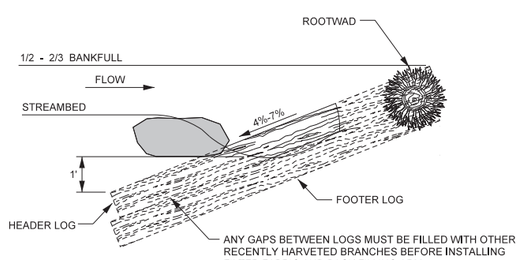
GRADE CONTROL LOG J-HOOK VANE



PLAN VIEW



SECTION A - A'



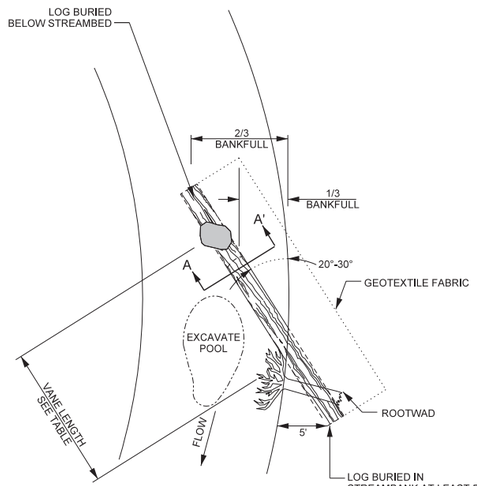
PROFILE VIEW

NOTES:

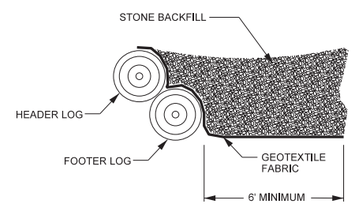
1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, RECENTLY HARVESTED, AND FOOTERED.
2. BOULDERS MUST BE OF SUFFICIENT SIZE TO ANCHOR LOGS.
3. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
4. ROOTWADS SHOULD BE PLACED BENEATH THE HEADER LOG AND PLACED SO THAT IT LOCKS THE HEADER LOG INTO THE BANK, SEE ROOTWAD DETAIL.
5. BOULDERS SHOULD BE PLACED ON TOP OF HEADER LOG FOR ACHORING.
6. HEADER BOULDERS TO BE PLACED 0.5 TO 0.75 FEET APART.
7. FILTER FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
8. TRANSPLANTS OR BOULDERS CAN BE USED INSTEAD OF ROOWADS, PER DIRECTION OF ENGINEER.
9. BOULDER SILL MUST BE A MINIMUM OF 6'.
10. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH WELL GRADED MIX OF CLASS B, CLASS A, & #57 STONE TO THE ELEVATION OF THE TOP OF THE HEADER ROCK. INCORPORATE ON-SITE ALLUVIUM WHERE AVAILABLE.

REACH	VANE LENGTH	BOULDER SIZE
UT4A	9'	1'x2'x3'
UT4B	10'	1'x2'x3'
UT5	7'	1'x2'x3'
REACH 7	18'	2'x3'x4'

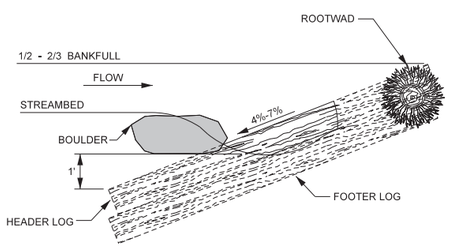
LOG VANE



PLAN VIEW



SECTION A - A'



PROFILE VIEW

NOTES:

1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. BOULDERS MUST BE OF SUFFICIENT SIZE TO ANCHOR LOGS.
3. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOGS.
4. ROOTWADS SHOULD BE PLACED BENEATH THE HEADER LOG AND PLACED SO THAT IT LOCKS THE HEADER LOG INTO THE BANK, SEE ROOTWAD DETAIL.
5. BOULDER SHOULD BE PLACED ON TOP OF HEADER LOG FOR ANCHORING.
6. GEOTEXTILE FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
7. TRANSPLANTS CAN BE USED INSTEAD OF ROOTWADS, PER DIRECTION OF ENGINEER.
8. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH WELL GRADED MIX OF CLASS B, CLASS A, & #57 STONE TO THE ELEVATION OF THE TOP OF THE HEADER ROCK. INCORPORATE ON-SITE ALLUVIUM WHERE AVAILABLE.

REACH	VANE LENGTH	BOULDER SIZE
UT4A	9'	1'x2'x3'
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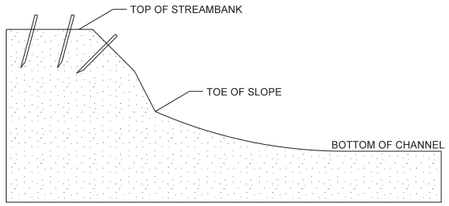
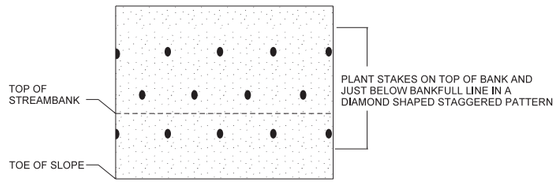
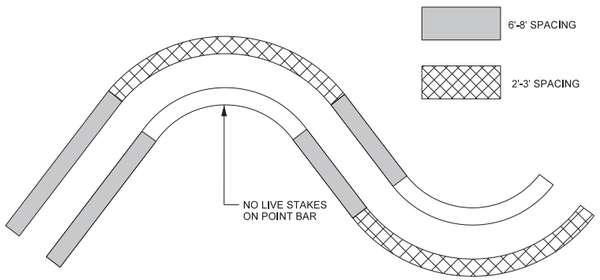
LIVE STAKING



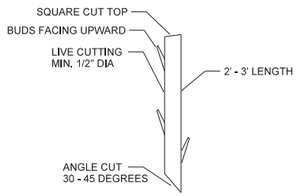
CROSS SECTION VIEW



PLAN VIEW



PLAN VIEW

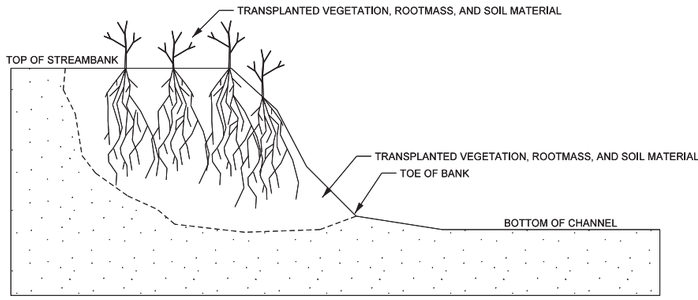


LIVE STAKE DETAIL

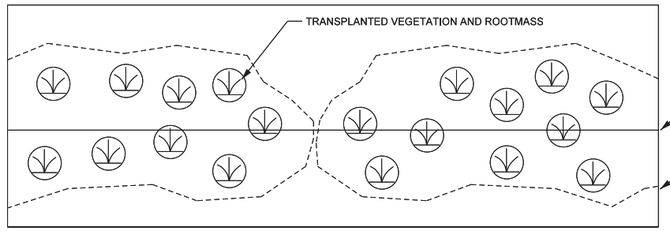
NOTES:

1. STAKES SHOULD BE CUT AND INSTALLED ON THE SAME DAY.
2. DO NOT INSTALL STAKES THAT HAVE BEEN SPLIT.
3. STAKES MUST BE INSTALLED WITH BUDS POINTING UPWARDS.
4. STAKES SHOULD BE INSTALLED PERPENDICULAR TO BANK.
5. STAKES SHOULD BE 1/2 TO 2 INCHES IN DIAMETER AND 2 TO 3 FT LONG.
6. STAKES SHOULD BE INSTALLED LEAVING 1/5 OF STAKE ABOVE GROUND.

TRANSPLANTED VEGETATION



CROSS SECTION VIEW



PLAN VIEW

NOTES:

1. EXCAVATE A HOLE IN THE BANK TO BE STABILIZED THAT WILL ACCOMMODATE THE SIZE OF TRANSPLANT TO BE PLACED. BEGIN EXCAVATION AT THE TOE OF THE BANK.
2. EXCAVATE TRANSPLANT USING A FRONT END LOADER. EXCAVATE THE ENTIRE ROOT MASS AND AS MUCH ADDITIONAL SOIL MATERIAL AS POSSIBLE. IF ENTIRE ROOT MASS CAN NOT BE EXCAVATE IN ONE BUCKET LOAD, THE TRANSPLANT IS TOO LARGE AND ANOTHER SHOULD BE SELECTED.
3. PLACE TRANSPLANT IN THE BANK TO BE STABILIZED SO THAT VEGETATION IS ORIENTATED VERTICALLY.
4. FILL IN ANY HOLES AROUND THE TRANSPLANT AND COMPACT.
5. ANY LOOSE SOIL LEFT IN THE STREAM SHOULD BE REMOVED.
6. PLACE MULTIPLE TRANSPLANTS CLOSE TOGETHER SUCH THAT THEY TOUCH.

PROJECT REFERENCE NO.	SHEET NO.
162039	2C

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKEITHAN

DocuSigned by: Kathleen M. McKeithan 247E84DF4161473...

APPROVED BY:

2/22/2022

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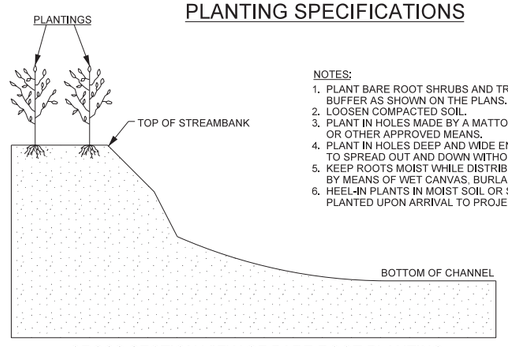
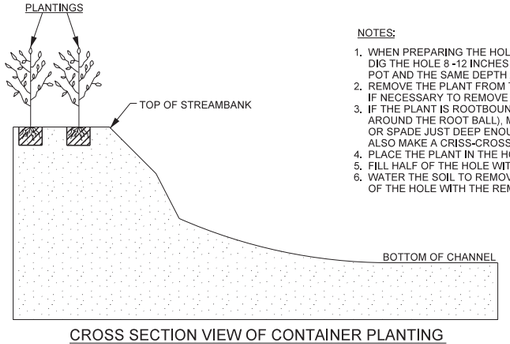
PLANTING SPECIFICATIONS



CROSS SECTION VIEW OF BARE ROOT PLANTING

NOTES:

1. PLANT BARE ROOT SHRUBS AND TREES TO THE WIDTH OF THE BUFFER AS SHOWN ON THE PLANS.
2. LOOSEN COMPACTED SOIL.
3. PLANT IN HOLES MADE BY A MATTOCK, DIBBLE, PLANTING BAR, OR OTHER APPROVED MEANS.
4. PLANT IN HOLES DEEP AND WIDE ENOUGH TO ALLOW THE ROOTS TO SPREAD OUT AND DOWN WITHOUT J-ROOTING.
5. KEEP ROOTS MOIST WHILE DISTRIBUTING OR WAITING TO PLANT BY MEANS OF WET CANVAS, BURLAP, OR STRAW.
6. HEEL-IN PLANTS IN MOIST SOIL OR SAWDUST IF NOT PROMPTLY PLANTED UPON ARRIVAL TO PROJECT SITE.

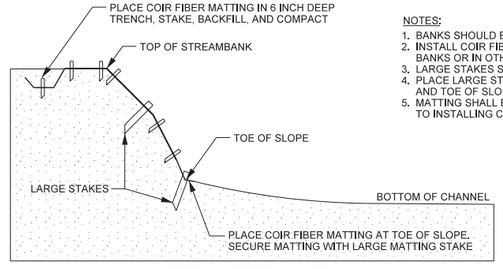


CROSS SECTION VIEW OF CONTAINER PLANTING

NOTES:

1. WHEN PREPARING THE HOLE FOR A POTTED PLANT OR SHRUB DIG THE HOLE 8 -12 INCHES LARGER THAN THE DIAMETER OF THE POT AND THE SAME DEPTH AS THE POT.
2. REMOVE THE PLANT FROM THE POT. LAY THE PLANT ON ITS SIDE IF NECESSARY TO REMOVE THE POT.
3. IF THE PLANT IS ROOTBOUND (ROOTS GROWING IN A SPIRAL AROUND THE ROOT BALL), MAKE VERTICAL CUTS WITH A KNIFE OR SPADE JUST DEEP ENOUGH TO CUT THE NET OF ROOTS. ALSO MAKE A CRISS-CROSS CUT ACROSS THE BOTTOM OF THE BALL.
4. PLACE THE PLANT IN THE HOLE.
5. FILL HALF OF THE HOLE WITH SOIL (SAME SOIL REMOVED FOR BACKFILL).
6. WATER THE SOIL TO REMOVE AIR POCKETS AND FILL THE REST OF THE HOLE WITH THE REMAINING SOIL.

COIR FIBER MATTING



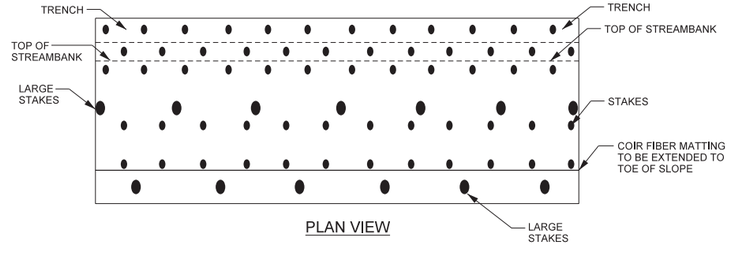
CROSS SECTION VIEW

NOTES:

1. BANKS SHOULD BE SEEDED PRIOR TO PLACEMENT OF MATTING.
2. INSTALL COIR FIBER MATTING PER SPECIFICATIONS ALONG STREAM BANKS OR IN OTHERS LOCATIONS SPECIFIED BY ENGINEER.
3. LARGE STAKES SHOULD NOT BE SPACED FURTHER THAN 36" APART.
4. PLACE LARGE STAKES ALONG ALL SEAMS, IN THE CENTER OF BANK, AND TOE OF SLOPE.
5. MATTING SHALL BE PLACED ON BANKS, STAKED, AND TRENCHED PRIOR TO INSTALLING CONSTRUCTED RIFFLE MATERIAL.

TYPICAL LARGE MATTING STAKE

LEG LENGTH	17.00 IN (43.18 CM) (TAPERED TO POINT)
WIDTH	1.5 IN (3.81 CM)
THICKNESS	1.5 IN (3.81 CM)



PLAN VIEW

TYPICAL SMALL MATTING STAKE

LEG LENGTH	11.00 IN (27.94 CM)
HEAD WIDTH	1.25 IN (3.18 CM)
HEAD THICKNESS	0.40 IN (1.02 CM)
LEG WIDTH	0.60 IN (1.52 CM) (TAPERED TO POINT)
LEG THICKNESS	0.40 IN (1.02 CM)
TOTAL LENGTH	12.00 IN (30.48 CM)

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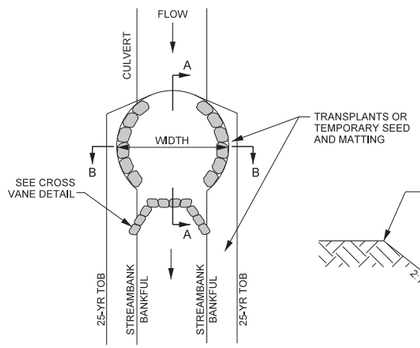
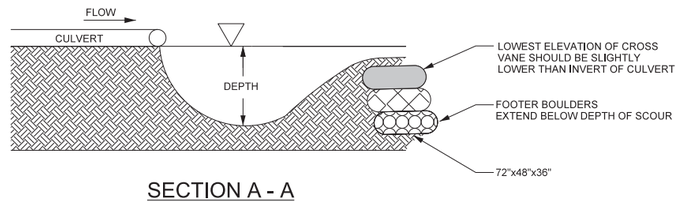
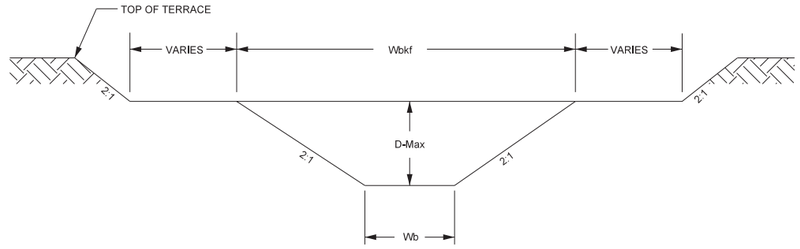
PLUNGE POOL



PLAN VIEW



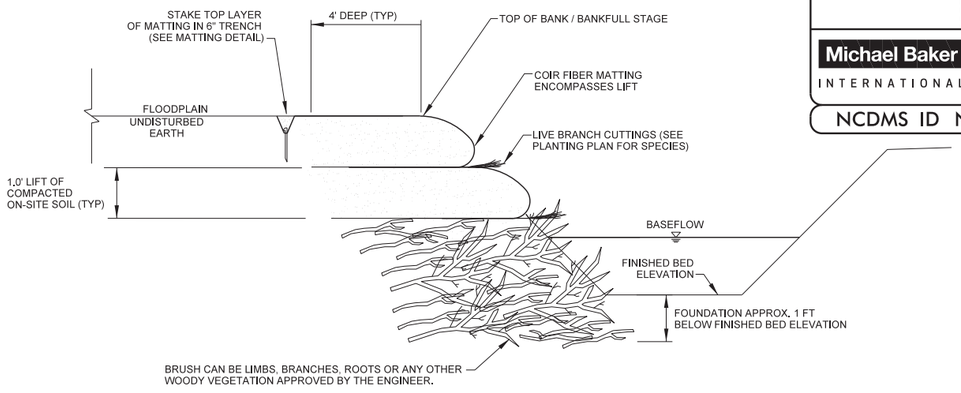
SECTION A - A



SECTION B - B

GEOLIFT WITH BRUSH TOE

NOTES:
1. LIVE BRANCH CUTTINGS SHALL BE THE SAME SPECIES AS THE LIVE STAKES AND SHALL BE INSTALLED DURING VEGETATION DORMANCY. IF CONSTRUCTION OCCURS OUTSIDE OF DORMANT SEASON, CONTRACTOR SHALL CONSULT WITH DESIGNER.
2. LIVE BRANCH CUTTINGS SHALL BE INSTALLED AT A DENSITY OF 20-30 CUTTINGS PER LINEAR FOOT AND A MAXIMUM DIAMETER OF 2.5 INCHES.
3. NUMBER OF SOIL LIFTS MAY VARY, IN GENERAL LIFTS SHALL EXTEND TO THE TOP OF BANK OR BANKFULL STAGE.
4. WHEN GEOLIFTS ARE BUILT ABOVE ROOTWAD CLUSTER, USE LARGE STONE BACKFILL BEHIND ROOT MASS TO BUILT FOUNDATION.
5. CLASS I STONE MAY BE USED AT THE DIRECTION OF THE ENGINEER TO BUILD THE FOUNDATION IN LIEU OF BRUSH MATERIAL.



PROJECT REFERENCE NO.	SHEET NO.
162039	2D

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKEITHAN

DocuSigned by: Kathleen M. McKeithan 247E84DF4161473...

APPROVED BY:

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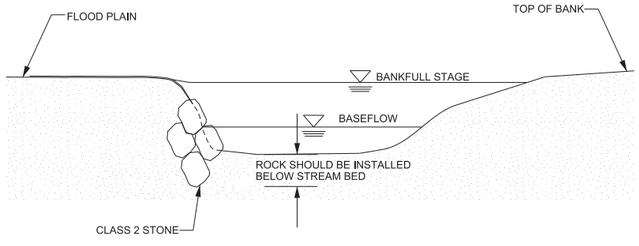
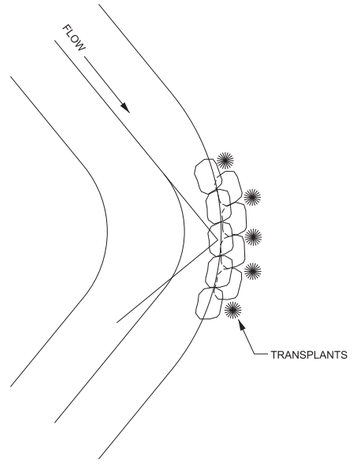
NCDMS ID NO. 100020

ROCK TOE PROTECTION

ROCK TOE PROTECTION
CROSS SECTION VIEW
NTS



ROCK TOE PROTECTION
PLAN VIEW
NTS



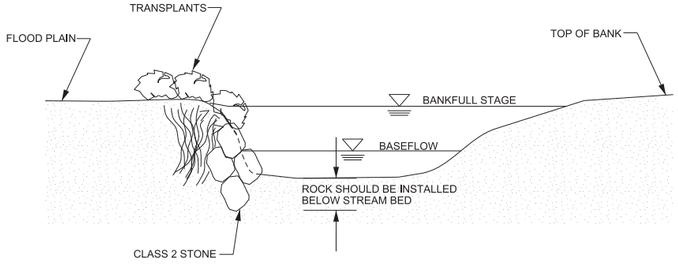
NOTES:

TRENCHING METHOD:
IF THE CLASS 2 CANNOT BE DRIVEN INTO THE BANK OR THE BANK NEEDS TO BE RECONSTRUCTED, THE TRENCHING METHOD SHOULD BE USED. THIS METHOD REQUIRES THAT A TRENCH BE EXCAVATED FOR THE CLASS 2. ONE-THIRD OF THE CLASS 2 SHOULD REMAIN BELOW NORMAL BASE FLOW CONDITIONS.

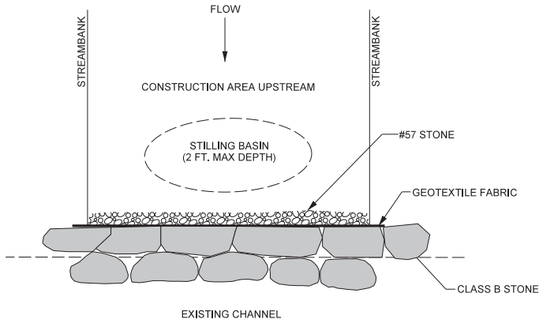
NOTES:

DRIVEN METHOD:
CLASS 2 SHOULD BE LAIN IN THE STREAMBED AND THEN DRIVEN INTO THE BANK WITH A HORIZONTAL AND DOWNWARD FORCE.

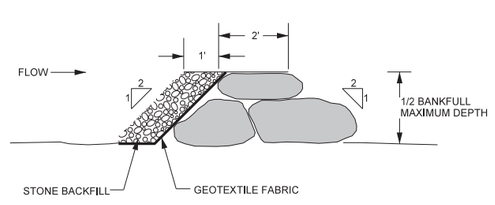
ROCK TOE PROTECTION WITH TRANSPLANTS
CROSS SECTION VIEW
NTS



ROCK DAM



PLAN VIEW

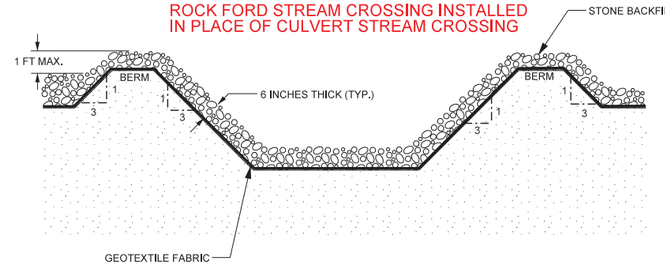


CROSS SECTION

NOTES:
CLEAN OUT STILLING BASIN OF TRAPPED SEDIMENT PRIOR TO REMOVAL.

ROCK FORD STREAM CROSSING

ROCK FORD STREAM CROSSING INSTALLED IN PLACE OF CULVERT STREAM CROSSING



NOTES:
1. CONSTRUCT STREAM CROSSING WHEN FLOW IS LOW.
2. HAVE ALL NECESSARY MATERIALS AND EQUIPMENT ON-SITE BEFORE WORK BEGINS.
3. MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. DO NOT EXCAVATE CHANNEL BOTTOM. COMPLETE ONE SIDE BEFORE STARTING ON THE OTHER SIDE.
4. INSTALL STREAM CROSSING AT RIGHT ANGLE TO THE FLOW.
5. GRADE SLOPES TO A 3:1 SLOPE. TRANSPLANT SOD FROM ORIGINAL STREAMBANK ONTO SIDE SLOPES.
6. MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL.
7. A STABILIZED PAD OF STONE BACKFILL, 6 INCHES THICK, LINED WITH GEOTEXTILE FABRIC SHALL BE USED OVER THE BERM AND ACCESS SLOPES.
8. WIDTH OF THE CROSSING SHALL BE SUFFICIENT TO ACCOMMODATE THE LARGEST VEHICLE CROSSING THE CHANNEL.
9. CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED.

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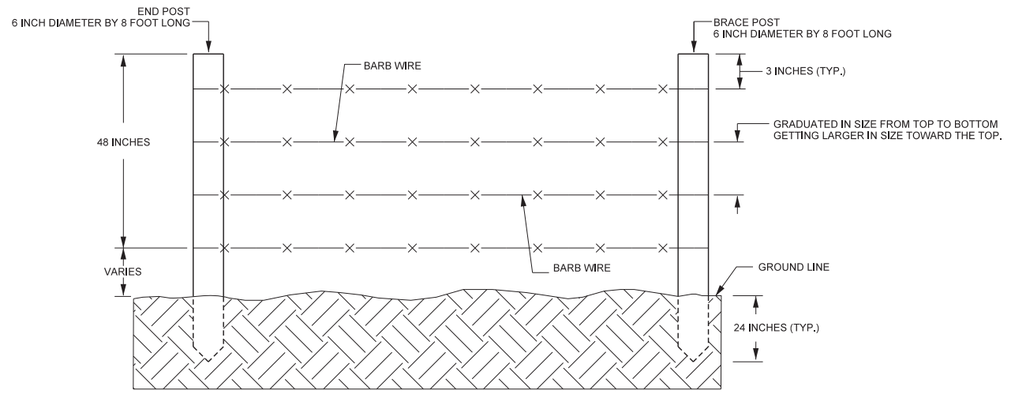
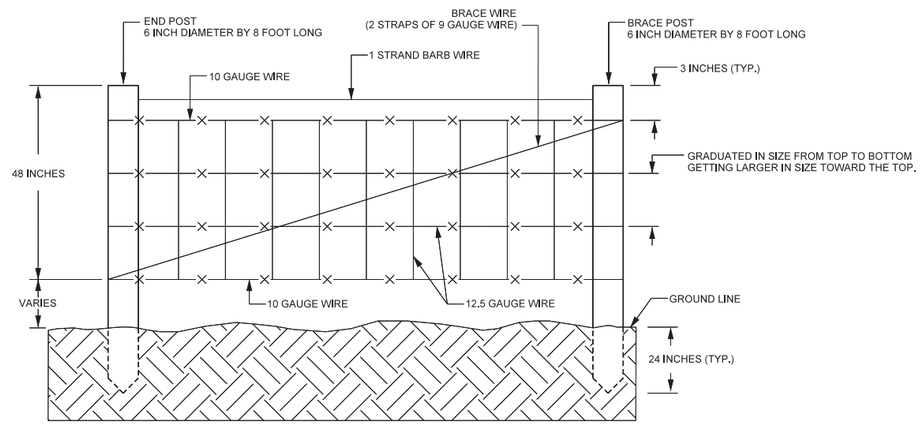
BARB WIRE FIELD FENCE



NOTE:

1. END POSTS SHALL BE INSTALLED AT A SPACING OF 10-15 FEET.

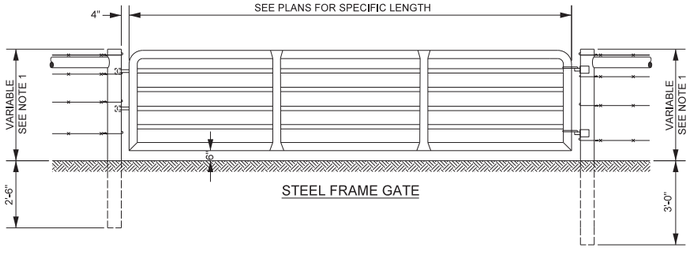
WOVEN WIRE FENCE



NOTE:

1. END POSTS SHALL BE INSTALLED AT A SPACING OF 10-15 FEET.

STEEL GATES

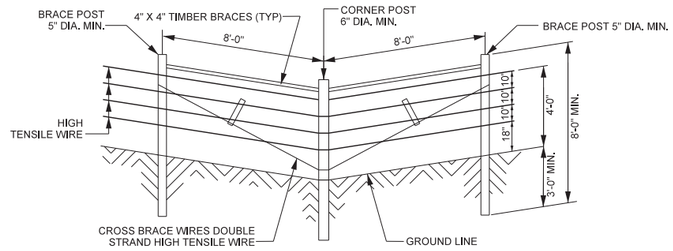


STEEL FRAME GATE

NOTES:

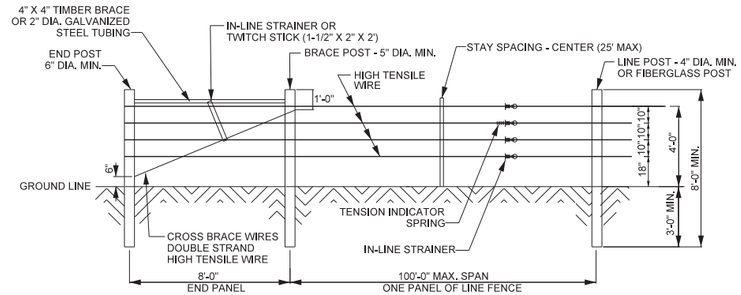
1. POST HEIGHT DIMENSION SHALL BE THE SAME AS REQUIRED FOR THE ADJACENT FENCE.
2. CONSTRUCT AN END OR STRESS PANEL, AS REQUIRED IN THE SPECIFICATION, ON EACH SIDE OF GATE.
3. HINGES AND LOCKS SHALL BE INSTALLED AS SPECIFIED BY GATE MANUFACTURER.

4 STRAND - HIGH TENSILE FENCING

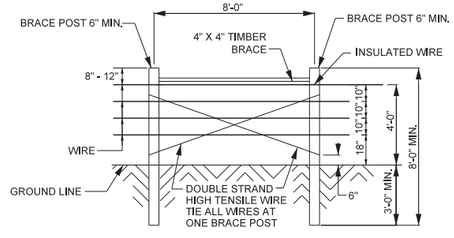


CORNER AND VERICAL CHANGE BRACING

INSTALL AT ALL POINTS WHERE FENCE ALIGNMENT CHANGES 15 DEGREES OR MORE

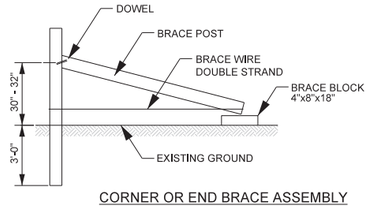


END ASSEMBLY AND LINE FENCE SECTION



PULL POST ASSEMBLY

PLACE IN FENCE LINE SO THAT MAXIMUM DISTANCE BETWEEN BRACED POSTS DOES NOT EXCEED 1320 FEET



CORNER OR END BRACE ASSEMBLY

OPTIONAL FIGURE 4

NOTES:

1. NOTCH POSTS 3/4" FOR 4" X 4" TIMBER BRACES.
2. DOWELS TO BE 1/2" DIA. X 5" PLAIN STEEL RODS. DRIVE DOWELS IN 7/16" DIA. HOLES, 2-1/2" INTO EACH POST AND TIMBER BRACE.
3. STAPLE CROSS-BRACE WIRES TO BRACE AND CORNER POSTS AT QUARTER POINTS OF THE POSTS.
4. HIGH TENSILE WIRE WILL BE NEW AND SMOOTH AND WILL MEET THE FOLLOWING 1) TENSILE STRENGTH - 110,000 PSI 2) GALVANIZING - TYPE III 3) GAGE - 12-1/2.
5. ALL CORNER POSTS, BRACE POSTS, BRACES, AND STAY SPACERS, SHALL BE PRESSURE TREATED. PRESSURE TREATMENT SHALL CONFORM TO FEDERAL SPECIFICATION TT-W-571. (1-1/4" LONG FOR HARD WOODS).
6. AT CORNER POSTS, STAPLE EACH WIRE AT QUARTER POINTS OF POSTS. AT BRACE POSTS, DOUBLE STAPLE EACH WIRE. AT LINE POSTS, SECURE EACH WIRE WITH STANDARD CLAMPS.
7. FIBERGLASS MAY BE USED FOR LINE POSTS. THESE WILL CONSIST OF MARBLE, FIBERGLASS, AND POLYMER RESINS WHICH HAVE BEEN TREATED BY THERMOSETTINGS (HEAT TREATMENT). POSTS MUST BE DRIVEN IN THE SOIL AT LEAST 18 INCHES.
8. 2" DIAMETER PIPE DIAGONAL BRACE MAY BE USED IN PLACE OF HORIZONTAL TIMBER BRACE AND DIAGONAL WIRES.
9. MINIMUM NET RETENTION OF CHROMATED COPPER ARSENATE (CCA) FOR WOOD FENCE POSTS SHALL BE 0.40 POUNDS PER CUBIC FOOT.
10. A SINGLE 12 FOOT LONG, 6 INCH MINIMUM DIAMETER POST MAY BE SUBSTITUTED FOR END PANEL, CORNER AND VERTICAL CHANGE BRACING, AND PULL POST ASSEMBLY. THE 12 FOOT LONG POSTS SHALL EXTEND A MINIMUM OF 7.5 FEET INTO THE GROUND AND BE BACKFILLED WITH GRAVEL.
11. FOR FURTHER DETAILS ON APPROVED METHODS OF FENCE INSTALLATION, SEE NATURAL RESOURCE SERVICE'S CONSERVATION PRACTICE MATERIALS AND CONSTRUCTION SPECIFICATIONS FOR FENCING (CODE 382) BY NRCS NORTH CAROLINA (FEBRUARY 2008).

PROJECT REFERENCE NO.	SHEET NO.
162039	2E

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKEITHAN

DocuSigned by: Kathleen M. McKeithan 247E84DF4161473...

APPROVED BY:

2/22/2022

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8000 Regency Parkway, Suite 600
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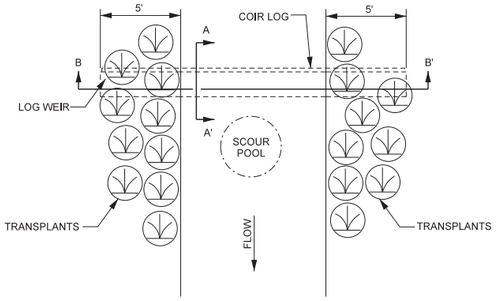
Fax: 919.463.5490
License #: F-1084

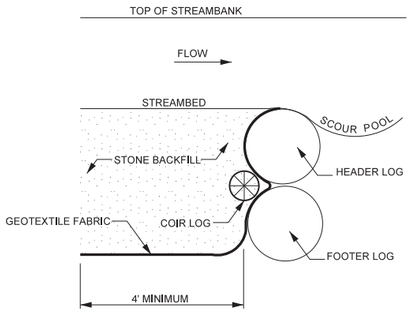
NCDMS ID NO. 100020

2/26/03

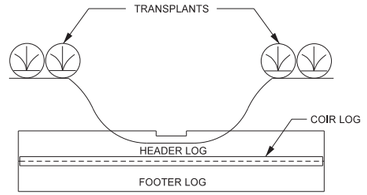
LOG DROP



PLAN VIEW



SECTION A - A'

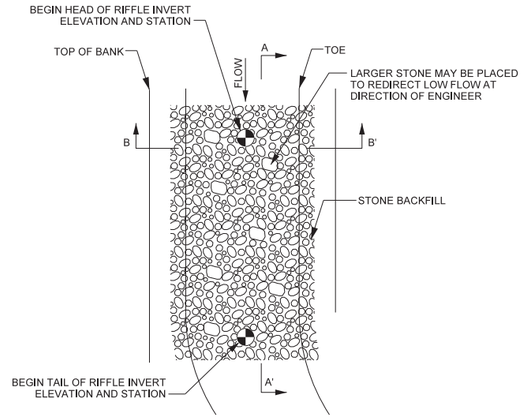


CROSS SECTION VIEW B - B'

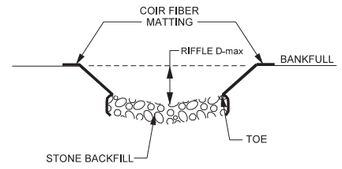
NOTES:

1. LOGS SHOULD BE AT LEAST 10 INCHES IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. TOP OF HEADER LOG SHOULD BE SET AT SAME ELEVATION AS THE STREAMBED.
3. DIAMETER OF COIR LOG SHOULD BE APPROXIMATELY 1/2 DIAMETER OF LOGS.
4. USE GEOTEXTILE FABRIC WITH COIR LOGS TO SEAL GAPS BETWEEN LOGS.
5. PLACE TRANSPLANTS ALONG BANKS TO PROTECT AGAINST BANK EROSION.
6. THE HEADER LOG SHOULD BE NOTCHED 2 - 3 INCHES DEEP IN THE CENTER AND FOR 20 - 30% OF THE CHANNEL WIDTH.

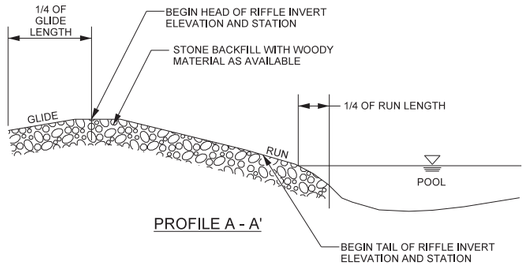
CONSTRUCTED RIFFLE



PLAN VIEW



SECTION B - B'



PROFILE A - A'

NOTES:

1. UNDERCUT CHANNEL BED ELEVATION AS NEEDED TO ALLOW FOR LAYERS OF STONE TO ACHIEVE FINAL GRADE.
2. INSTALL COIR FIBER MATTING ALONG COMPLETED BANKS SUCH THAT THE EROSION CONTROL MATTING AT THE TOE OF THE BANK EXTENDS DOWN TO THE UNDERCUT ELEVATION.
3. INSTALL STONE BACKFILL, COMPACTED TO GRADE.
4. FINAL CHANNEL BED SHAPE SHOULD BE ROUNDED, SMOOTH, AND CONCAVE, WITH THE ELEVATION OF THE BED 0.2 FT DEEPER IN THE CENTER THAN AT THE EDGES.
5. CONSTRUCTED RIFFLES SHALL BE 12" THICK.
6. CHANNEL BED SHALL INCLUDE WOODY MATERIAL AS AVAILABLE ON-SITE LAYERED IN WITH STONE BACKFILL.

REACH	STONE BACKFILL MIX
APPLIES TO ALL REACHES	10% CLASS I RIPRAP 20% CLASS B RIPRAP 40% CLASS A RIPRAP 30% ON-SITE ALLUVIUM

PROJECT REFERENCE NO.	SHEET NO.
162039	2F

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKEITHAN

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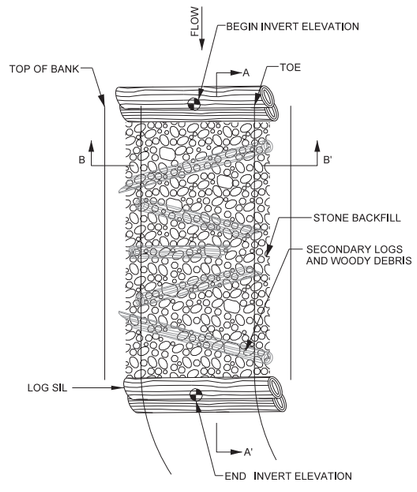
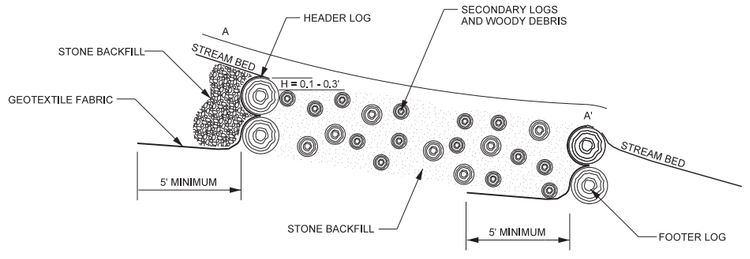
NCDMS ID NO. 100020

CONSTRUCTED RIFFLE WITH WOOD

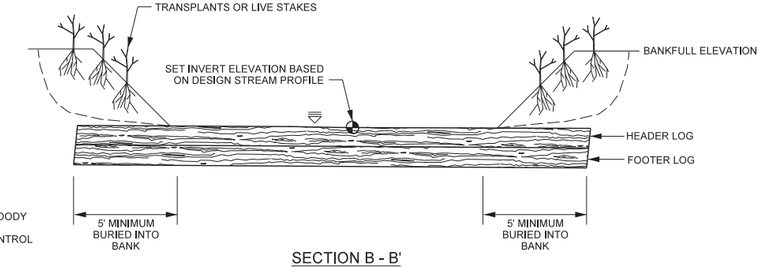
CONSTRUCTED RIFFLE WITH WOOD
INSTALLED IN PLACE OF
GRADE CONTROL LOG JAM



PLAN VIEW



SECTION A - A'



SECTION B - B'

NOTES:

1. UNDERCUT CHANNEL BED ELEVATION AS NEEDED TO ALLOW FOR LAYERS OF STONE AND WOODY MATERIAL TO ACHIEVE FINAL GRADE.
2. INSTALL COIR FIBER MATTING ALONG COMPLETED BANKS SUCH THAT THE EROSION CONTROL MATTING AT THE TOE OF THE BANK EXTENDS DOWN TO THE UNDERCUT ELEVATION.
3. INSTALL STONE BACKFILL, COMPACTED TO GRADE.
4. FINAL CHANNEL BED SHAPE SHOULD BE ROUNDED, SMOOTH, AND CONCAVE, WITH THE ELEVATION OF THE BED 0.2 FT DEEPER IN THE CENTER THAN AT THE EDGES.
5. CONSTRUCTED RIFFLES SHALL BE 12" THICK.
6. CHANNEL BED SHALL INCLUDE WOODY MATERIAL AS AVAILABLE ON-SITE LAYERED IN WITH STONE BACKFILL.

2/22/2022
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mcaleu

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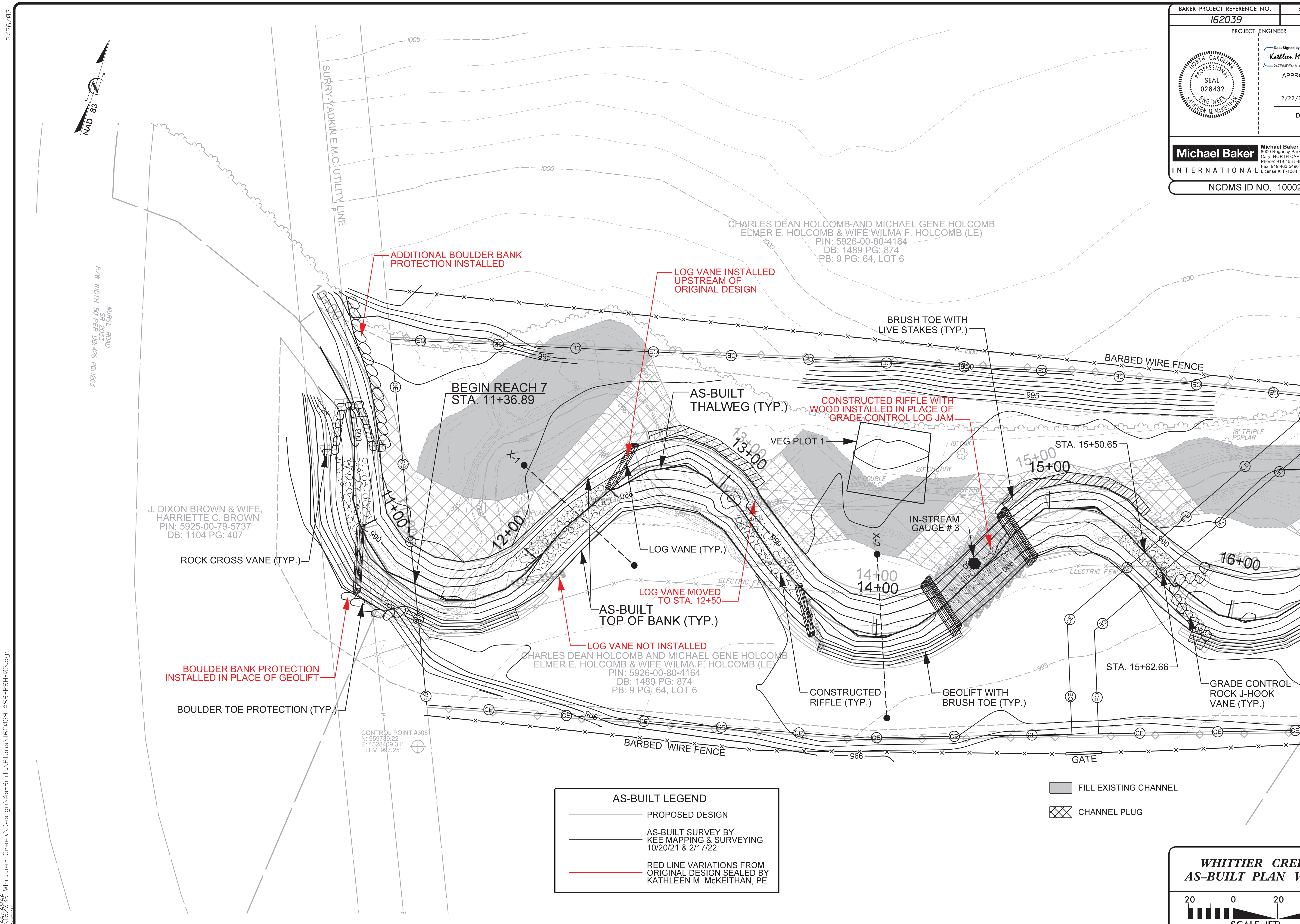

NAD 83
SURRY-YADKIN E.M.C. UTILITY LINE
NURSE ROAD
SR 2033
R/W WIDTH 50' PER DB. 426 PG. 263
ADDITIONAL BOULDER BANK PROTECTION INSTALLED
LOG VANE INSTALLED UPSTREAM OF ORIGINAL DESIGN
CHARLES DEAN HOLCOMB AND MICHAEL GENE HOLCOMB
ELMER E. HOLCOMB & WIFE WILMA F. HOLCOMB (LE)
PIN: 5926-00-80-4164
DB: 1489 PG: 874
PB: 9 PG: 64, LOT 6
BRUSH TOE WITH LIVE STAKES (TYP.)
BARBED WIRE FENCE
BEGIN REACH 7
STA. 11+36.89
AS-BUILT THALWEG (TYP.)
CONSTRUCTED RIFFLE WITH WOOD INSTALLED IN PLACE OF GRADE CONTROL LOG JAM
VEG PLOT 1
STA. 15+50.65
15+00
13+00
12+00
11+00
14+00
16+00
X-1
X-2
IN-STREAM GAUGE # 3
J. DIXON BROWN & WIFE,
HARRIETTE C. BROWN
PIN: 5925-00-79-5737
DB: 1104 PG: 407
ROCK CROSS VANE (TYP.)
LOG VANE (TYP.)
LOG VANE MOVED TO STA. 12+50
AS-BUILT TOP OF BANK (TYP.)
LOG VANE NOT INSTALLED
CHARLES DEAN HOLCOMB AND MICHAEL GENE HOLCOMB
ELMER E. HOLCOMB & WIFE WILMA F. HOLCOMB (LE)
PIN: 5926-00-80-4164
DB: 1489 PG: 874
PB: 9 PG: 64, LOT 6
BOULDER BANK PROTECTION INSTALLED IN PLACE OF GEOLIFT
BOULDER TOE PROTECTION (TYP.)
CONTROL POINT #305
N: 959739.22'
E: 1528409.31'
ELEV: 997.25'
CONSTRUCTED RIFFLE (TYP.)
GEOLIFT WITH BRUSH TOE (TYP.)
STA. 15+62.66
GRADE CONTROL ROCK J-HOOK VANE (TYP.)
GATE
ELECTRIC FENCE
MATCH LINE – SEE SHEET 4
1005
1000
995
990
AS-BUILT LEGEND
PROPOSED DESIGN
AS-BUILT SURVEY BY KEE MAPPING & SURVEYING 10/20/21 & 2/17/22
RED LINE VARIATIONS FROM ORIGINAL DESIGN SEALED BY KATHLEEN M. McKEITHAN, PE
FILL EXISTING CHANNEL
CHANNEL PLUG

BAKER PROJECT REFERENCE NO. 162039 — SHEET NO. 3

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 028432 KATHLEEN M. McKEITHAN

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WHITTIER CREEK
AS-BUILT PLAN VIEW

SCALE (FT): 20 0 20 40

2/26/03

2/22/2022
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2/26/03

AS-BUILT LEGEND

- PROPOSED DESIGN
- AS-BUILT SURVEY BY KEE MAPPING & SURVEYING 10/20/21 & 2/17/22
- RED LINE VARIATIONS FROM ORIGINAL DESIGN SEALED BY KATHLEEN M. McKEITHAN, PE

BAKER PROJECT REFERENCE NO.	SHEET NO.
162039	4

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M McKEITHAN

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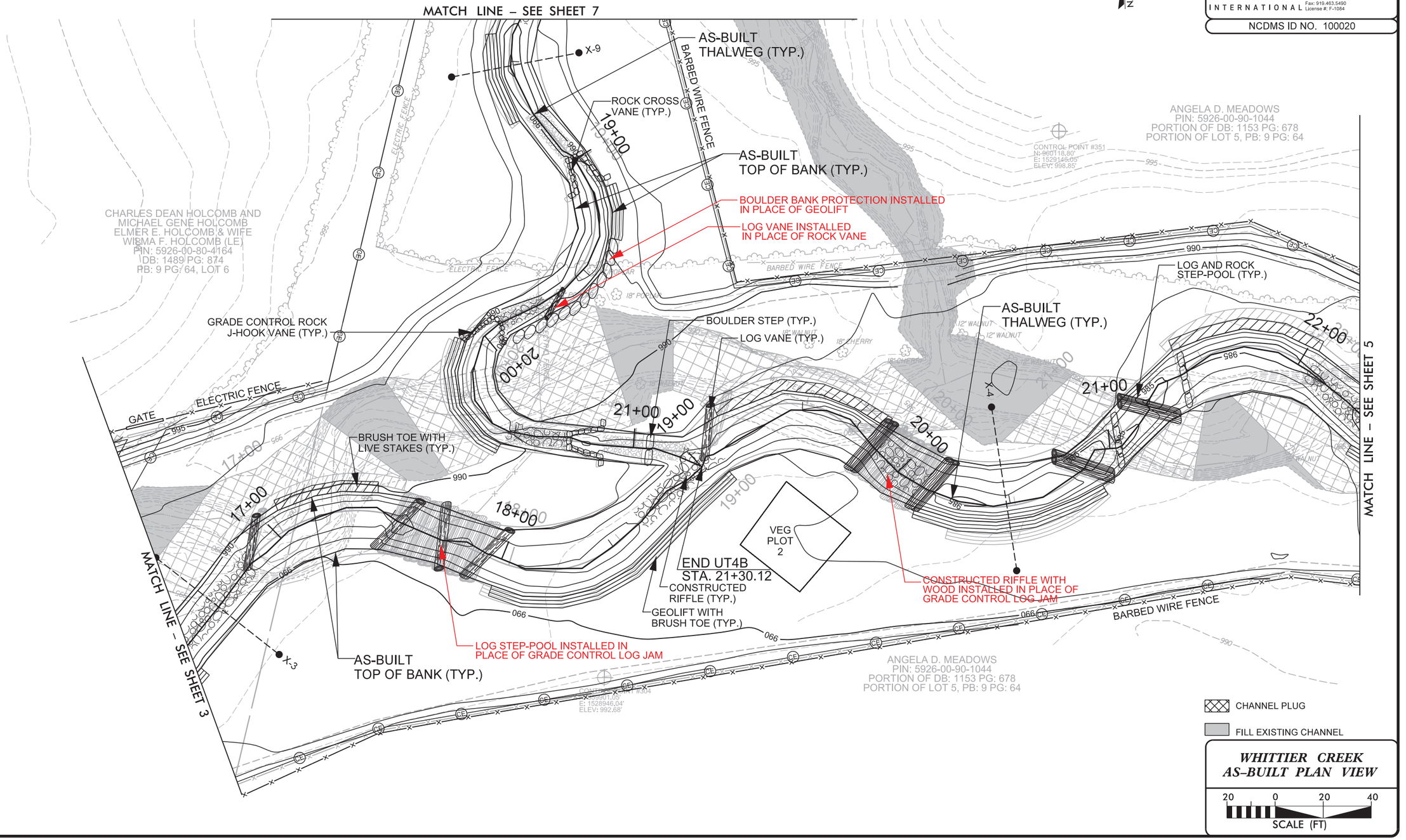
NAD 83



CHANNEL PLUG

FILL EXISTING CHANNEL

WHITTIER CREEK AS–BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

2/22/2022
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mcgee

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
162039	5

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M McKEITHAN

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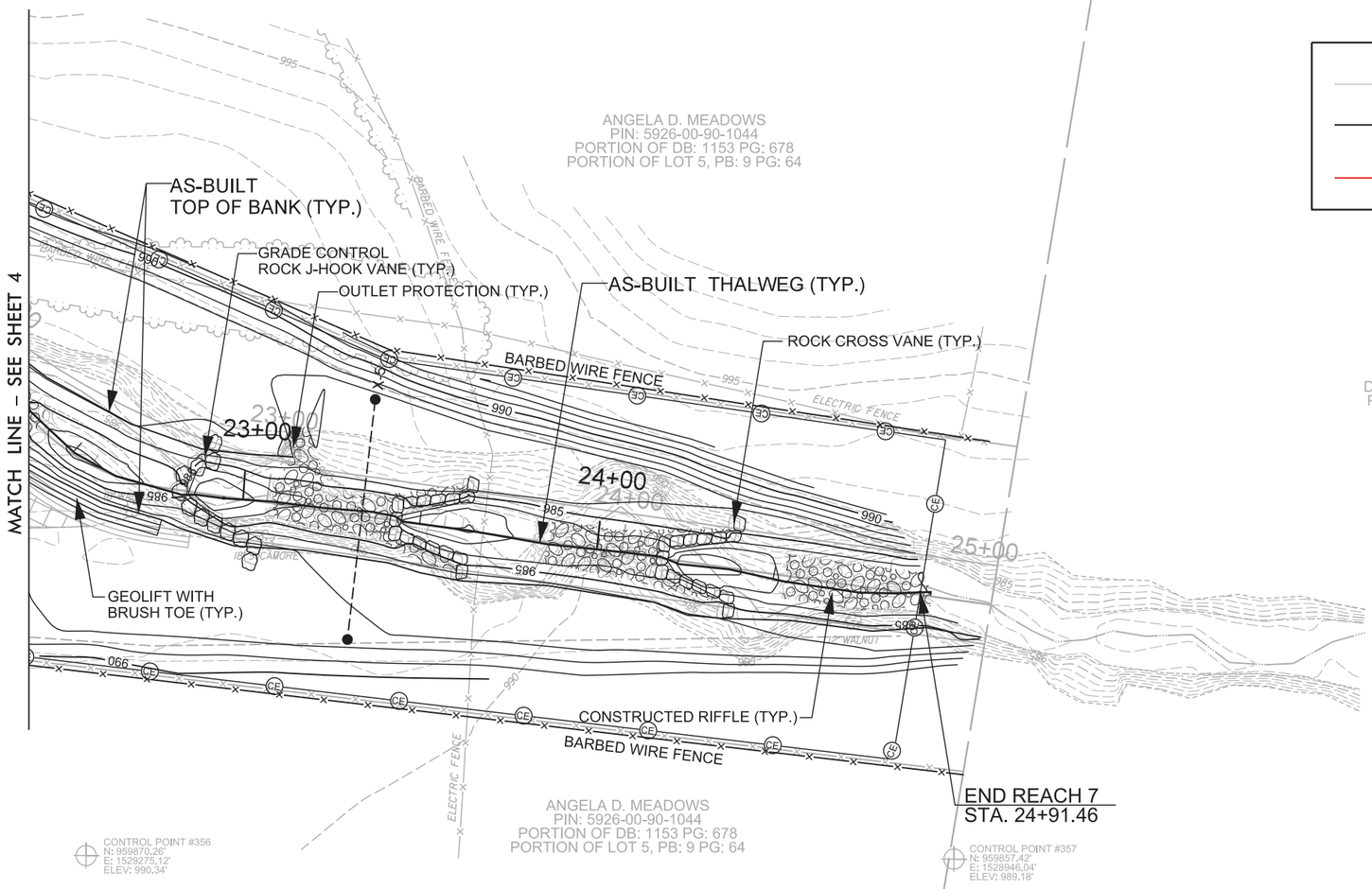
NCDMS ID NO. 100020

NAD 83

AS-BUILT LEGEND

- PROPOSED DESIGN
- AS-BUILT SURVEY BY KEE MAPPING & SURVEYING 10/20/21 & 2/17/22
- RED LINE VARIATIONS FROM ORIGINAL DESIGN SEALED BY KATHLEEN M. McKEITHAN, PE



FILL EXISTING CHANNEL

CHANNEL PLUG

WHITTIER CREEK AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

3/22/2022
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mcasey

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
162039	6

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M McKEITHAN

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NCDMS ID NO. 100020

AS-BUILT LEGEND

- PROPOSED DESIGN
- AS-BUILT SURVEY BY KEE MAPPING & SURVEYING 10/20/21 & 2/17/22
- RED LINE VARIATIONS FROM ORIGINAL DESIGN SEALED BY KATHLEEN M. McKEITHAN, PE

NAD 83

FRANCES F. ATKINS
CLAYTON FULK (LE)
PIN: 5926-00-91-0590
DB: 1218 PG: 345, TRACT 2
PB: 9 PG: 64, LOT 2

ROCK HILL CHURCH ROAD
SR 2034
R/W WIDTH 50' PER DB:854 PG:654 & 656

CHARLES DEAN HOLCOMB AND MICHAEL GENE HOLCOMB
ELMER E. HOLCOMB & WIFE WILMA F. HOLCOMB (LE)
PIN: 5926-00-80-4164
DB: 1489 PG: 874
PB: 9 PG: 64, LOT 6

AS-BUILT TOP OF BANK (TYP.)

BOULDER STEP (TYP.)

LOG DROP INSTALLED IN PLACE OF GRADE CONTROL J-HOOK VANE

AS-BUILT THALWEG (TYP.)

X-6

EXCAVATE BANKFULL BENCH

VEG PLOT 3

LOG VANE INSTALLED IN PLACE OF J-HOOK VANE

SLOPE BANKS AT 3:1

BEGIN UT4A
STA. 10+00.00

END UT4A
BEGIN UT4B
STA. 13+27.80

13+76.55

MATCH LINE – SEE SHEET 7

CONTROL POINT #501
N: 960892.43'
E: 1528483.53'
ELEV: 1013.19'

CONTROL POINT #301
N: 960656.92'
E: 1528646.29'
ELEV: 1006.49'

SURRY-YADKIN E.M.C. UTILITY LINE

CHARLES DEAN HOLCOMB AND MICHAEL GENE HOLCOMB
ELMER E. HOLCOMB & WIFE WILMA F. HOLCOMB (LE)
PIN: 5926-00-80-4164
DB: 1489 PG: 874
PB: 9 PG: 64, LOT 6

FILL EXISTING CHANNEL

CHANNEL PLUG

WHITTIER CREEK AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

2/26/2003
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mcfall

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
162039	7

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M McKEITHAN

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License #: F-1084

NCDMS ID NO. 100020

MATCH LINE – SEE SHEET 8

MATCH LINE – SEE SHEET 6

MATCH LINE – SEE SHEET 4

NAD 83

ROCK CROSS VANE (TYP.)

LOG STEP POOL (TYP.)

18" CEDAR

AS-BUILT THALWEG (TYP.)

LOG DROP INSTALLED IN PLACE OF BOULDER STEP

AS-BUILT TOP OF BANK (TYP.)

LOG VANE NOT INSTALLED

LOG VANE (TYP.)

CONSTRUCTED RIFFLE (TYP.)

BOULDER STEP (TYP.)

BRUSH TOE WITH LIVE STAKES (TYP.)

BARBED WIRE FENCE

ADDITIONAL LOG DROP INSTALLED

GRADE CONTROL ROCK J-HOOK VANE (TYP.)

LOG J-HOOK VANE INSTALLED IN PLACE OF ROCK J-HOOK VANE

LOG VANE INSTALLED IN PLACE OF ROCK VANE

GEOLIFT WITH BRUSH TOE (TYP.)

LOG STEP POOL (TYP.)

ROCK J-HOOK VANE (TYP.)

END UT5
STA. 17+92.77

IN-STREAM GAUGE # 2

15+00

16+00

17+00

18+00

X-11

X-7

X-8

CONTROL POINT #300
N: 960297.06'
E: 1529217.20'
ELEV: 1010.47'

CONTROL POINT #302
N: 960463.27'
E: 1528735.15'
ELEV: 1001.42'

CONTROL POINT #303
N: 960229.10'
E: 1528902.26'
ELEV: 994.85'

CHARLES DEAN HOLCOMB AND
MICHAEL GENE HOLCOMB
ELMER E. HOLCOMB & WIFE
WILMA F. HOLCOMB (LE)
PIN: 5926-00-80-4164
DB: 1489 PG: 874
PB: 9 PG: 64, LOT 6

ANGELA D. MEADOWS
PIN: 5926-00-90-1044
PORTION OF DB: 1153 PG: 678
PORTION OF LOT 5, PB: 9 PG: 64

SHED

BARN

BARN

AS-BUILT LEGEND

PROPOSED DESIGN

AS-BUILT SURVEY BY KEE MAPPING & SURVEYING 10/20/21 & 2/17/22

RED LINE VARIATIONS FROM ORIGINAL DESIGN SEALED BY KATHLEEN M. McKEITHAN, PE

FILL EXISTING CHANNEL

CHANNEL PLUG

WHITTIER CREEK AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

2/22/2022
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mcgeu

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
162039	8

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M. McKEITHAN

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License #: F-1084

NCDMS ID NO. 100020

NAD 83

ANGELA D. MEADOWS
PIN: 5926-00-90-5577
DB: 1332 PG: 199
PB: 24 PG: 57
PORTION OF LOT 5, PB: 9 PG: 64

DWELLING
CONCRETE
12" CMP
INV. IN: 1027.68'
INV. OUT: UNKNOWN
TEL PED
GRAVEL ROAD
SOIL ROAD
BARBED WIRE FENCE
ROCK HILL CHURCH ROAD SR 2014
SURRY-YADKIN E.M.C. UTILITY LINE
CONTROL POINT #350
N: 960577.74'
E: 1529412.86'
ELEV: 1014.58'
P
PP
1005
1010
1015
1020
1025

CONSTRUCTED RIFFLE (TYP.)
BOULDER STEP (TYP.)
ROCK CROSS VANE (TYP.)
AS-BUILT THALWEG (TYP.)
LOG DROP INSTALLED IN PLACE OF GRADE CONTROL J-HOOK VANE
BARBED WIRE FENCE
GATE
LOG DROP INSTALLED IN PLACE OF J-HOOK VANE
LOG VANE INSTALLED IN PLACE OF J-HOOK VANE
GRADE CONTROL ROCK J-HOOK VANE (TYP.)
GEOLIFT WITH BRUSH TOE (TYP.)
VEG PLOT 4
STA. 12+91.22
X-10
IN-STREAM GAUGE # 1
10+00
11+00
12+00
13+00
14+00
STA. 12+46.07
RVP-MY0
FIBER OPTIC CABLE MARKER
30" POPLAR
WOOD FENCE
CONCRETE HEADWALL
48" CMP
INV. IN: 1011.90'
INV. OUT: 1010.36'
RIP RAP OUTLET
36" RCP
INV. IN: 1014.05'
INV. OUT: 1012.93'
LOG DROP INSTALLED IN PLACE OF BOULDER STEP
LOG J-HOOK VANE INSTALLED IN PLACE OF GRADE CONTROL J-HOOK VANE
ROCK FORD STREAM CROSSING INSTALLED IN PLACE OF 48" RCP AND PLUNGE POOL
GATE
BARBED WIRE FENCE
LOG DROP INSTALLED IN PLACE OF BOULDER STEP
AS-BUILT TOP OF BANK (TYP.)
MATCH LINE - SEE SHEET 7
WLB
BKM

ANGELA D. MEADOWS
PIN: 5926-00-90-1044
PORTION OF DB: 1153 PG: 678
PORTION OF LOT 5, PB: 9 PG: 64

BEGIN UT5
STA. 10+00.41

FRANCES F. ATKINS
CLAYTON FULK (LE)
PIN: 5926-00-91-0590
DB: 1218 PG: 345, TRACT 2
PB: 9 PG: 64, LOT 2

FILL EXISTING CHANNEL

CHANNEL PLUG

AS-BUILT LEGEND

- PROPOSED DESIGN
- AS-BUILT SURVEY BY KEE MAPPING & SURVEYING 10/20/21 & 2/17/22
- RED LINE VARIATIONS FROM ORIGINAL DESIGN SEALED BY KATHLEEN M. McKEITHAN, PE

WHITTIER CREEK AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

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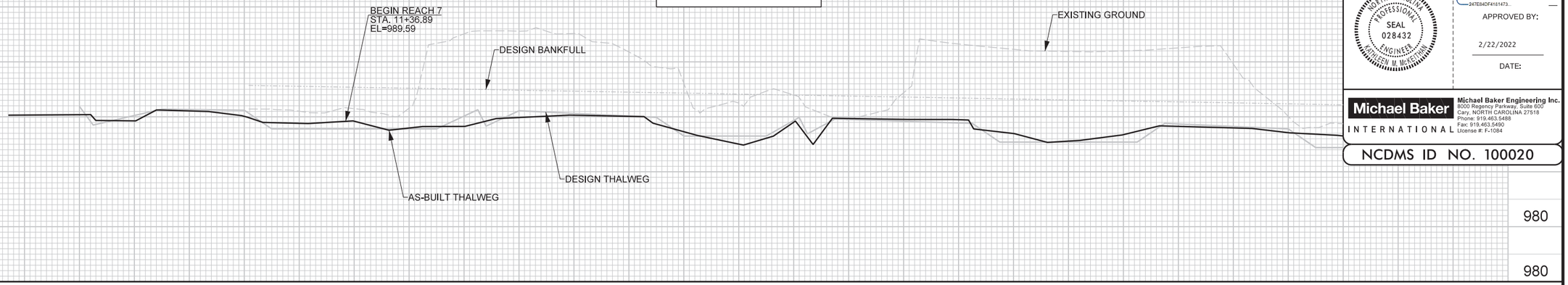

BAKER PROJECT REFERENCE NO.	SHEET NO.
162039	9

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M. McKEITHAN

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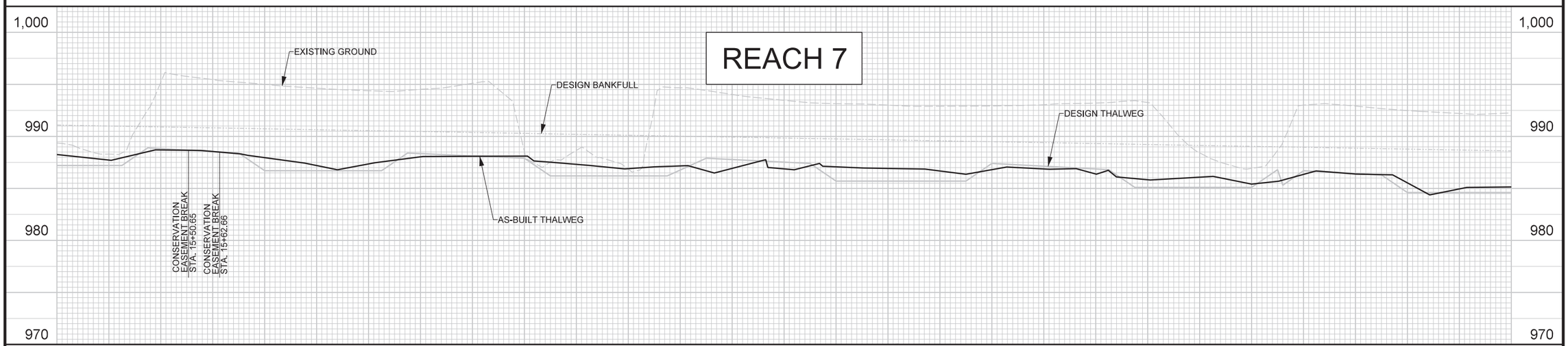
REACH 7



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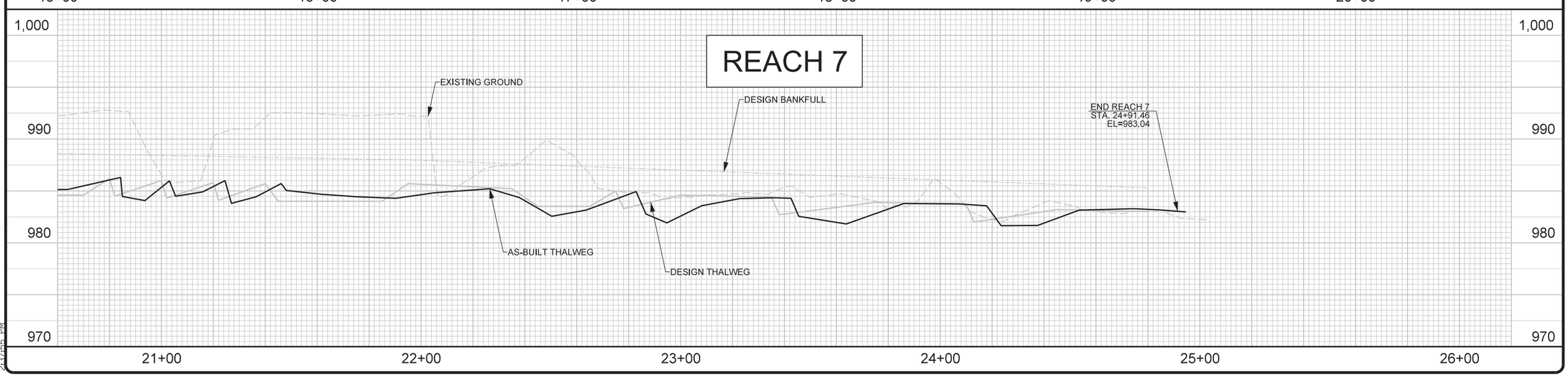

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162039	10

PROJECT ENGINEER

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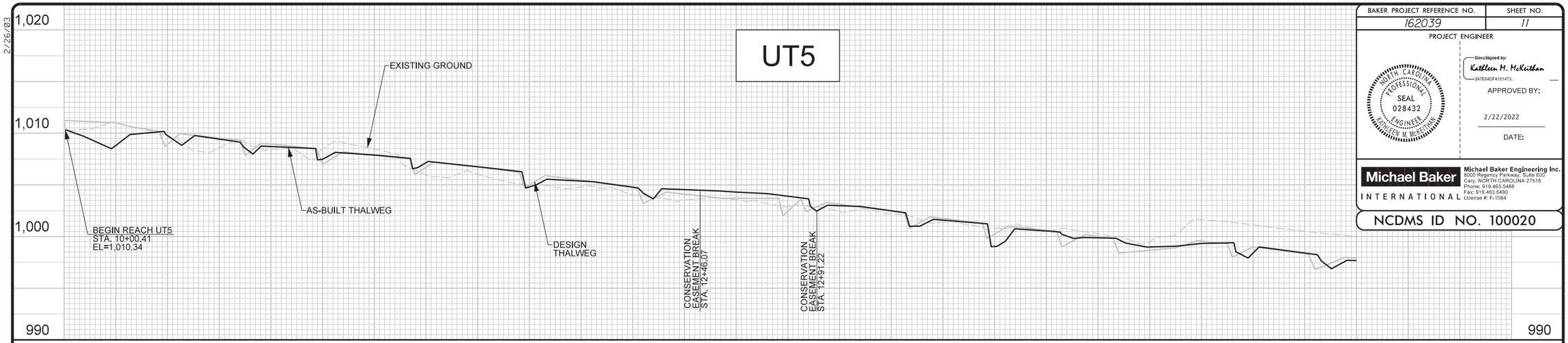

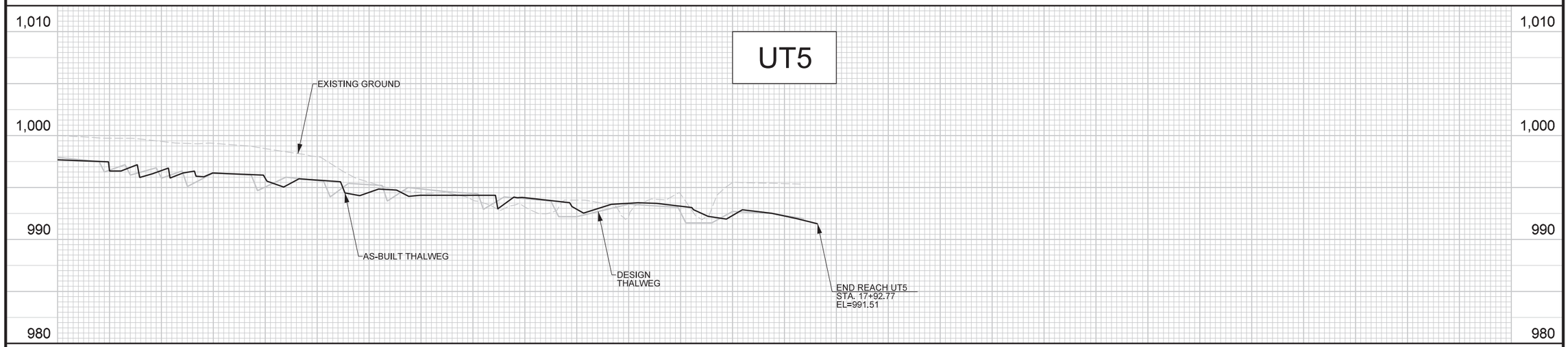

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162039	11

PROJECT ENGINEER

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