As-built Baseline Monitoring Report FINAL
Lochill Farm Stream Mitigation Project

DMS Project ID No. 97083, DEQ Contract No. 6828

USACE Action ID No. SAW-2016-00881, DWR# 16-0370

Orange County, North Carolina, Neuse River Basin: 03020201-030030

Baseline Data Collection Period: Dec. 2018 to Feb. 2019

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
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Submission Date: April 2019

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May 20, 2019

Lindsay Crocker, Project Manager
NCDEQ, Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Subject: Response to DMS Comments for DRAFT As-Built Baseline Report
Lochill Farm Stream Mitigation Project, Orange County
DMS Project # 97083, DEQ Contract #6828, Neuse-01 River Basin

Ms. Crocker:

Please find enclosed our responses to the NC Division of Mitigation Services (DMS) review comments dated April 24, 2019 in reference to the Lochill Farm Stream Mitigation Project - DRAFT As-Built Baseline Report. We have revised the draft document in response to the review comments as outlined below.

Digital files:

1. Provide the riparian buffer shapefiles for credit. These should match the numbers in the asset table.

Response: A new shapefile has been added to the digital submission file for the riparian buffer features and it was confirmed to match the numbers found in the asset table.

Report Comments/Questions:

2. Section 1.6: remove end of last sentence after the comma. Contract is independent of assets.
   Response: Completed as requested.
3. Monitoring: are the crest gauges manual to document overbank events or auto recording pressure transducers. If they are manual, this is fine to leave in report but if not, revise language to be specific.
   Response: One of the crest gauges is an auto recording device while the other two are cork gauges. The text was revised to clarify.
4. Riparian Buffer restoration:
   - Add Riparian Buffer asset onto your Figure 2 to show those assets by type. Alternatively, provide a secondary figure for those assets.
     Response: A new figure was created to clearly show both the stream and riparian buffer assets on the project.
   - Add a sentence or two in the Project Success Criteria and/or Mitigation Component Summary to describe/cover Riparian Buffer project component for DWR (reference meeting success per 15A NCAC 02B .0295 and 5-year monitoring requirement, etc).
     Response: As advised, additional text was added to the Project Success Criteria section to clarify issues related to the riparian buffer assets.
5. As-Built drawings: can Katie seal these drawings for the final report?
   Response: The As-Built plan sheets have been signed/sealed by both the PE (Katie McKeithan) and the PLS (Brad Kee).
6. Table 1. Thank you for the transparency and clarity in your asset table and explanations of deviation from constructed stream lengths. There has been some recent conflicting direction on what to measure and how to account for crediting. Based on the most recent direction provided to DMS, please revise the table as follows:

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- Update Mitigation Credits column to show/revert to Mitigation Plan Credits. These are considered final approved credit amounts by the IRT. Any change from these will require a petition and request to modify the Mitigation Plan per IRT. This change will also require the report to be updated on Page 3 in the total stream mitigation credits shown.
- Revise column name 'Creditable Footage' to show as 'As-Built Centerline (ft)'
- Revise column name 'Restored Footage' to show 'As-Built Restored (ft)'
- Add an additional column to show 'Mitigation Plan Designed (ft)' and populate this from Mitigation Plan.
  Response: All of the above requested changes to the credits and assets in Table 1 were completed.
- LI and & LII are listed on this table under the Approach column. Does it mean to show EI and EII?
  Response: That 'Approach Level' column is intended to provide more detail to the previous 'Restoration Level' column. The LII and LI listed for Reaches R2 and R3 both have Enhancement as their restoration level and are meant to stand for Level II and Level I Enhancement respectively for those reaches.
- DMS apologies for any deviations we are asking from previous templates.
  Response: We completely understand and thank you for working with us on the changes.

Baker has provided three (3) hardcopies of the FINAL report, and the updated e-submission digital files will be sent via secure ftp link. Please do not hesitate to contact me should you have any questions regarding our response submittal.

Sincerely,

Scott King, LSS, PWS
Project Manager

Enclosures

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APPENDICES

1.0 PROJECT SUMMARY

1.1 Project Description

Michael Baker Engineering, Inc. (Michael Baker) restored approximately 3,245 linear feet of existing jurisdictional stream, enhanced 2,227 linear feet of stream, and preserved 733 linear feet of unnamed tributaries to Buckwater Creek. Michael Baker also re-established approximately 3.9-acres of forested riparian buffer associated with this stream system and preserved an additional 11.9-acres. The project is located in the Neuse River Basin, within the Hydrologic Unit Code (HUC) 03020201-030030 (the Middle Eno River), which is identified as a Targeted Local Watershed (TLW) in DMS's 2010 Neuse River Basin Restoration Priority (RBRP) Plan and its March 2016 Update.

The Lochill Farm Stream Mitigation project is located on an active horse farm in Orange County, North Carolina, 6.2 miles northeast of the Town of Hillsborough (Figure 1). Historic agriculture uses on the project site include horse, cattle, and sheep animal operations as well as tobacco and small grain row-cropping and timber harvesting. 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 4,113 stream mitigation credits and 176,511 buffer mitigation credits (Table 1) and is protected by a 15.8-acre permanent conservation easement.

1.2 Goals and Objectives

The goals of this project are identified below:

- Reconnect stream reaches to their floodplains
- Stabilize steep and/or eroding stream banks
- Improve in-stream habitat
- Reestablish forested riparian buffers
- Permanently protect the project

To accomplish these goals, the following objectives were identified:

- To restore appropriate bankfull dimensions, remove spoil berms, and/or raise channel beds, by utilizing either a Priority I Restoration approach (R1) or an Enhancement Level I approach (R3).
- 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, with structures including cross vanes, geo-lifts, brush-toe, log vanes/weirs, boulder sills, root wads, and/or J-hooks. Also repair stream disconnects in the channels caused by clogged pipe culverts.
- Establish riparian buffers at a 50 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. The performance standards for the riparian buffer assets will be held in accordance with 15A NCAC 02B.0295(n)(2)(B) and 15A NCAC 02B.0295(n)(4), and annual monitoring reports will be submitted at the end of each of the first five monitoring years.

1.4 Mitigation Component Summary

The project involved the restoration, enhancement, or preservation of seven reaches. Reach R1 (Finches Branch) was restored to a Rosgen Type-C stream using a Priority Level I approach. The stream had been straightened and relocated, which caused it to become incised and eroded. The channel was restored by raising the streambed and relocating the channel towards the center of the valley. Multiple in-stream structures were installed throughout the reach to control grade, dissipate energy, protect streambanks, and create bedform/habitat diversity.

Reach R2 is a spring-fed stream located near the upper section of Reach R1. The stream had been ditched and straightened and lacked a full buffer. The stream still maintained some functional value however, so an Enhancement Level II approach was used. A stream disconnect was repaired, while the lowermost 120 ft was relocated to better reconnect with the restored Reach R1 and includes two structures and a pool feature.

Reach R3 was improved using an Enhancement Level I approach. The uppermost 450 feet and lowermost 100 feet of the reach were both relocated with improved pattern, profile, and channel dimensions. Much of the rest of Reach R3 retained its existing alignment, though many sections were graded back to improve channel dimensions and two stream disconnects were repaired. Additionally, many in-stream structures were installed throughout the reach to control grade, promote bedform/habitat diversity, and to protect streambanks from erosion.

Reaches T1, T2, T3, and T4 are all small, spring-fed streams that were largely preserved within the conservation easement. These reaches are tributaries that feed into Reaches R1 and R3 and were not significantly modified except where necessary to connect back into their restored adjacent reach.

Additionally, a full 50’ buffer was established around all project streams, resulting in the ultimate re-establishment of 3.8-acres of forested riparian buffer that had previously been in hay production or pasture. The entire project area will be preserved in perpetuity in a 15.8-acre permanent conservation easement. A full summary of the project components and mitigation credits is presented in Table 1, while the complete project assets are shown in Figure 2.

1.5 Project Timeline

Project construction was initiated in May 2018 and completed in November 2018. Livestakes were planted in December 2018, while bareroot stems were planted in January 2019. The As-Built survey was completed in December of 2018. All 12 cross-sections (6 riffle and 6 pool) and 3 crest gauges were installed in December 2018, while the 3 groundwater monitoring wells were installed in January of 2019. The 6 vegetation plots (5 permanent and 1 random) were installed in February of 2019. The crest gauge located at the bottom of R1 is an auto-recording pressure transducer, while the crest gauges located at the top of R1 and top of R3 are manual cork-and-dowel type gauges. Construction delays occurred due to substantial seasonal rainfall, especially from Hurricanes Florence and Michael in September and October

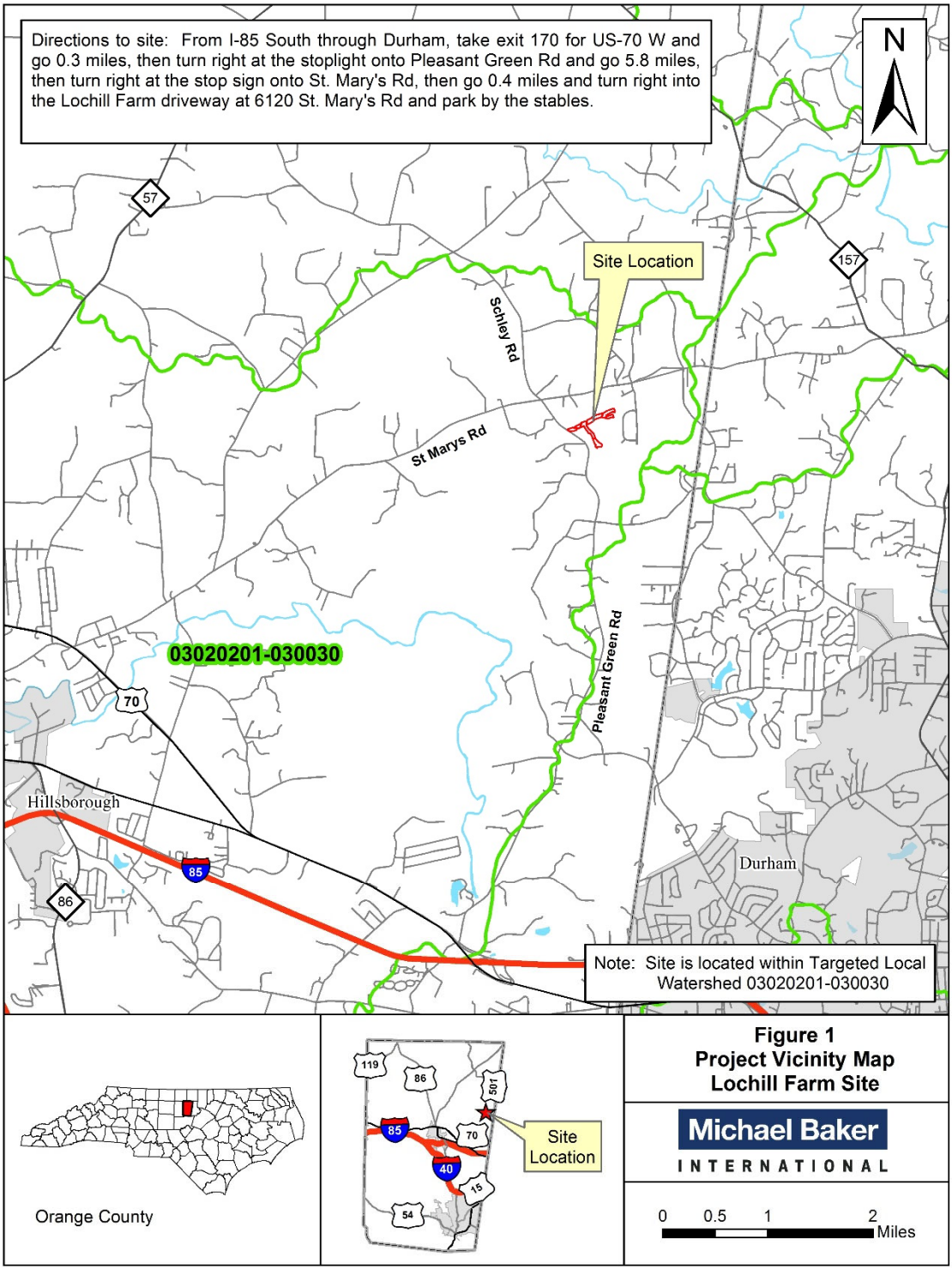
2018. Repair work was necessary following those events (mostly riffle and bank repairs and floodplain reseeding – no structures were damaged), which delayed project completion until November 2018. However, the site was fully planted in the winter of 2018-2019 as anticipated and Monitoring Year 1 is on schedule for 2019 as shown in Table 2.

1.6 Design Change Deviations

During project construction, there were a few, relatively minor deviations from the original design plans as marked in red in the as-built plans (Appendix E). Primarily these were structure substitutions made in the field due to the presence of bedrock in the bank or channel bed, such as along Reach R1 where boulder-toe was installed in place of the brush-toe along two stream bends, or at the top of Reach R3 where the single 48-inch pipe was replaced with dual 30-inch pipes. But none of these minor changes should negatively affect stream performance, function, or credit. Additionally, the 48-inch pipe crossing located outside the easement originally planned for Reach R1 will instead be replaced by a small bridge. IRT comments during site walkovers encouraged the use of an elliptical culvert here and though the standard pipe crossing was in the approved plans, Michael Baker worked with the landowner to have that replaced with a more aesthetically-pleasing bridge that more closely mimics an elliptical culvert, and which also has a much smaller impact in the floodplain. The pipe crossing would have required a long earthen ramp on either side of the pipe and also precluded the presence of natural stream bed and banks for this section of channel. This change is expected to slightly improve stream performance and function, and will not affect stream credits as it is located outside the conservation easement area.

There were, however, slight modifications made to the alignments of the lowermost sections of Reaches R2, T1, and T2 where they connect back into their adjacent larger reach. These changes resulted in slightly shorter reach lengths that may reduce the resulting credits. The alignment for Reach R2 was adjusted to avoid having to clear several mature trees, which resulted in a 12-ft shorter length. Reach T1 was originally designed to tie back into the adjacent Reach R1 at the end of a riffle, but it was agreed in the field that this design resulted in a parallel channel that was too long and too close to R1, with the potential to undermine or destabilize the bank in high flow conditions. Thus, it was relocated to more directly tie into R1 at the top of a riffle, resulting in a 30-ft shortening of T1. Reach T2 was also shortened by 5-ft to avoid established, mature vegetation.

1.7 Vicinity Map



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, which was derived from the As-built Survey. 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 six 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 groundwater monitoring wells were installed in the floodplain along Reach R1 following USACE protocols (USACE 2005). The gauges themselves are all In-Situ brand Rugged Troll 100 data loggers. These were installed at the behest of NCDWR to provide supplemental information about the stream restoration's effect on the existing adjacent jurisdictional wetlands. If during monitoring it becomes clear that the restored stream is not having any detrimental impact to the wetlands, Michael Baker may request to the IRT that the wells be removed.

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. 2010. Neuse River Basin Restoration Priorities. NC Department of Environmental Quality. Raleigh, NC.

North Carolina Division of Mitigation Services. 2016. Neuse River Basin Restoration Priorities: Neuse-01 Catalog Unit *Update*. 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.

United States Army Corps of Engineers (USACE). 2005. "Technical Standard for Water-Table Monitoring of Potential Wetland Sites," WRAP Technical Notes Collection (ERDC TN-WRAP-05-2), U.S. Army Engineer Research and Development Center. Vicksburg, MS.

APPENDIX A

Background Tables and Figures

Table 1. Project Components and Mitigation Credits
Lochill Farm Stream Mitigation Project - NCDMS Project No. 97083

Project Component (reach ID, etc.)	Wetland Position and HydroType	Existing Footage or Acreage	Stationing	As-Built Restored Footage, or SF [1]	As-Built Centerline Footage, or SF [2]	Mitigation Plan Designed Footage	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Plan Credits [3]
Reach R1		2,925	10+00 -42+45	3,245	3,105	3,105	R	PI	1	3,105
Reach R2		590	10+00 -16+05	605	588	600	E	LII	5	120
Reach R3		1,697	10+00 - 26+22	1,622	1,602	1,602	E	LI	2	801
Reach T1		96	10+00 - 10+73	73	73	104	P	-	5	21
Reach T2		49	10+00 - 10+54	54	54	59	P	-	10	6
Reach T3		482	10+00 - 14+82	482	482	482	P	-	10	48
Reach T3b		34	10+00 - 10+34	34	34	34	P	-	10	3
Reach T4		89	10+00 - 10+90	90	89	89	P	-	10	9
Wetland Group 1										
Buffer Group 1 (BG1)				169,553	169,553		R		1	169,553
Buffer Group 2 (BG2)				13,067	13,067		P		5	2,613
Buffer Group 3 (BG3)				424,955	43,451		P		10	4,345

1 All stream stationing and restored footage numbers reported here, discussed in the report text, and shown in the as-built plan sheets use *thalweg* survey values.

2 The stream footage reported here uses the as-built stream *centerline* survey values and have all easement breaks removed from their totals. Buffer group values reported here are the creditable areas as allowed for each group as described in detail in the mitigation plan.

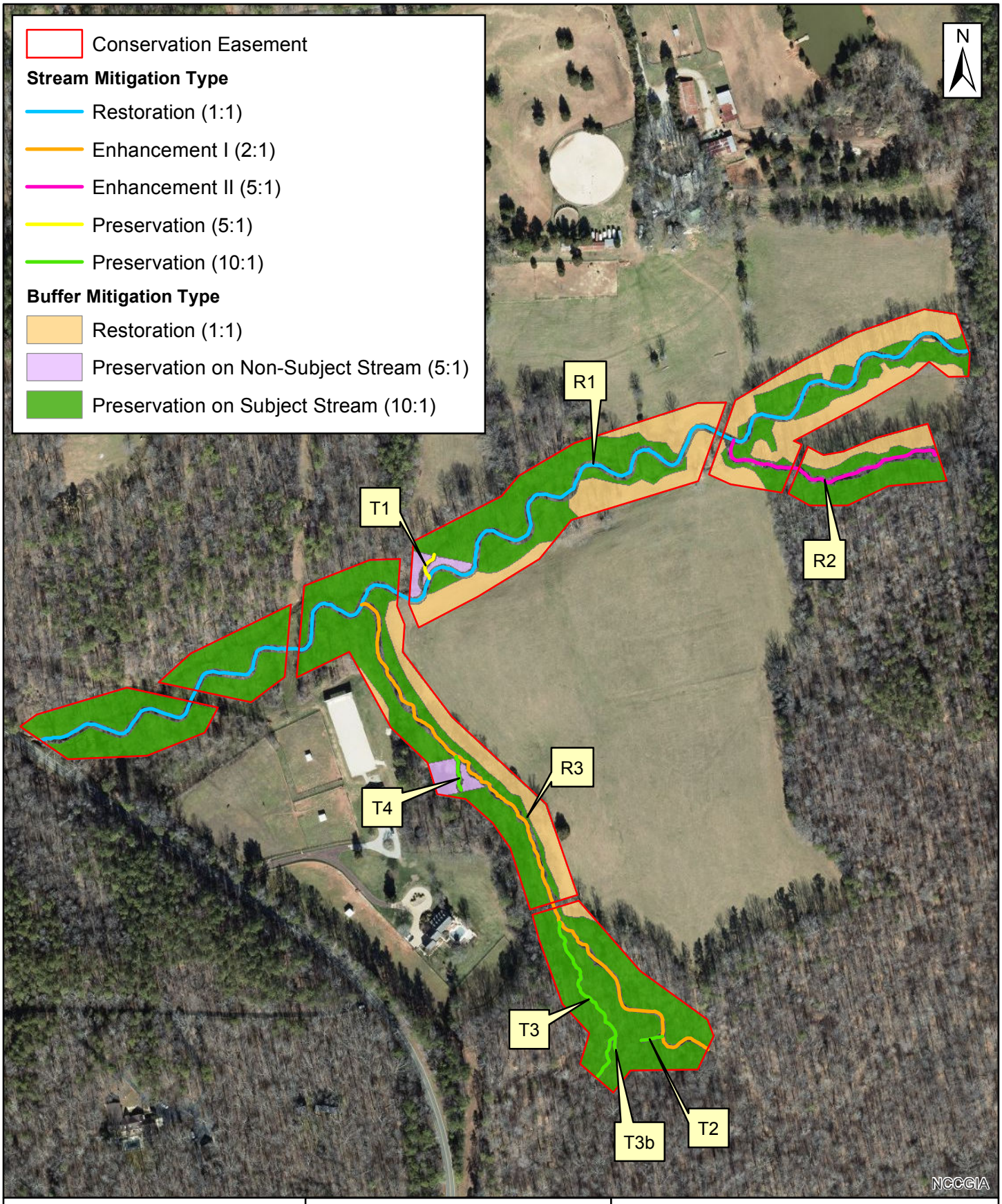
3 Credits reported here are taken directly from the approved mitigation plan Table 11.1

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 (square feet)
		Riverine	Non-Riverine		
Restoration	3,105				169,553
Enhancement					
Enhancement I	1,602				
Enhancement II	588				
Creation					
Preservation	732				56,518
High Quality Pres					

Table 1.2
Overall Assets Summary

Asset Category	Overall Credits
Stream	**4,113**
RP Wetland	**-**
NR Wetland	**-**
Buffer	**176,511**



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0 250 500 Feet

Figure 2
Project Asset Map
(Stream and Riparian Buffer)
Lochill Farm Site

Table 2. Project Activity and Reporting History
Lochill Farm Stream Mitigation Project - NCDMS Project No. 97083

Elapsed Time Since grading complete:	**5 months**
Elapsed Time Since planting complete:	**3 months**
Number of Reporting Years[1]:	**0**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
404 permit date	N/A	Mar-18
Mitigation Plan	N/A	Jan-18
Final Design – Construction Plans	N/A	Nov-17
Construction Grading Completed	N/A	Nov-18
As-Built Survey	Dec-18	Dec-18
Livestake and Bareroot Planting Completed	N/A	Jan-19
As-Built Baseline Monitoring Report (MY0)	Feb-19	Apr-19
Year 1 Monitoring (anticipated)	Oct-19	Dec-19
Year 2 Monitoring (anticipated)	Oct-20	Dec-20
Year 3 Monitoring (anticipated)	Oct-21	Dec-21
Year 4 Monitoring (anticipated)	Oct-22	Dec-22
Year 5 Monitoring (anticipated)	Oct-23	Dec-23
Year 6 Monitoring (anticipoated)	Oct-24	Dec-24
Year 7 Monitoring (anticipated)	Oct-25	Dec-25

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

Table 3. Project Contacts
Lochill Farm Stream Mitigation Project - NCDMS Project No. 97083

Designer	8000 Regency Parkway, Suite 600
Michael Baker Engineering, Inc.	Cary, NC 27518 Contact: Scott King, Tel. 919-481-5731
Construction Contractor	114 W. Main St.
River Works, Inc.	Clayton, NC 27520 Contact: Bill Wright, Tel. 919-590-5193
Survey Contractor	88 Central Avenue
Kee Mapping and Surveying	Asheville, NC 28801 Contact: Brad Kee, Tel. 828-575-9021
Planting Contractor	114 W. Main St.
River Works, Inc.	Clayton, NC 27520 Contact: Bill Wright, Tel. 919-590-5193
Seeding Contractor	114 W. Main St.
River Works, Inc.	Clayton, NC 27520 Contact: Bill Wright, Tel. 919-590-5193
Seed Mix Sources	
Green Resources	Telephone: 336-855-6363
Nursery Stock Suppliers	
Mellow Marsh Farm	Telephone: 919-742-1200
ArborGen	Telephone: 843-528-3204
Monitoring Performers	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 600 Cary, NC 27518
Stream Monitoring POC	Scott King, Tel. 919-481-5745
Vegetation Monitoring POC	Scott King, Tel. 919-481-5745

Table 4. Project Attributes
Lochill Farm Stream Mitigation Project - NCDMS Project No. 97083

Project Name	Lochill Farm Stream Mitigation Project			
County	Orange County			
Project Area (acres)	15.8			
Project Coordinates (latitude and longitude)	36.113419 N, -78.991165 W			
Planted Acreage (Acres of Woody Stems Planted)	8.1			
Project Watershed Summary Information				
Physiographic Province	Piedmont			
River Basin	Neuse			
USGS Hydrologic Unit 8-digit: 3020201	USGS Hydrologic Unit 14-digit: 3020201-030030			
DWR Sub-basin	03-04-01			
Project Drainage Area (Acres and Square Miles)	1,020 acres/1.59 square miles (at downstream end of R1)			
Project Drainage Area Percentage of Impervious Area	<1% impervious area			
CGIA Land Use Classification	80.6% forested, 12.7% agriculture, 6.5% developed, 0.2% open water			
Existing Reach Summary Information				
Parameters	**Reach R1**	**Reach R2**	**Reach R3**	**Reach T1**
Length of reach (linear feet)	2,925	590	1,697	96
Valley confinement (Confined, moderately confined, unconfined)	Unconfined	Unconfined	Unconfined	Unconfined
Drainage area (Acres)	1,020	12	190	0.8
Perennial, Intermittent, Ephemeral	Perennial	Intermittent	Perennial	Intermittent
NCDWR Water Quality Classification	WS-IV, NSW	WS-IV, NSW	WS-IV, NSW	WS-IV, NSW
Stream Classification (existing)	E4 (incised)	B5	E4b to B4	E5
Stream Classification (proposed)	C4	B5	C4b	E5
Evolutionary trend (Simon)	IV - Degradation and Widening	I - Stable System	IV - Degradation and Widening	I - Stable System
FEMA classification	Zone X	Zone X	Zone X	Zone X
Existing Reach Summary Information				
Parameters	**Reach T2**	**Reach T3**	**Reach T3b**	**Reach T4**
Length of reach (linear feet)	49	482	34	89
Valley confinement (Confined, moderately confined, unconfined)	Unconfined	Unconfined	Unconfined	Unconfined
Drainage area (Acres and Square Miles)	0.7	37	36	2.9
Perennial, Intermittent, Ephemeral	Intermittent	Perennial	Perennial	Perennial
NCDWR Water Quality Classification	WS-IV, NSW	WS-IV, NSW	WS-IV, NSW	WS-IV, NSW
Stream Classification (existing)	E5	E5	E5	E5
Stream Classification (proposed)	E5	R5	E5	E5
Evolutionary trend (Simon)	I - Stable System	I - Stable System	I - Stable System	I - Stable System
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 / NWP 27 / JD	
Water of the United States - Section 401	Yes	Yes	PCN / NWP 27 / JD	
Endangered Species Act	Yes	Yes	Categorical Exclusion	
Historic Preservation Act	Yes	Yes	Categorical Exclusion	
Coastal Zone Management Act (CZMA or 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

Conservation Easement
Cross-Section
Groundwater Well
Crest Gauge
Photo-Point

Vegetation Plots

Permanent Plot (5)
Random Plot (1)
Stream Structures
Stream Top-of-Bank

Reaches by Mitigation Type

Restoration
Enhancement I
Enhancement II
Preservation

R1
R2
R3
T1
T2
T3
T4
PP1
PP2
PP3
PP4
PP5
PP6
PP7
PP8
PP9
PP10
PP11
PP12
PP13
PP14
PP15
PP16
PP17
PP18
PP19
PP20
PP21
PP22
PP23
PP24
PP25
PP26
PP27
PP28
PP29
PP30
PP31
PP32
PP33
XS-1
XS-2
XS-3
XS-4
XS-5
XS-6
XS-7
XS-8
XS-9
XS-10
XS-11
XS-12
CG-1
CG-2
CG-3
MW1
MW2
MW3
VP-1
VP-2
VP-3
VP-4
VP-5
MY0
NCCGIA

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NCDEQ: Division of Mitigation Services
Project #97083

0 250 500 Feet

N

Figure 3. Current Condition Plan View
As-Built MY0
Lochill Farm Mitigation Project
Orange County, NC

Lochill Farm: As-Built MY0 Stream Station Photo-Points (from January 2019)

PP-1: Reach 1, view downstream, Station 10+00

PP-2: Reach 1, view downstream, Station 11+50

PP-3: Reach 1, view downstream, Station 13+75

PP-4: Reach 1, view downstream, Station 15+25

PP-5: Reach 1, view downstream, Station 16+50

PP-6: Reach 1, view upstream, Station 19+50

Lochill Farm: As-Built MY0 Stream Station Photo-Points (from January 2019)

PP-7: Reach 1, view downstream, Station 21+50

PP-8: Reach 1, view downstream, Station 23+00

PP-9: Reach 1, view downstream, Station 25+00

PP-10: Reach 1, view upstream, Station 27+50

PP-11: Reach 1, view downstream, Station 29+00

PP-12: Reach 1, view downstream, Station 30+00

Lochill Farm: As-Built MY0 Stream Station Photo-Points (from January 2019)

PP-13: Reach 1, view downstream, Station 30+50

PP-14: Reach 1, view downstream, Station 32+00

PP-15: Reach 1, view downstream, Station 33+50

PP-16: Reach 1, view downstream, Station 34+25

PP-17: Reach 1, view downstream, Station 35+75

PP-18: Reach 1, view downstream, Station 37+25

Lochill Farm: As-Built MY0 Stream Station Photo-Points (from January 2019)

PP-19: Reach 1, view downstream, Station 39+75

PP-20: Reach 1, view downstream, Station 41+00

PP-21: Reach 2, view upstream, Station 15+50

PP-22: Reach 2, view downstream, Station 15+75

PP-23: Reach 3, view upstream, Station 10+50

PP-24: Reach 3, view downstream, Station 10+75

Lochill Farm: As-Built MY0 Stream Station Photo-Points (from January 2019)

PP-25: Reach R3, view upstream, Station 11+75

PP-26: Reach 3, view downstream, Station 12+75

PP-27: Reach 3, view downstream, Station 14+00

PP-28: Reach 3, view downstream, Station 16+25

PP-29: Reach 3, view downstream, Station 18+25

PP-30: Reach 3, view downstream, Station 22+50

Lochill Farm: As-Built MY0 Stream Station Photo-Points (from January 2019)

PP-31: Reach 3, view upstream, Station 25+50

PP-32: Reach 3, view downstream, Station 25+75

PP-33: Reach T1, view downstream, Station 10+00

Lochill Farm: As-Built MY0 Vegetation Plot Photographs

Vegetation Plot 1

Vegetation Plot 2

Vegetation Plot 3

Vegetation Plot 4

Vegetation Plot 5

Random Plot MY0

Lochill Farm: As-Built MY0 Crest Gauge and Groundwater Well Photographs

Crest Gauge #1, Reach 1, Station 35+50

Crest Gauge #2, Reach 1, Station 13+50

Crest Gauge #3, Reach 3, Station 11+00

Monitoring Well #1, Reach 1, Station 20+75

Monitoring Well #2, Reach 1, Station 33+50

Monitoring Well #3, Reach 1, Station 36+25

APPENDIX C

Vegetation Plot Data

Table 5. Planted Stem Counts by Plot and Species
Lochill Farm Restoration Project: DMS Project ID No. 97083

Scientific Name	Common Name	Lochill Farm Vegetation Plots (MY0 2019)						Annual Means
		1	2	3	4	5	MY0 Random [1]	MY0 (2019)
Acer negundo	Box Elder			1	1	2	1	5
Alnus serrulata	Tag Alder		1	3	1	1		6
Asimina triloba	Pawpaw						1	1
Betula nigra	River Birch	2	7	1	4	2	2	18
Carpinus caroliniana	Iron Wood	4	3	1		1	1	10
Celtis laevigata	Sugarberry		1	2	3	1		7
Fraxinus pennsylvanica	Green Ash	3			1		1	5
Ilex verticillata	Winterberry			2	1			3
Lindera benzoin	Northern Spicebush			2	1			3
Liriodendron tulipifera	Tulip Poplar	6	1		2	1		10
Nyssa sylvatica	Black Gum				1			1
Platanus occidentalis	Sycamore	1	4	3	3	5	3	19
Quercus michauxii	Swamp Chestnut Oak				1			1
Quercus phellos	Willow Oak			2		1	4	7
Viburnum dentatum	Arrow-wood					3	2	5
Viburnum nudum	Possumhaw			2				2
	Stems/Plot	16	17	19	19	17	15	103
	Plots (ares)	1	1	1	1	1	1	6
	Plot Size (Acres)	0.025	0.025	0.025	0.025	0.025	0.025	0.148
	Stems/Acre	647	688	769	769	688	607	695

Exceeds requirements by 10%

[1] Plot 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
Lochill Farm Restoration Project: DMS Project No ID. 97083
Reach 1

Parameter	Pre-Existing Condition				Reference Reach(es) Data				Design				As-built			
					Composite											
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	10.1	12.4	-----	14.6	8.7	16.8	14.7	33.2	-----	15.7	----	----	14.6	16.0	16.6	16.9
Floodprone Width (ft)	13	56	-----	99	26	79	52	229	65	83	----	100	73	75	75	76
BF Mean Depth (ft)	1.3	1.6	-----	1.9	0.9	1.2	0.9	2.3	-----	1.2	----	----	0.9	1.2	1.2	1.3
BF Max Depth (ft)	1.9	2.3	-----	2.6	1.4	1.8	1.5	2.8	-----	1.5	----	----	1.4	1.7	1.6	1.9
BF Cross-sectional Area (ft²)	15.3	19.4	-----	23.5	10.6	23.3	13.6	75.1	-----	19.0	----	----	15.5	18.6	18.3	22.7
Width/Depth Ratio	5.2	7.9	-----	10.6	7.3	14.5	14.5	18.6	-----	13.0	----	----	12.0	14.0	12.5	18.4
Entrenchment Ratio	1.5	5.0	-----	8.5	2.0	6.6	2.9	26.3	4.1	5.3	----	6.4	4.4	4.7	4.5	5.2
Bank Height Ratio	1.7	2.2	-----	2.6	1.0	1.0	1.0	1.0	-----	1.0	----	----	1.0	1.0	1.0	1.0
d50 (mm)	17.7	21.7	-----	25.6	-----	-----	-----	-----	-----	-----	-----	-----	36	54	59	64
Pattern																
Channel Beltwidth (ft)	25	47	-----	68	14	31	28	52	56	91	-----	125	55	71	73	83
Radius of Curvature (ft)	23	44	-----	65	5	18	19	26	31	39	-----	47	30	36	35	49
Rc/Bankfull width (ft/ft)	1.5	4.0	-----	6.4	0.6	1.5	1.4	2.5	2.0	2.5	-----	3.0	1.9	2.3	2.2	3.0
Meander Wavelength (ft)	52	87	-----	121	32	87	74	196	112	152	-----	192	124	155	152	199
Meander Width Ratio	1.7	4.2	-----	6.7	1.1	2.7	2.4	6.0	3.6	5.8	-----	8.0	3.4	4.4	4.6	5.2
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	19	48	48	82
Riffle Slope (ft/ft)	-----	0.0260	-----	-----	0.0100	0.0282	0.0190	0.0670	0.0062	0.0075	-----	0.0101	0.0046	0.0070	0.0068	0.0120
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	21	35	33	62
Pool to Pool Spacing (ft)	49	130	-----	211	13	92	64	277	64	87	-----	110	49	98	102	140
Pool Max Depth (ft)	4.2	5.5	-----	6.8	1.8	2.6	2.5	4.1	2.5	3.3	-----	4.0	2.8	3.3	3.3	3.9
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / Bo%		1% / 10% / 77% / 11% / 1%			-----	-----	-----	-----	-----	-----	-----	-----		0% / 1% / 61% / 38% / 1%		
d16 / d35 / d50 / d84 / d95		4 / 9 / 13 / 49 / 110			----	-----	-----	-----	-----	-----	-----	-----		23 / 41 / 54 / 96 / 158		
Additional Reach Parameters																
Drainage Area (SM)	-----	1.59	-----	-----	0.41	2.57	0.75	8.35	-----	1.59	-----	---	-----	1.59	-----	-----
Impervious cover estimate (%)	-----	0.27%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	E4	-----	-----	-----	C4	-----	-----	-----	C4	-----	-----	-----	C4	-----	-----
BF Velocity (fps)	3.2	3.8	-----	4.3	3.5	4.3	-----	5.0	-----	3.9	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	75	-----	-----	-----	-----	-----	-----	-----	75	-----	-----	-----	-----	-----	-----
Valley Length	-----	2,559	-----	-----	-----	-----	-----	-----	-----	2,559	-----	-----	-----	2,559	-----	-----
Channel Length (ft)	-----	2,936	-----	-----	-----	-----	-----	-----	-----	3,252	-----	-----	-----	3,245	-----	-----
Sinuosity	-----	1.15	-----	-----	1.2	1.3	-----	1.4	-----	1.27	-----	-----	-----	1.27	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	0.0081	-----	-----	0.0070	0.0112	0.0132	0.0133	0.0052	0.0066	-----	0.0153	-----	0.0066	-----	-----

Table 6. Baseline Stream Data Summary
Lochill Farm Restoration Project: DMS Project No ID. 97083

Reach 3

Parameter	Pre-Existing Condition				Reference Reach(es) Data #REF!				Design				As-built			
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	6.2	8.6	-----	11.0	-----	-----	-----	-----	-----	11.0	----	----	-----	11.8	-----	-----
Floodprone Width (ft)	14	37	-----	60	-----	-----	-----	-----	24.0	42.0	----	60.0	-----	60.3	-----	-----
BF Mean Depth (ft)	0.9	1.1	-----	1.2	-----	-----	-----	-----	-----	0.9	----	----	-----	1.0	-----	-----
BF Max Depth (ft)	1.3	1.4	-----	1.4	-----	-----	-----	-----	-----	1.2	----	----	-----	1.5	-----	-----
BF Cross-sectional Area (ft²)	7.5	9.1	-----	10.6	-----	-----	-----	-----	-----	10.3	----	----	-----	12.1	-----	-----
Width/Depth Ratio	5.2	8.3	-----	11.3	12	15	-----	18	-----	12.2	----	----	-----	11.5	-----	-----
Entrenchment Ratio	2.3	3.9	-----	5.4	-----	-----	-----	-----	2.2	3.9	-----	5.5	-----	5.1	-----	-----
Bank Height Ratio	1.6	1.7	-----	1.7	-----	1.0	-----	-----	-----	1.0	-----	----	-----	1.0	-----	-----
d50 (mm)	----	23.0	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	55	-----	-----
Pattern																
*Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	54	57	-----	60	55	57	56	61
*Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	27	30	-----	33	26	30	31	33
*Rc/Bankfull width (ft/ft)	-----	-----	-----	-----	2.0	2.5	-----	3.0	2.0	2.5	-----	3.0	2.2	2.5	2.6	2.8
*Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	96	123	-----	150	94	125	128	153
*Meander Width Ratio	-----	-----	-----	-----	3.5	6.8	-----	10.0	4.9	5.2	-----	5.5	4.7	4.9	4.7	5.2
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	24	40	36	60
Riffle Slope (ft/ft)	-----	0.0258	-----	-----	-----	-----	-----	-----	-----	0.027	-----	----	-----	0.027	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	16	25	27	34
Pool to Pool Spacing (ft)	20	36	-----	51	-----	-----	-----	-----	20	39	-----	57	12	34	32	70
Pool Max Depth (ft)	1.4	1.7	-----	2.0	----	-----	-----	----	-----	2.5	-----	----	---	2.1	---	---
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / B%		1% / 11% / 68% / 20% / 0%			-----	-----	-----	-----	-----	-----	-----	-----		0% / 0% / 60% / 39% / 1%		
d16 / d35 / d50 / d84 / d95		5.9 / 13 / 23 / 79 / 141							-----	-----	-----	-----		31 / 43 / 55 / 113 / 170		
Additional Reach Parameters																
Drainage Area (SM)	-----	0.30	-----	-----	-----	-----	-----	-----	-----	0.30	-----	-----	-----	0.30	-----	-----
Impervious cover estimate (%)	-----	0.27%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
*Rosgen Classification	-----	B4 to E4b	-----	-----	-----	C4b	-----	-----	-----	C4b	-----	-----	-----	C4b	-----	-----
BF Velocity (fps)	3.6	5.5	-----	7.4	4.0	5.0	-----	6.0	-----	4.4	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	45	-----	-----	-----	-----	-----	-----	-----	45	-----	-----	-----	-----	-----	-----
Valley Length	-----	1,488	-----	-----	-----	-----	-----	-----	-----	1,488	-----	-----	-----	1,488	-----	-----
Channel Length (ft)	-----	1,599	-----	-----	-----	-----	-----	-----	-----	1,616	-----	-----	-----	1,622	-----	-----
Sinuosity	-----	1.07	-----	-----	1.1	1.2	-----	1.3	-----	1.09	-----	-----	-----	1.09	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	0.0220	-----	-----	-----	-----	-----	-----	-----	0.0216	-----	-----	-----	0.0213	-----	-----

* These parameters apply only to the upper portion of Reach R3 where the channel was relocated with improved pattern, profile, and in-stream structures.

Table 7. Cross-Section Morphology Data Summary
Lochill Farm Restoration Project: DMS Project No ID. 97083

Stream Reach	Reach 1																									
	Cross-section X-1 (Riffle)							Cross-section X-2 (Pool)							Cross-section X-3 (Pool)							Cross-section X-4 (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)	15.2							21.0							21.5							16.6						
BF Mean Depth (ft)	1.3							1.5							1.6							1.1						
Width/Depth Ratio	12.0							13.7							13.8							15.0						
BF Cross-sectional Area (ft²)	19.4							32.3							33.6							18.3						
BF Max Depth (ft)	1.9							3.2							3.3							1.6						
Width of Floodprone Area (ft)	75.3							-							-							73.0						
Entrenchment Ratio (MY1 will provide standard)*	4.9							-							-							4.4						
Bank Height Ratio (MY1 will provide standard)*	1.0							-							-							1.0						
Wetted Perimeter (ft)	15.9							22.8							23.5							17.2						
Hydraulic Radius (ft)	1.2							1.4							1.4							1.1						
d50 (mm)	36							-							-							-						

Stream Reach	Reach 1																									
	Cross-section X-5 (Riffle)							Cross-section X-6 (Pool)							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)	16.9							19.6							16.8							14.6						
BF Mean Depth (ft)	0.9							2.0							1.5							1.2						
Width/Depth Ratio	18.4							9.6							11.4							12.3						
BF Cross-sectional Area (ft²)	15.5							40.1							24.7							17.3						
BF Max Depth (ft)	1.4							3.9							2.8							1.6						
Width of Floodprone Area (ft)	75.6							-							-							75.2						
Entrenchment Ratio (MY1 will provide standard)*	4.5							-							-							5.2						
Bank Height Ratio (MY1 will provide standard)*	1.0							-							-							1.0						
Wetted Perimeter (ft)	17.4							22.4							18.3							15.4						
Hydraulic Radius (ft)	0.9							1.8							1.4							1.1						
d50 (mm)	64							-							-							-						

Stream Reach	Reach 1														Reach 3													
	Cross-section X-9 (Riffle)							Cross-section X-10 (Pool)							Cross-section X-11 (Riffle)							Cross-section X-12 (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)	16.9							14.3							11.8							16.4						
BF Mean Depth (ft)	1.3							1.9							1.0							1.0						
Width/Depth Ratio	12.5							7.6							11.5							15.9						
BF Cross-sectional Area (ft²)	22.7							26.8							12.1							16.9						
BF Max Depth (ft)	1.9							3.5							1.5							2.1						
Width of Floodprone Area (ft)	75.0							-							60.3							-						
Entrenchment Ratio (MY1 will provide standard)*	4.4							-							5.1							-						
Bank Height Ratio (MY1 will provide standard)*	1.0							-							1.0							-						
Wetted Perimeter (ft)	17.7							16.3							12.5							18.0						
Hydraulic Radius (ft)	1.3							1.6							1.0							0.9						
d50 (mm)	59							-							55							-						

Figure 3. Lochill Farm Reach 1 Longitudinal Profile

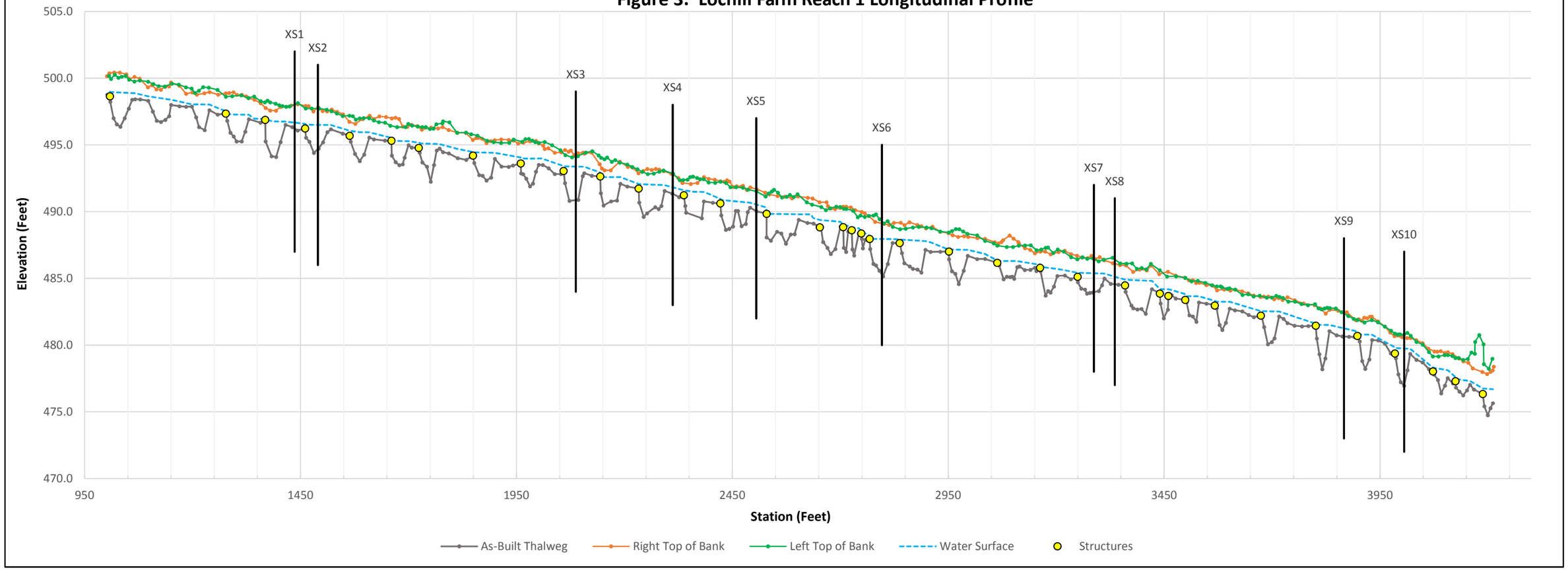


Figure 3. Lochill Farm Reach 3 Longitudinal Profile

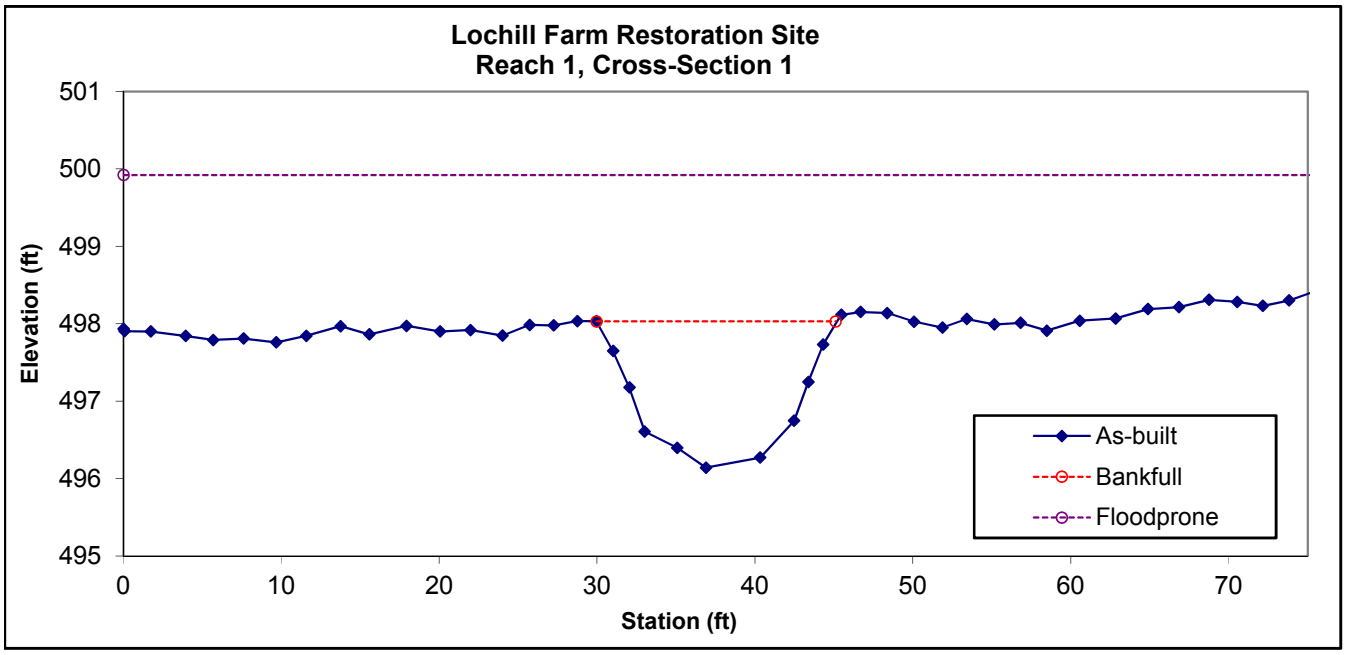
Figure 4. MY0 Cross-Sections

Permanent Cross-Section 1
(As-built Survey Data Collected: December 2018)

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	19.4	15.2	1.3	1.9	12.0	1.0	4.9	498.03	498.03



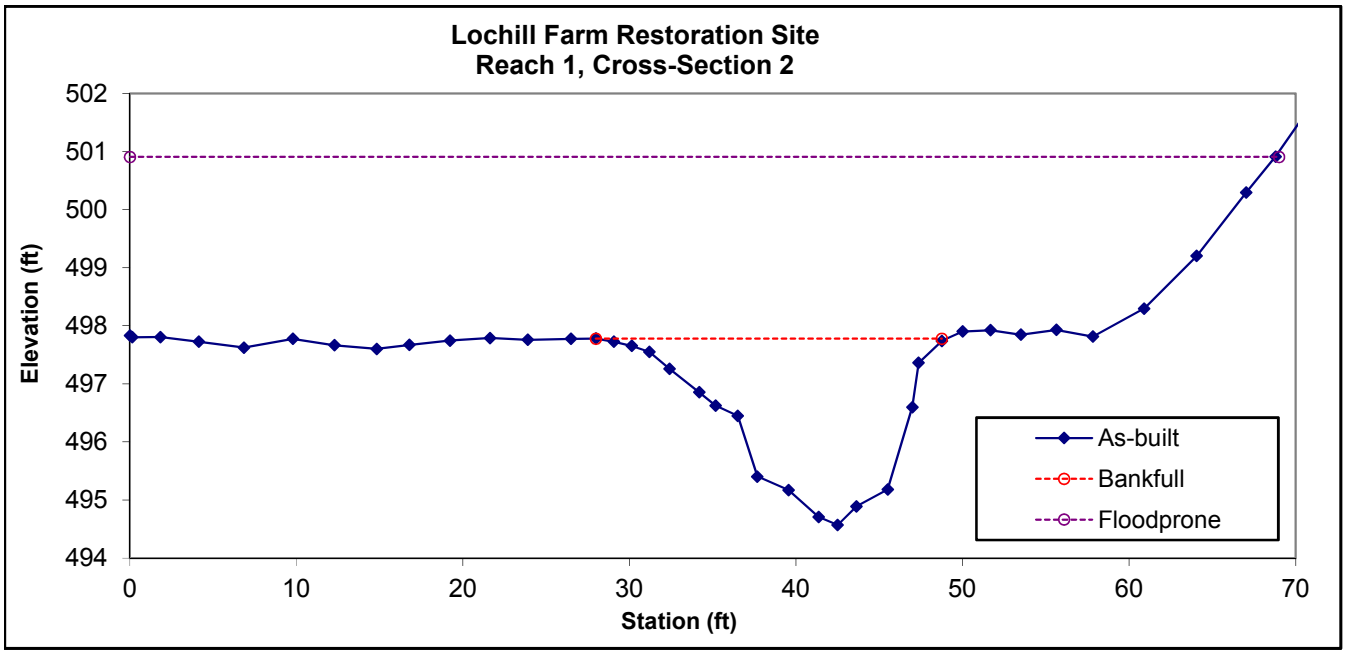
Permanent Cross-Section 2

(As-built Survey Data Collected: December 2018)

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	--	32.3	21	1.5	3.2	13.7	--	--	497.78	497.78



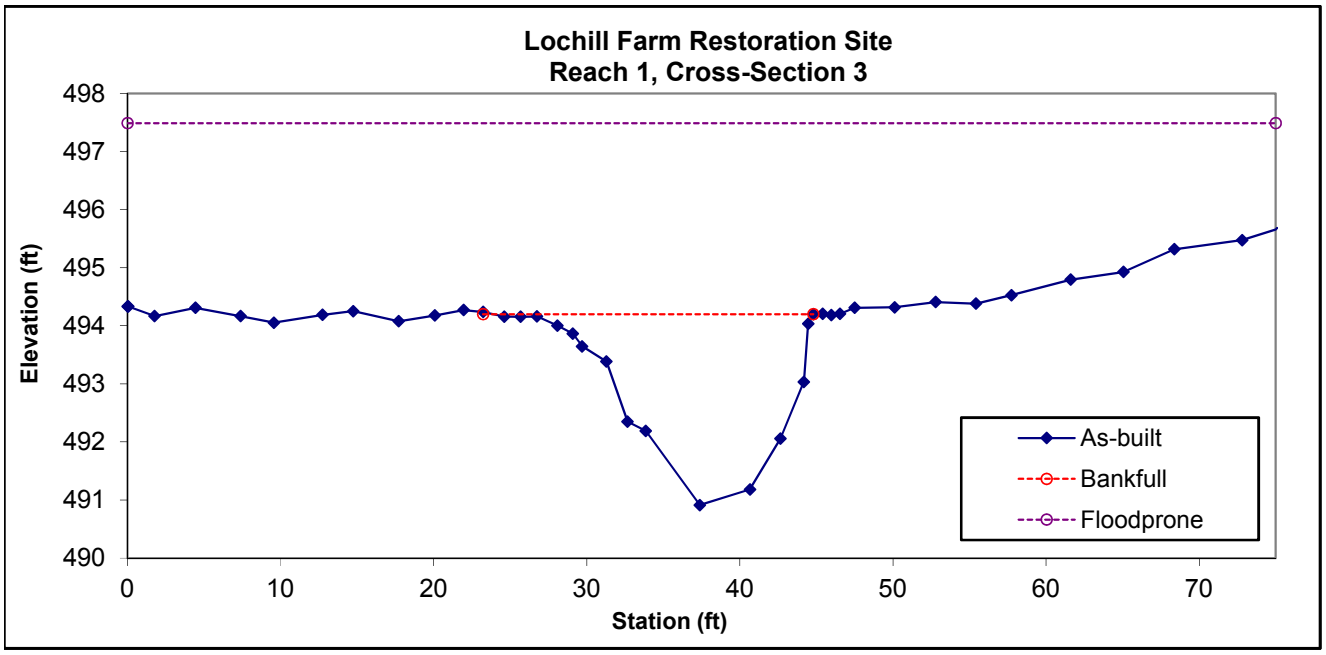
Permanent Cross-Section 3

(As-built Survey Data Collected: December 2018)

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	--	33.6	21.5	1.6	3.3	13.8	--	--	494.2	494.2



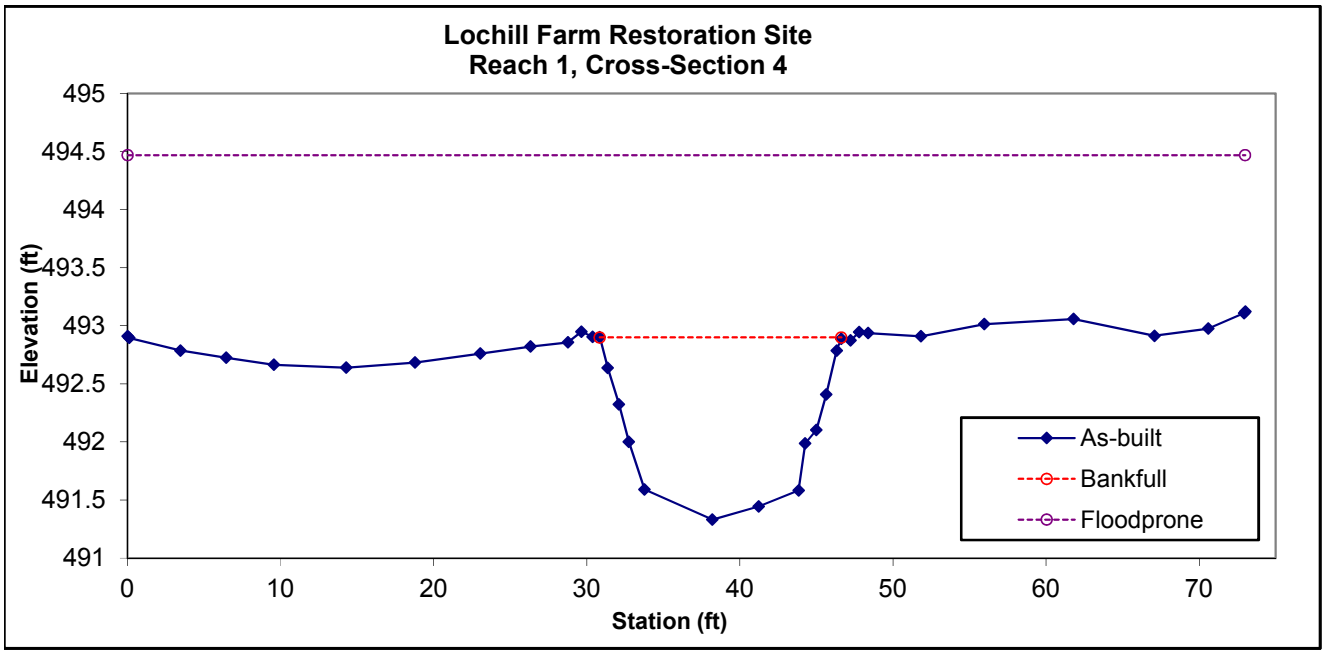
Permanent Cross-Section 4

(As-built Survey Data Collected: December 2018)

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	18.3	16.6	1.1	1.6	15.0	1.0	4.4	492.9	492.9



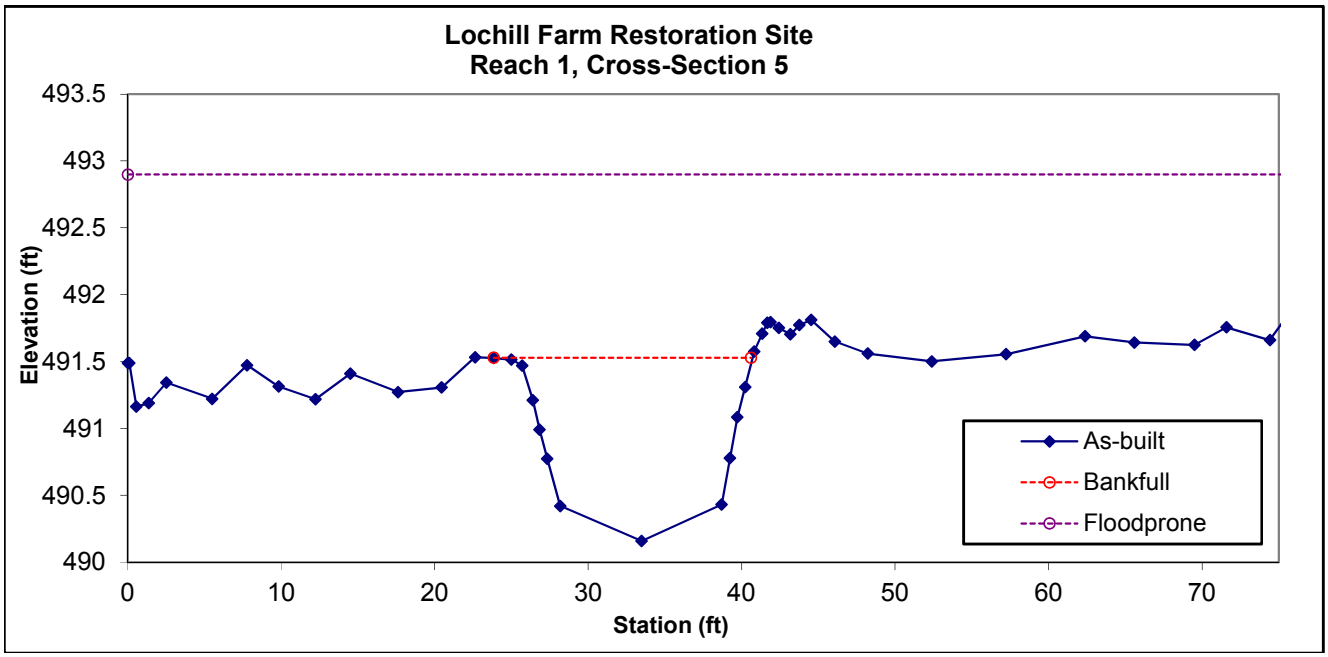
Permanent Cross-Section 5

(As-built Survey Data Collected: December 2018)

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	15.5	16.9	0.9	1.4	18.4	1.0	4.5	491.53	491.53



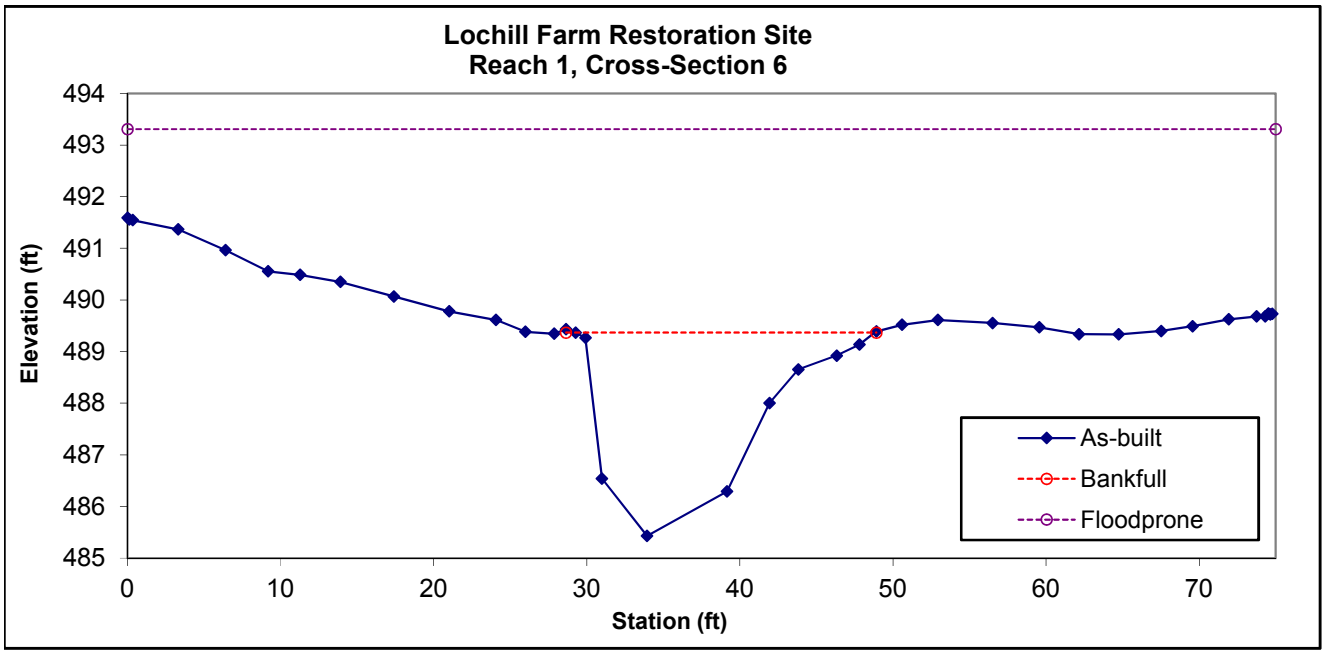
Permanent Cross-Section 6

(As-built Survey Data Collected: December 2018)

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	--	40.1	19.6	2.0	3.9	9.6	--	--	489.37	489.37



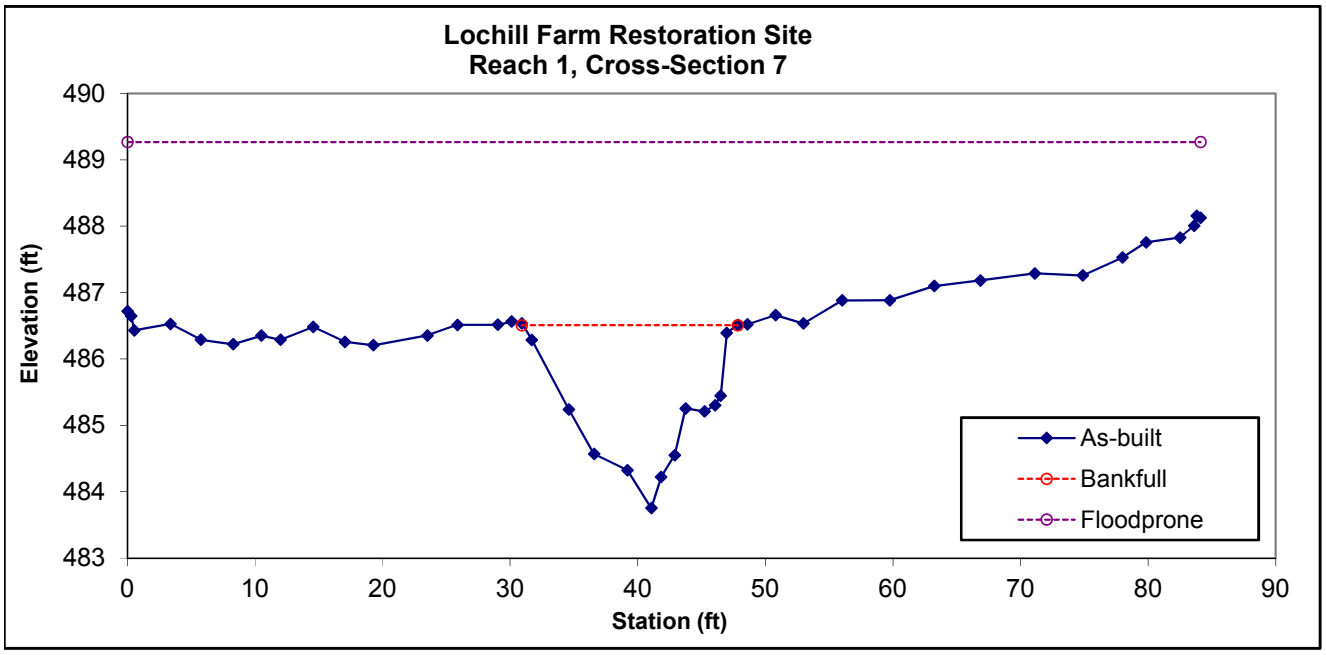
Permanent Cross-Section 7

(As-built Survey Data Collected: December 2018)

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	--	24.7	16.8	1.5	2.8	11.4	--	--	486.51	486.51



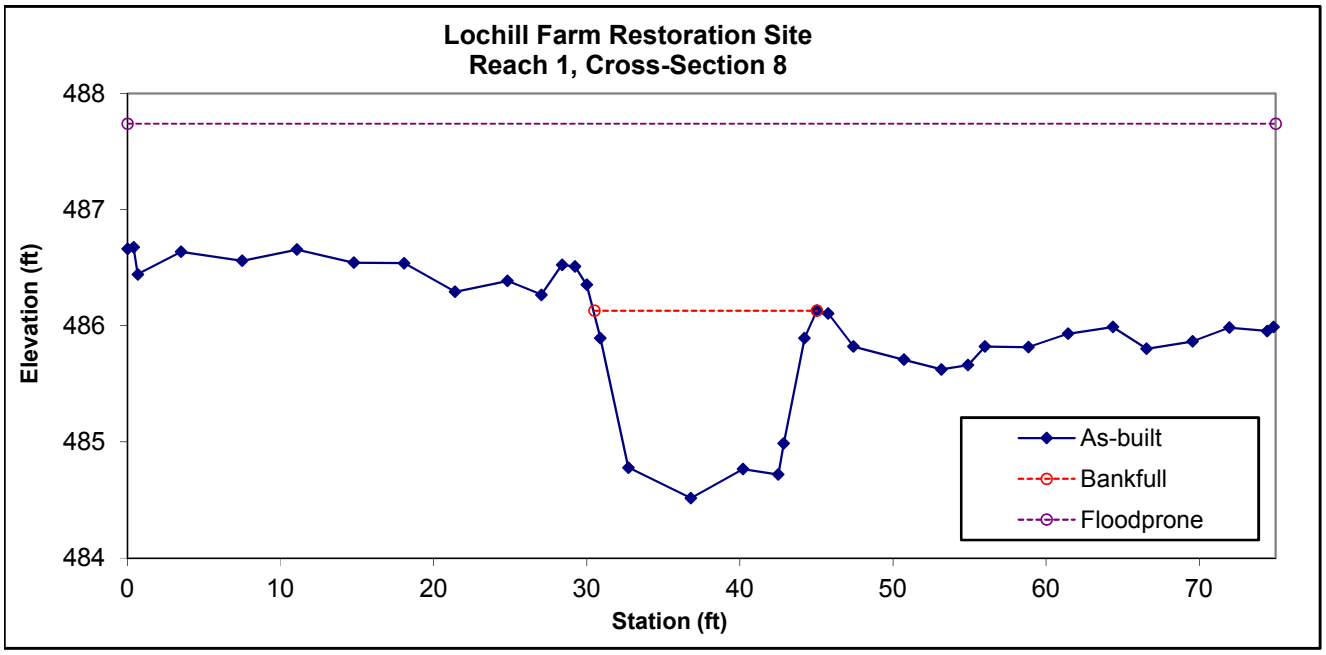
Permanent Cross-Section 8

(As-built Survey Data Collected: December 2018)

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	17.3	14.6	1.2	1.6	12.3	1.0	5.2	486.13	486.13



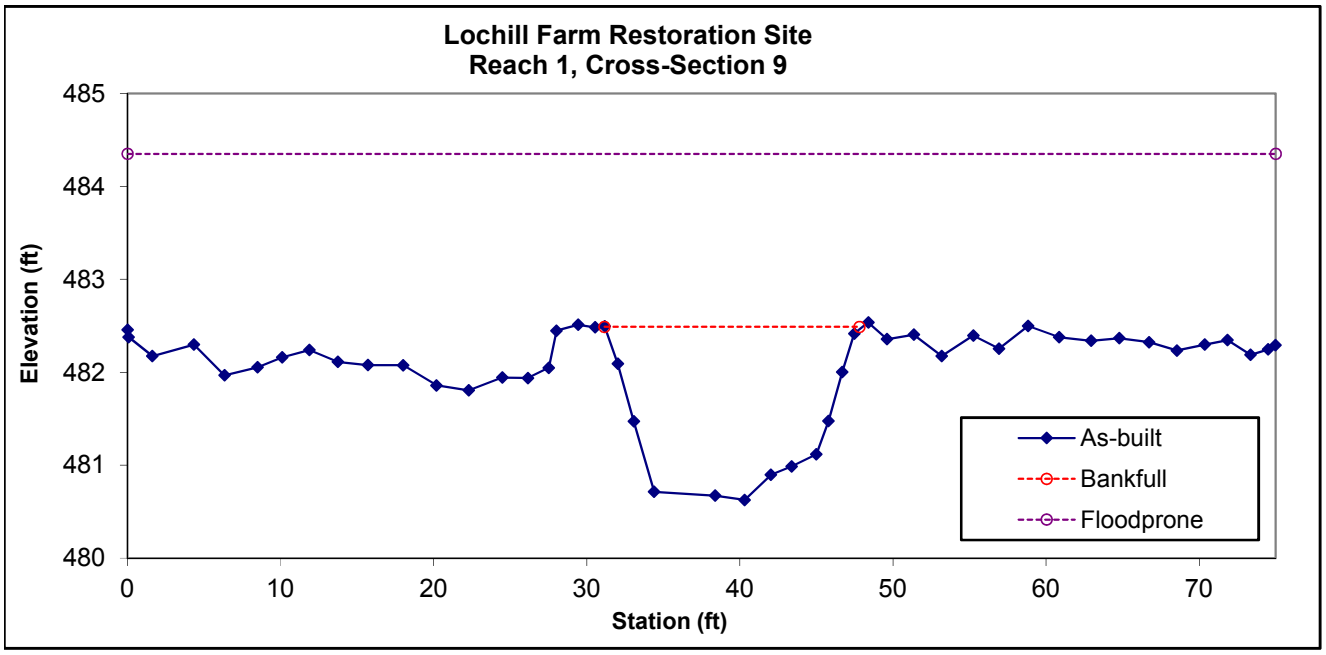
Permanent Cross-Section 9

(As-built Survey Data Collected: December 2018)

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	22.7	16.9	1.3	1.9	12.5	1.0	4.4	484.49	484.49



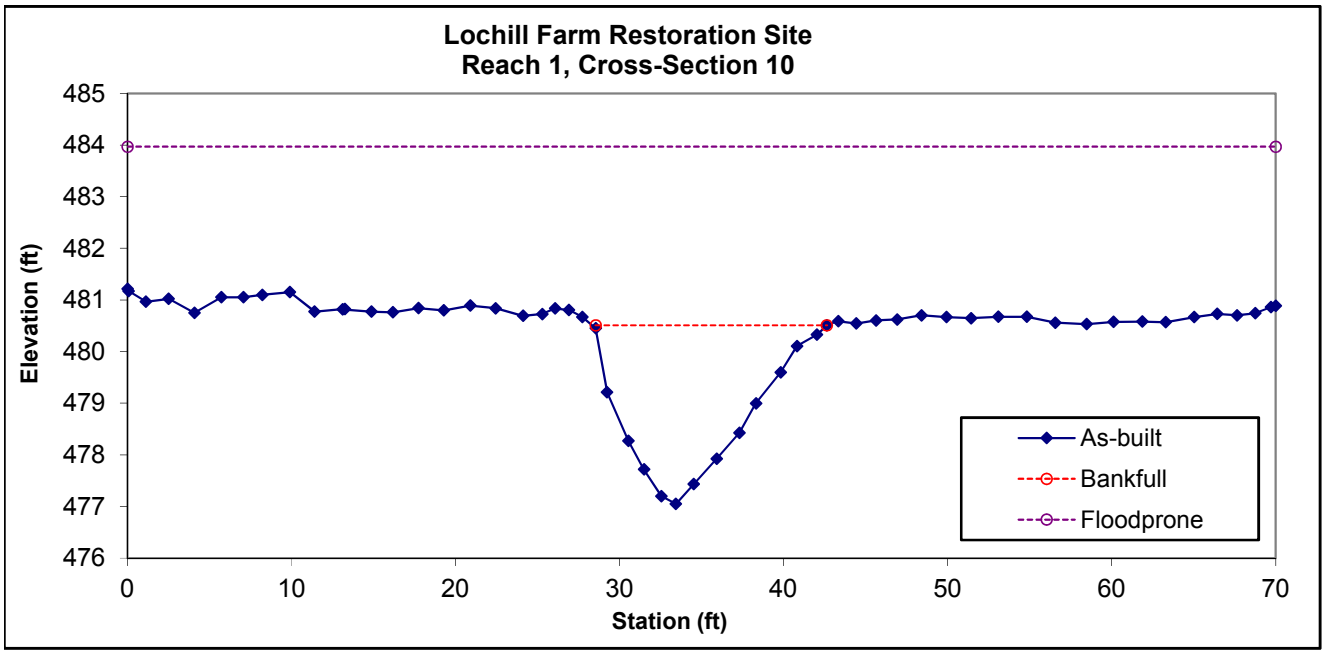
Permanent Cross-Section 10

(As-built Survey Data Collected: December 2018)

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	--	26.8	14.3	1.9	3.5	7.6	--	--	480.51	480.51



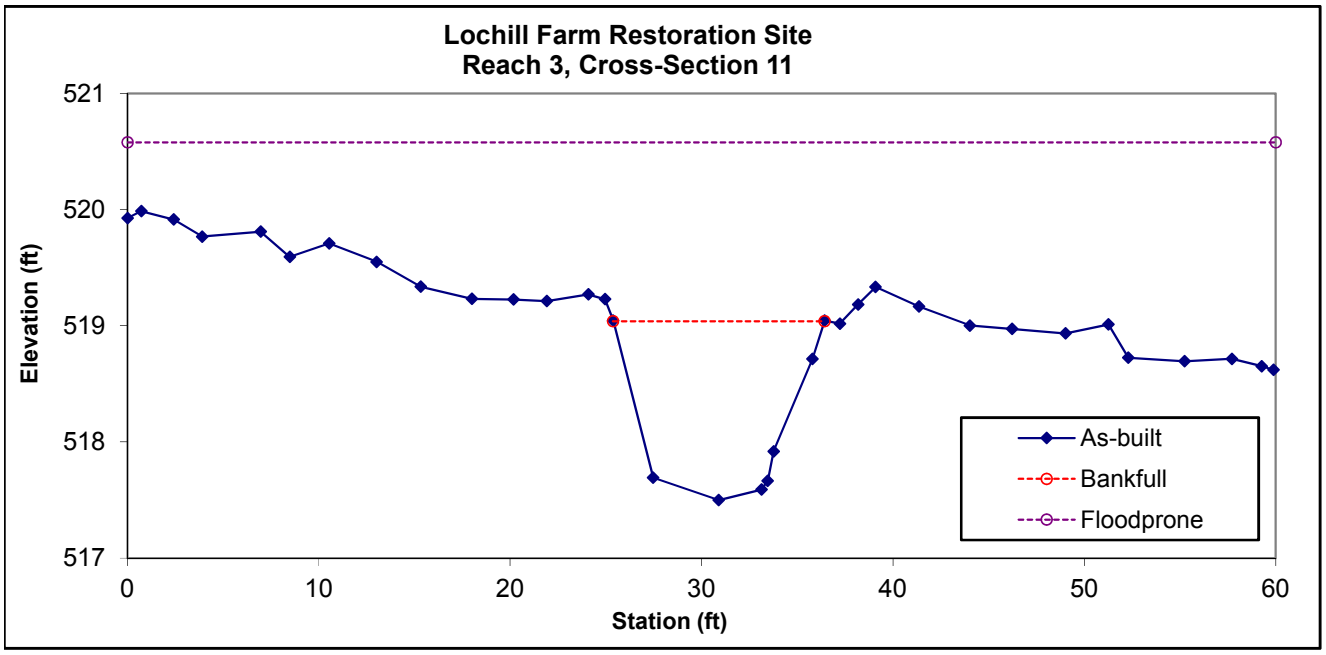
Permanent Cross-Section 11

(As-built Survey Data Collected: December 2018)

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	12.1	11.8	1.0	1.5	11.5	1.0	5.1	519.04	519.04



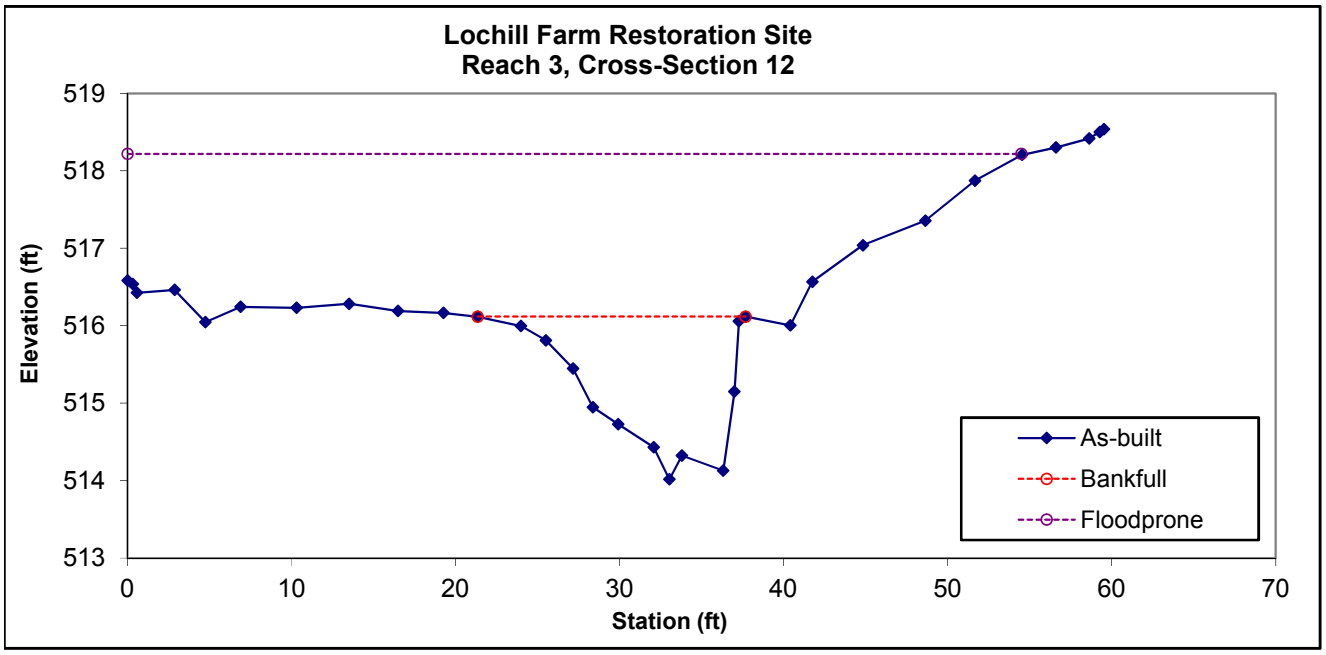
Permanent Cross-Section 12

(As-built Survey Data Collected: December 2018)

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	--	16.9	16.4	1.0	2.1	15.9	--	--	516.12	516.12



APPENDIX E

As-Built Plan Sheets

LOCHILL FARM

PROJECT: 153145

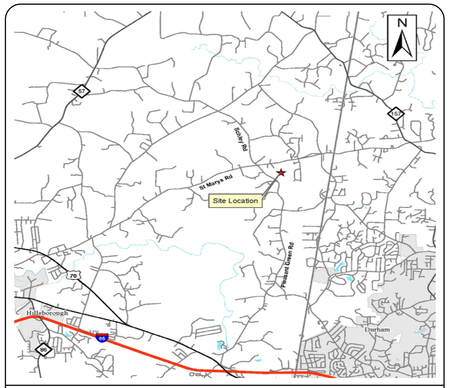
STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	153145	1	23

NORTH CAROLINA
DIVISION OF MITIGATION SERVICES

ORANGE COUNTY

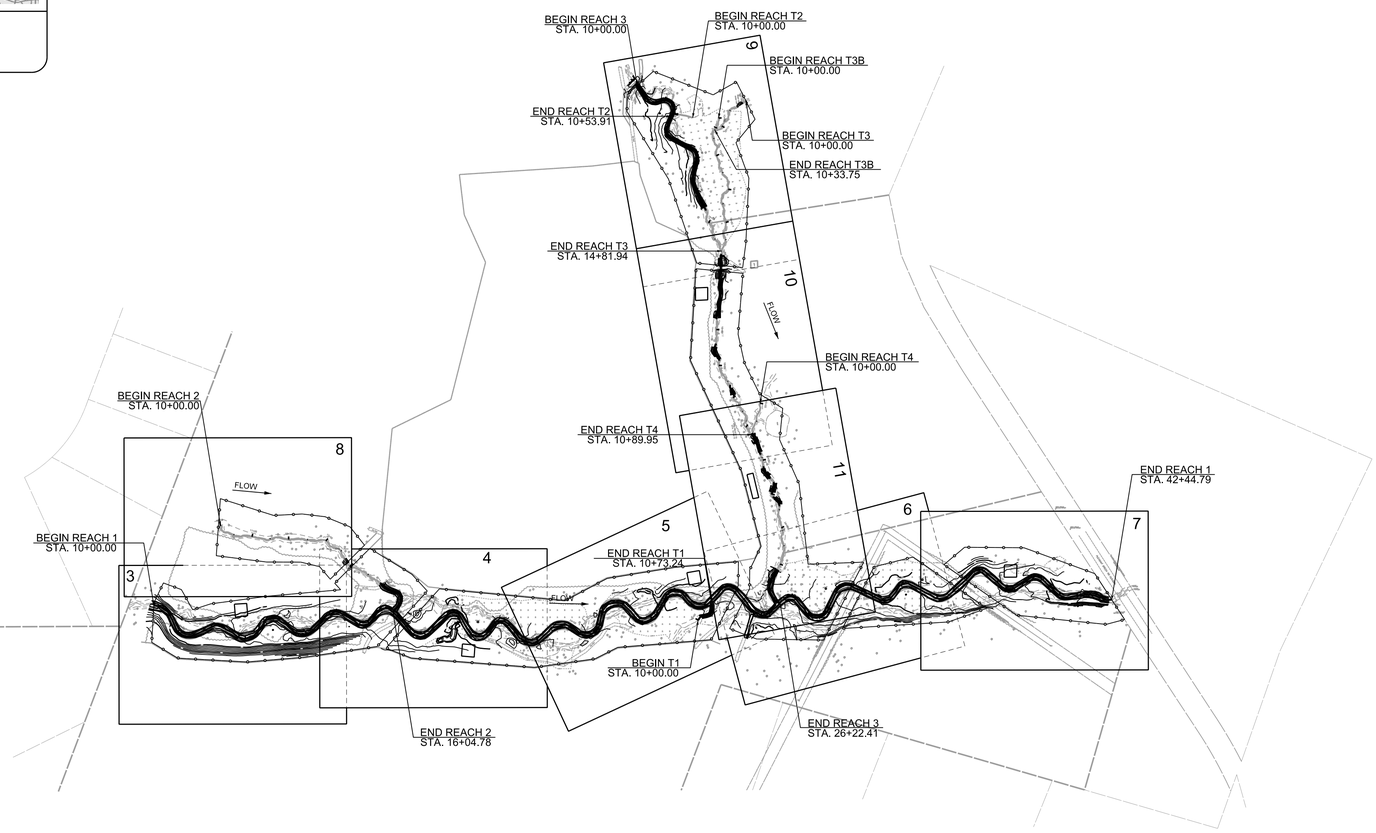
LOCATION: OFF ST. MARY'S ROAD NEAR ITS INTERSECTION WITH PLEASANT GREEN ROAD

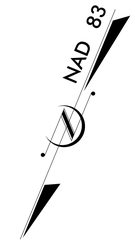
LOCATION: AS – BUILT PLAN



VICINITY MAP

INDEX OF SHEETS





AS-BUILT SURVEY PREPARED BY:
KEE MAPPING & SURVEYING, PA - Asheville, N.C.

RECORD DRAWINGS

This record drawing has been prepared in part, based upon information furnished by others. While this information is believed to be reliable, the Engineer cannot assure its accuracy, and this is not responsible for the accuracy of this record drawing or for any errors or omissions which may have been incorporated into it as a result. Those relying on this record document are advised to obtain independent verification of its accuracy before applying for any purpose.

CERTIFICATE OF SURVEY AND ACCURACY

I, PHILLIP B. KEE, CERTIFY THAT THE GROUND TOPOGRAPHIC SURVEY PORTION OF THIS PROJECT WAS COMPLETED UNDER MY DIRECT SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY DIRECT SUPERVISION; THAT THE RECORD DRAWINGS WERE PREPARED BY MICHAEL BAKER ENGINEERING, INC. FROM DIGITAL FILES PROVIDED BY KEE MAPPING AND SURVEYING, PA AS SHOWN ON AN AS-BUILT SURVEY FOR "THE STATE OF NC, DIVISION OF MITIGATION SERVICES", JOB #1810131-AB, DATED APRIL 19, 2019; THAT THIS SURVEY WAS PERFORMED AT THE 95% CONFIDENCE LEVEL TO MEET THE FEDERAL GEOGRAPHIC DATA COMMITTEE STANDARDS AND TO MEET THE REQUIREMENTS OF A TOPOGRAPHIC SURVEY TO THE ACCURACY OF CLASS A HORIZONTAL AND CLASS C VERTICAL WHERE APPLICABLE; THAT THE ORIGINAL DATA WAS OBTAINED BETWEEN THE DATES OF 11/30/18 - 4/01/19 ; THAT THE CONTOURS SHOWN AS BROKEN LINES MAY NOT MEET THE STATED STANDARD AND ALL COORDINATES ARE BASED ON NAD 83 (NSRS 2011) AND ALL ELEVATIONS ARE BASED ON NAVD 88; THAT THIS MAP MEETS THE SPECIFICATIONS FOR TOPOGRAPHIC SURVEYS AS STATED IN TITLE 21, CHAPTER 56, SECTION .1606.

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL THIS _____ DAY OF _____, ____, A.D.

5/20/2019

NORTH CAROLINA PROFESSIONAL SEAL L-4647 LAND SURVEYOR PHILLIP B. KEE

DocuSigned by: Phillip B Kee
DS6500AA7692407...
PHILLIP B. KEE, PLS L-4647

NCDMS ID NO. 97083

GRAPHIC SCALES

20 0 20 40
PLANS

20 0 20 40
PROFILE (HORIZONTAL)

5 0 5 10
PROFILE (VERTICAL)

SUMMARY

REACH	DESIGN LENGTH*	AS–BUILT LENGTH*
R1	3,105.04 LF	3,130.45 LF
R2	600.22 LF	588.45 LF
R3	1,602.12 LF	1,607.36 LF
T1	103.95 LF	73.24 LF
T2	59.17 LF	53.91 LF
T3	481.94 LF	481.94 LF
T3B	33.75 LF	33.75 LF
T4	88.73 LF	89.95 LF

* EXCLUDES EASEMENT BREAKS

PREPARED FOR THE OFFICE OF:

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

CONTACT: LINDSAY CROCKER
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

FALL 2017
LETTING DATE:

KATHLEEN M. McKEITHAN, PE
PROJECT ENGINEER

SCOTT E. KING, LSS
PROJECT MANAGER

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M McKEITHAN

5/21/2019

DocuSigned by: kathleen M McKeithan
P.E.
SIGNATURE:

2/26/03

STREAM CONVENTIONAL SYMBOLS
SUPERCEDES SHEET 1-B

- ROCK J-HOOK
- BOULDER STEP
- 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
- LOG VANE
- LOG WEIR
- LOG CROSS VANE
- LOG ROLLER
- GRADE CONTROL LOG JAM
- CONSTRUCTED RIFFLE
- BOULDER CLUSTER
- ROCK STEP POOL
- BOULDER BANK PROTECTION
- PHOTO POINT
- MONITORING WELL
- FLOW GAUGE
- CREST GAUGE
- SAFETY FENCE
- TAPE FENCE
- 100 YEAR FLOOD PLAIN
- CONSERVATION EASEMENT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- LIMITS OF DISTURBANCE
- PROPERTY LINE
- FOOT BRIDGE
- TEMPORARY STREAM CROSSING
- PERMANENT STREAM CROSSING
- TRANSPLANTED VEGETATION
- TREE REMOVAL
- TREE PROTECTION
- DITCH PLUG
- CHANNEL FILL
- TOE WOOD
- GEOLIFT WITH BRUSH TOE
- BANK GRADING

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

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 (3'x2'x2'), 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 TO BEGIN FALL/WINTER 2017.
4. CONTRACTOR SHOULD CALL NORTH CAROLINA "ONE-CALL" BEFORE EXCAVATION STARTS. (1-800-632-4949)
5. ENGINEER WILL FLAG TREES TO BE SAVED PRIOR TO CONSTRUCTION.
6. FENCING MUST BE INSTALLED IN LOCATIONS SHOWN AND COMPLETELY OUTSIDE OF THE CONSERVATION EASEMENT.

PROJECT REFERENCE NO.	SHEET NO.
153145	1-A

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKEITHAN

DocuSigned by: Kathleen M McKeithan 247E84BF4161473...

APPROVED BY:

5/17/2019

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. 97083

STANDARD SPECIFICATIONS

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

6.05 TREE PROTECTION
6.06 TEMPORARY GRAVEL CONSTRUCTION ENTRANCE
6.24 RIPARIAN AREA SEEDING
6.60 TEMPORARY SEDIMENT TRAP
6.62 TEMPORARY SILT FENCE
6.63 TEMPORARY ROCK DAM
6.70 TEMPORARY STREAM CROSSING

VEGETATION SELECTION

Proposed Bare-Root and Live Stake Species
Lochill Farm Stream Mitigation Project – NCDMS Project No. 97083

Botanical Name	Common Name	% Planted by Species	Wetland Tolerance
All Buffer Plantings at 8' x 8' spacing for 680 stems/acre Riparian Floodplain – Overstory Species			
Fraxinus pennsylvanica	Green Ash	10%	FACW
Betula nigra	River Birch	10%	FACW
Liriodendron tulipifera	Tulip Poplar	10%	FACU
Quercus phellos	Willow Oak	5%	FAC
Acer negundo	Box Elder	5%	FACW
Platanus occidentalis	American Sycamore	10%	FACW
Celtis laevigata	Sugarberry	10%	FACW
Riparian Floodplain – Understory Species			
Carpinus caroliniana	American Hornbeam	10%	FAC
Asimina triloba	Pawpaw	10%	FAC
Viburnum dentatum	Arrowwood Viburnum	10%	FAC
Aesculus sylvatica	Painted Buckeye	10%	FAC
Wetland Buffer Plantings – Overstory			
Fraxinus pennsylvanica	Green Ash	10%	FACW
Betula nigra	River Birch	10%	FACW
Quercus michauxii	Swamp Chestnut Oak	10%	FACW
Acer negundo	Box Elder	10%	FACW
Platanus occidentalis	American Sycamore	10%	FACW
Celtis laevigata	Sugarberry	5%	FACW
Nyssa sylvatica	Black gum	5%	FAC
Wetland Buffer Plantings – Understory			
Lindera benzoin	Spicebush	10%	FAC
Alnus serrulata	Tag Alder	10%	OBL
Ilex verticillata	Winterberry	10%	FACW
Viburnum nudum	Possumhaw	10%	OBL
Streambank Live Stake Plantings			
Salix sericea	Silky Willow	25%	OBL
Sambucus nigra canadensis	Elderberry	25%	FAC
Cephalanthus occidentalis	Buttonbush	15%	OBL
Cornus amomum	Silky Dogwood	25%	FACW
Salix nigra	Black Willow	10%	OBL

Note: Final species selection may change due to refinement or availability at the time of planting. If species substitution is required, the planting contractor will submit a revised planting list to Baker for approval prior to the procurement of plant stock.

Proposed Permanent Seed Mixture
Lochill Farm Stream Mitigation Project – NCDMS Project No. 97083

Botanical Name	Common Name	% Planted by Species	Density (lbs/ac)	Wetland Tolerance
Andropogon gerardii	Big blue stem	10%	1.50	FAC
Dichanthelium clandestinum	Deer tongue	15%	2.25	FAC
Carex crinita	Fringed sedge	10%	1.50	OBL
Elymus virginicus	Virginia wild rye	10%	1.50	FACW
Juncus effusus	Soft rush	10%	1.50	FACW
Panicum virgatum	Switchgrass	15%	2.25	FAC
Schizachyrium scoparium	Little blue stem	10%	1.50	FACU
Sorghastrum nutans	Indiangrass	10%	1.50	FACU
Impatiens capensis	Jewelweed	10%	1.50	FACW
	Total	100%	15.00	

Note: Final species selection may change due to refinement or availability at the time of planting. If species substitution is required, the planting Contractor will submit a revised planting list to Baker for approval prior to the procurement of plant stock.

Proposed Temporary Seed Mixture
Lochill Farm Stream Mitigation Project – NCDMS Project No. 97083

Planting Dates	Species	Rate (lbs/ac)
September to March	Rye Grain (cool season)	130
April to August	Browntop millet (warm season)	40

Note: All disturbed areas will be stabilized using mulch and temporary seed as defined in the construction specifications.

4/24/2019
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mcpeters

2/26/03

PROJECT REFERENCE NO.	SHEET NO.
153145	1-B
NCDMS ID No. 97083	

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKEITHAN

Kathleen M. McKeithan
APPROVED BY:
5/17/2019
DATE:

*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
- Well
- 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
- Proposed Right of Way Line with Concrete or Granite Marker
- 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
- 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
- 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
- TV Tower
- U/G TV Cable Hand Hole
- 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.

4/24/2019
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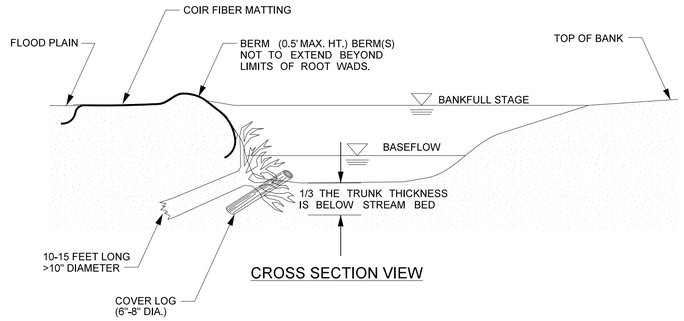
revised 02/02/00

2/26/03

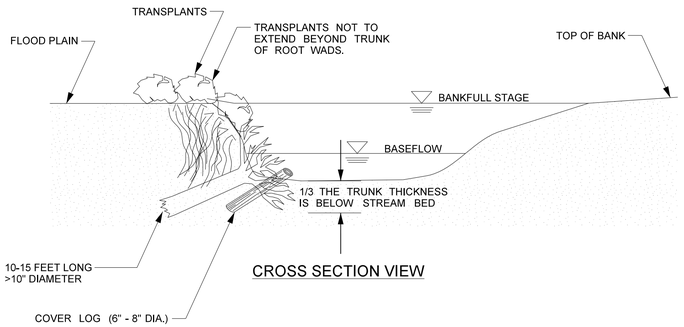
ROOT WADS

ROOT WADS WITHOUT TRANSPLANTS
USE IF TRANSPLANTS ARE NOT AVAILABLE ON-SITE



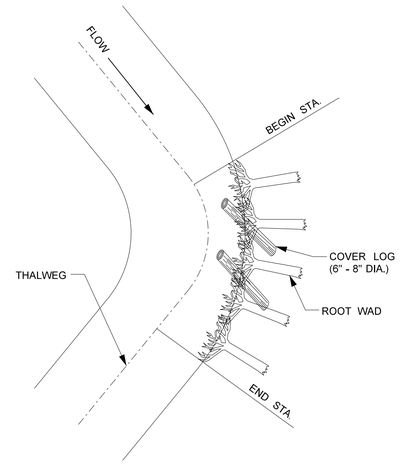
CROSS SECTION VIEW

ROOT WADS WITH TRANSPLANTS
USE IF TRANSPLANTS ARE AVAILABLE ON-SITE



CROSS SECTION VIEW

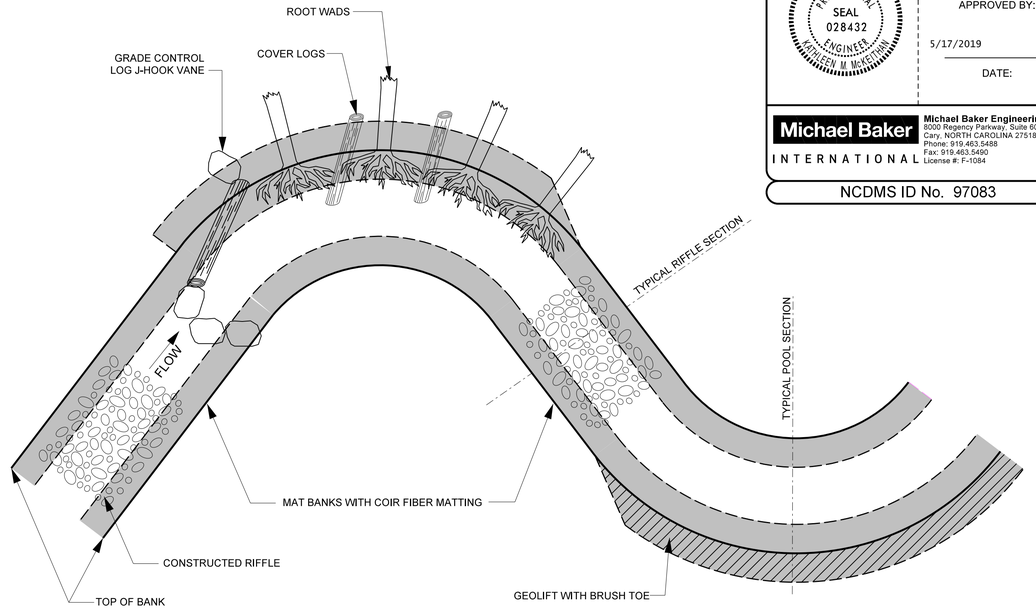
PLAN VIEW



NOTES:

1. INSTALLATION USING THE TRENCHING METHOD REQUIRES THAT A TRENCH BE EXCAVATED FOR THE LOG PORTION OF THE ROOT WAD. ONE-THIRD OF THE ROOT WAD SHOULD REMAIN BELOW NORMAL BASE FLOW CONDITIONS OR CHANNEL BOTTOM.
2. THE NUMBER OF ROOTWADS ESTIMATED MAY VARY DEPENDING ON THE ROOTMASS SIZE. IN GENERAL, ROOTWADS SHOULD PROTECT THE OUTER MEANDER BEND AS SHOWN. SEE STRUCTURE TABLE FOR APPROXIMATE STATION AND LOCATION.
3. INSTALL COVER LOGS BETWEEN ROOTWADS TO PROVIDE HABITAT ONLY WHEN AVAILABLE FROM ON-SITE HARVESTING.

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.

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	2

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKEITHAN

DocuSigned by: Kathleen M. McKeithan 247E86DE4181473

APPROVED BY:

5/17/2019

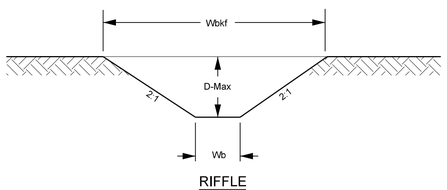
DATE:

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

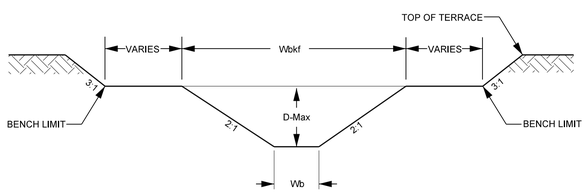
NCDMS ID No. 97083

TYPICAL RIFFLE, POOL, AND BANKFULL BENCH CROSS-SECTIONS

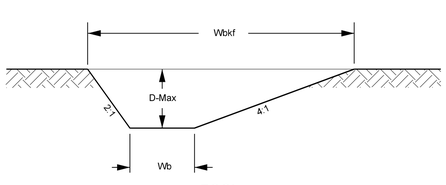
R1		R2		R3		
RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	
15.7	24.0	6.7	8.0	11.0	15.0	WIDTH OF BANKFULL (Wbkf)
1.5	3.5	0.6	1.0	1.2	2.5	MAXIMUM DEPTH (D-Max)
13.0	-	12.0	-	12.2	-	WIDTH TO DEPTH RATIO (Wbkf / D)
19.0	-	3.8	-	10.3	-	BANKFULL AREA (Abkf)
9.7	4.8	3.9	-	6.4	-	BOTTOM WIDTH (Wb)



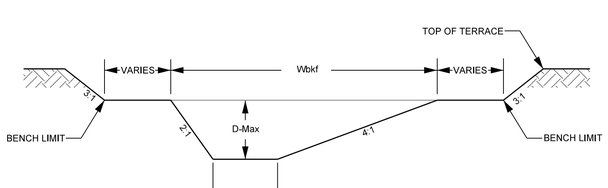
RIFFLE



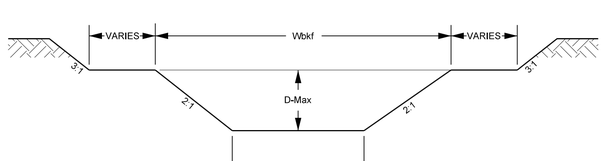
RIFFLE WITH BANKFULL BENCH



POOL



POOL WITH BANKFULL BENCH



STEP - POOL

NOTES:

1. DURING CONSTRUCTION CORNERS OF DESIGN CHANNEL WILL BE ROUNDED AND A THALWEG WILL BE SHAPED PER DIRECTION OF ENGINEER.
2. POOLS SHOWN ABOVE ARE LEFT POOLS FOR MEANDER CHANNELS.

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BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	2-A

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 028432 KATHLEEN M. MCKEITHAN

DocuSigned by: Kathleen M. McKeithan

APPROVED BY:

5/17/2019

DATE:

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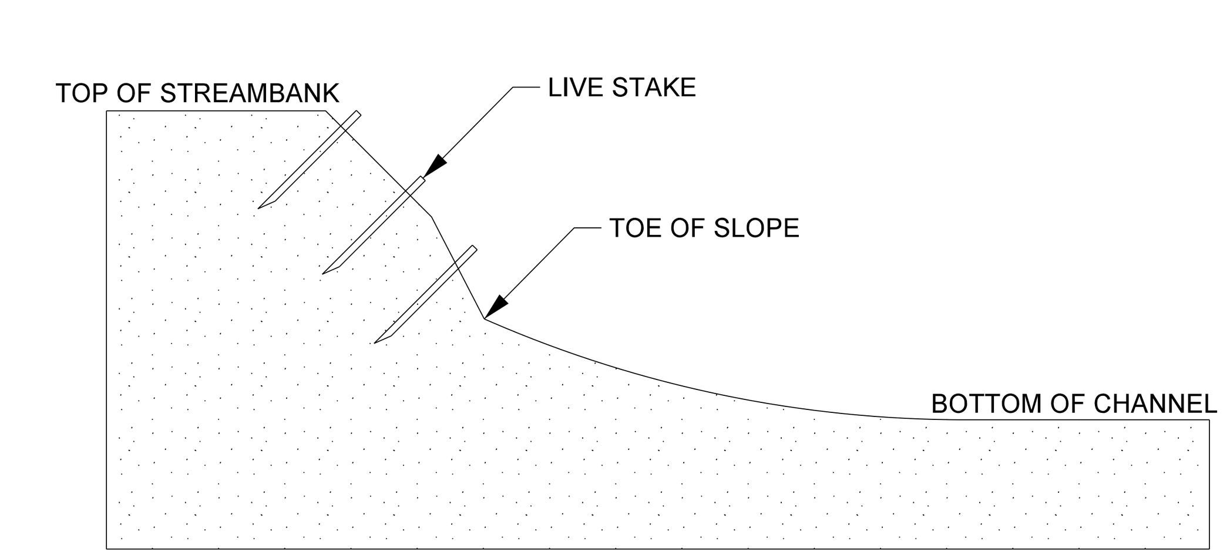
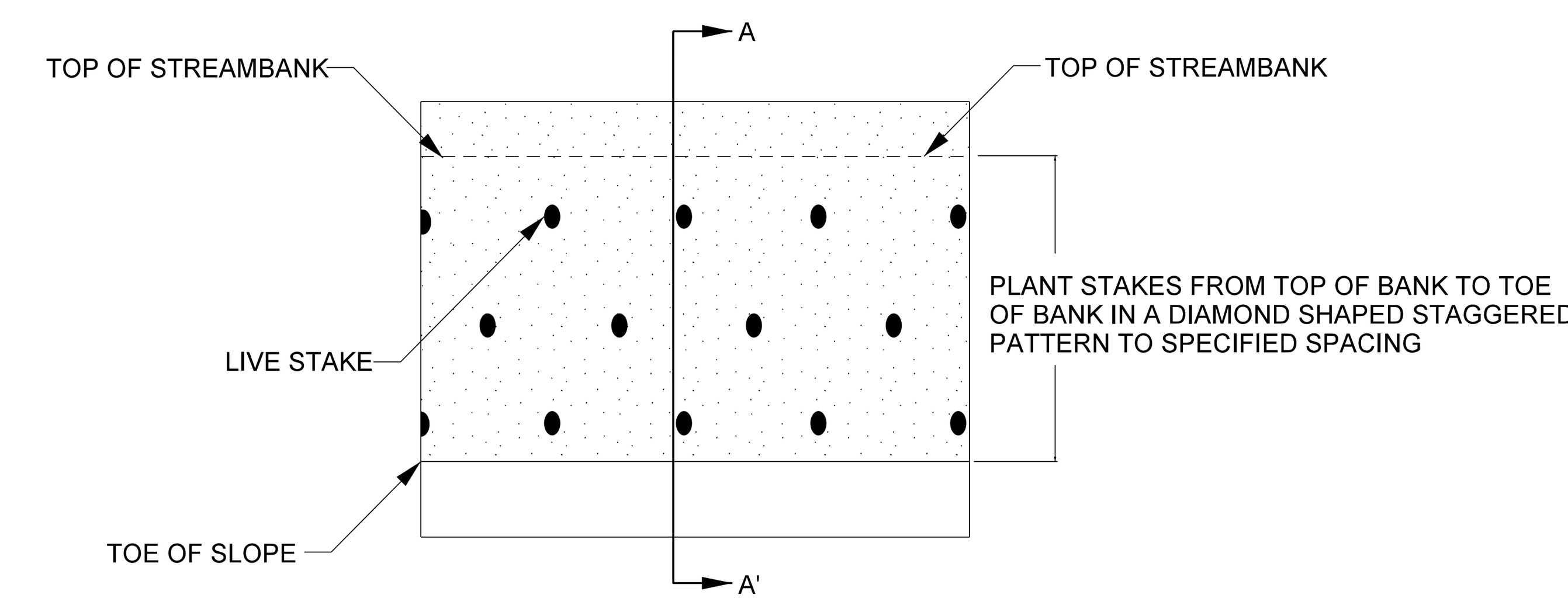
NCDMS ID No. 97083

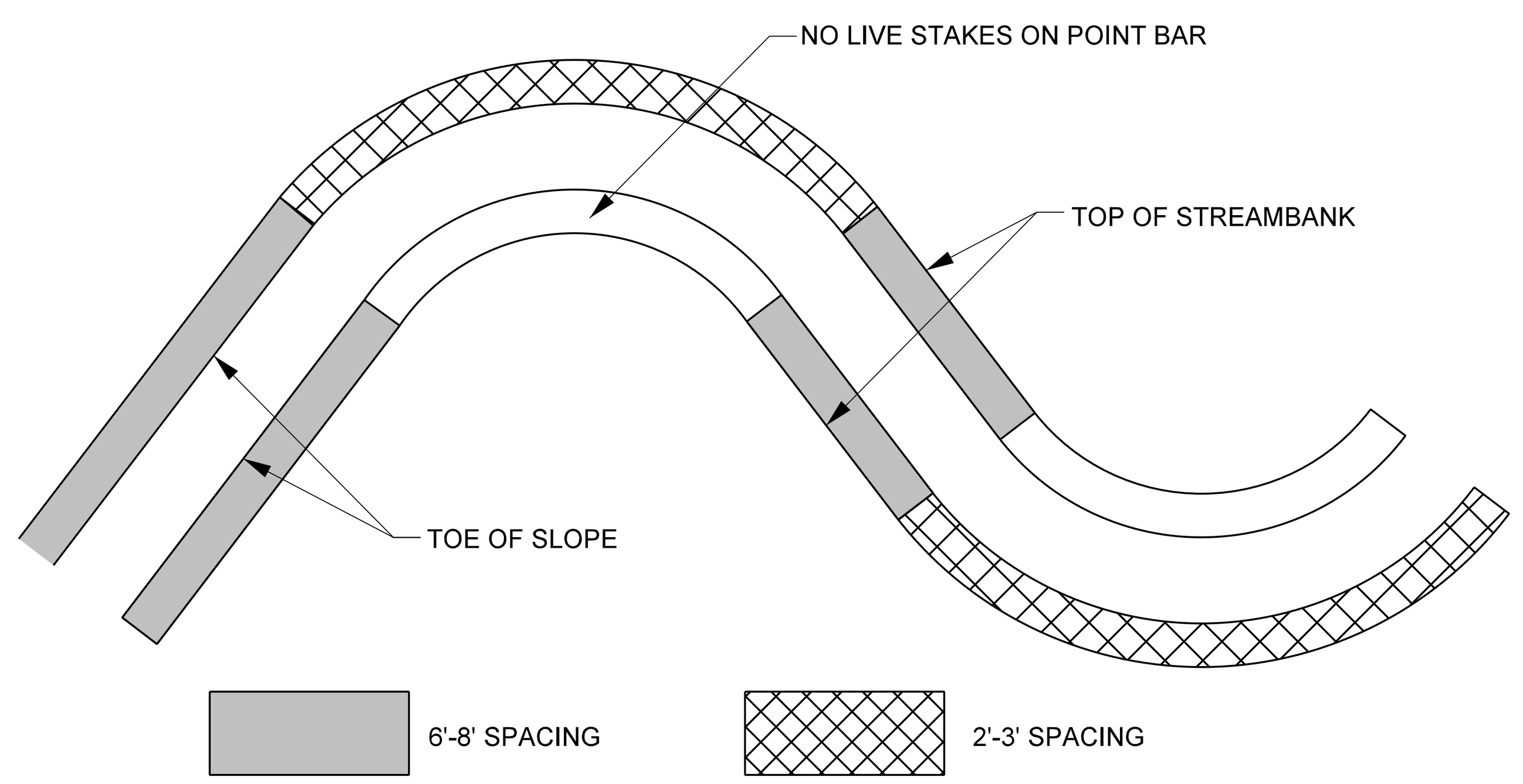
LIVE STAKING



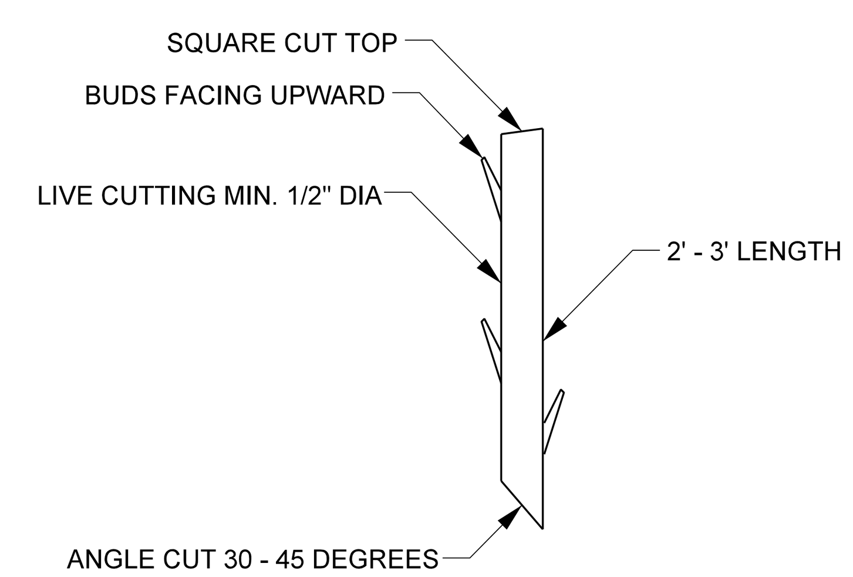
SECTION A - A'



PLAN VIEW



LIVE STAKE SPACING PLAN VIEW

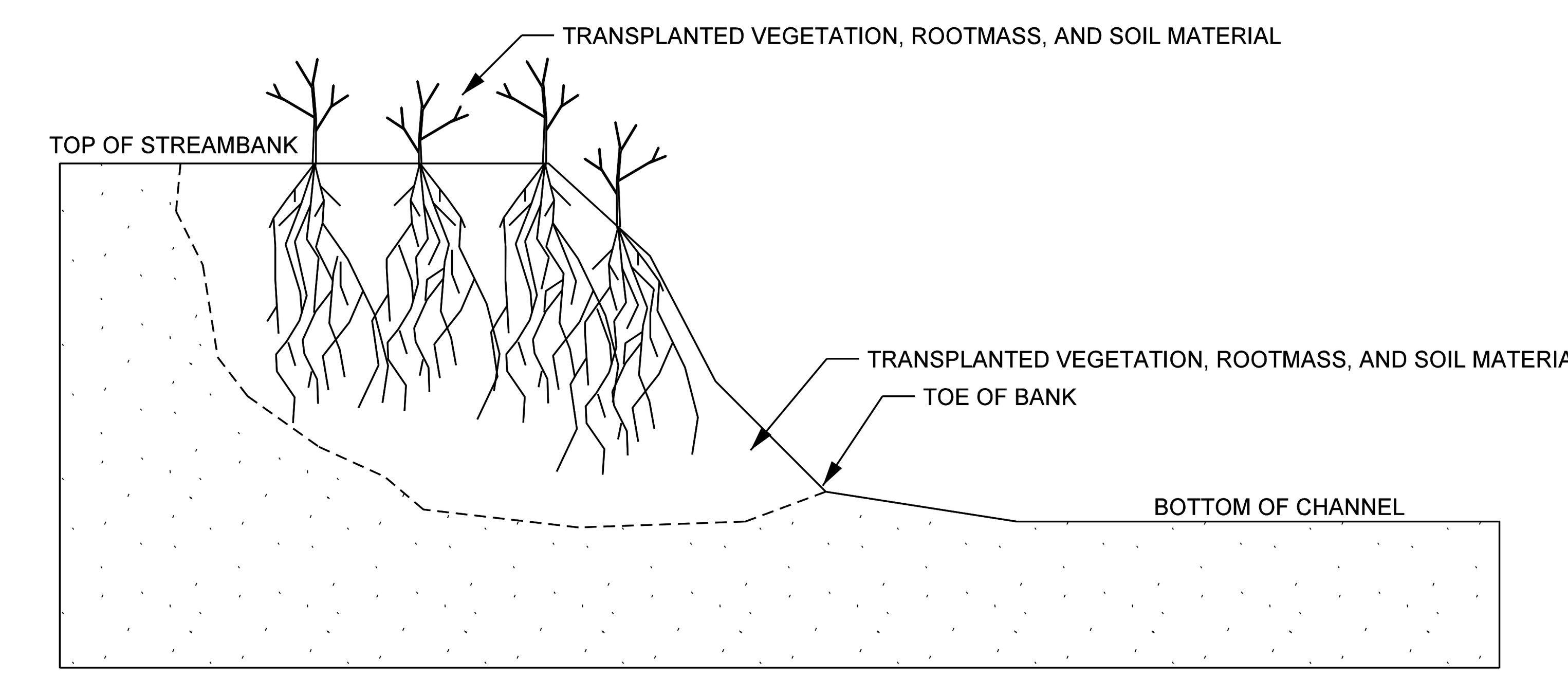


LIVE STAKE DETAIL

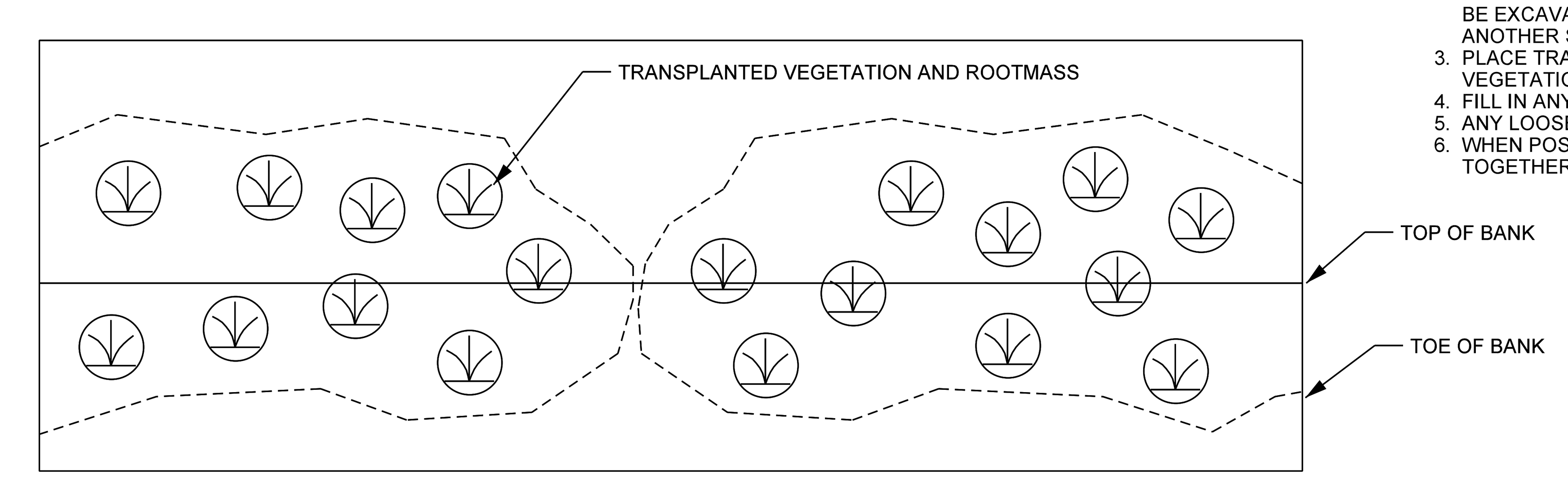
NOTES:

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

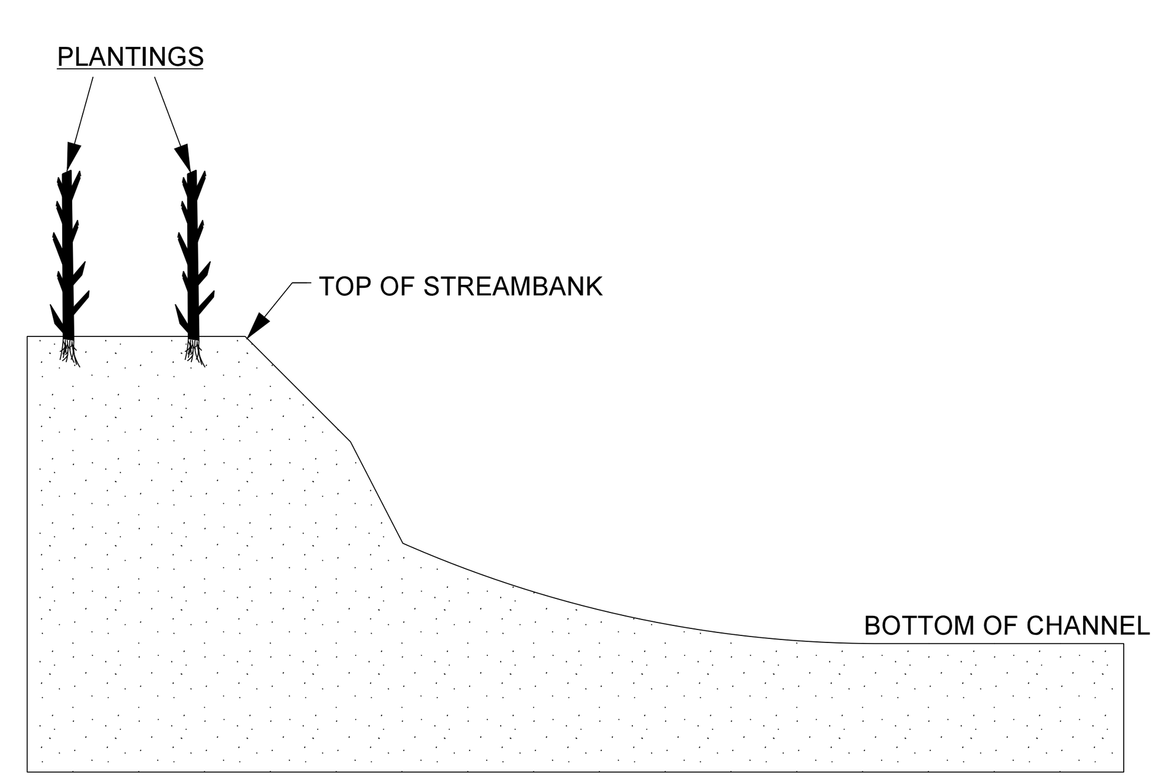


PLAN VIEW

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 THE ENTIRE ROOT MASS AND AS MUCH ADDITIONAL SOIL MATERIAL AS POSSIBLE. IF ENTIRE ROOT MASS CAN NOT BE EXCAVATED AT ONCE, 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. WHEN POSSIBLE, PLACE MULTIPLE TRANSPLANTS CLOSE TOGETHER SUCH THAT THEY TOUCH.

PLANTING SPECIFICATIONS

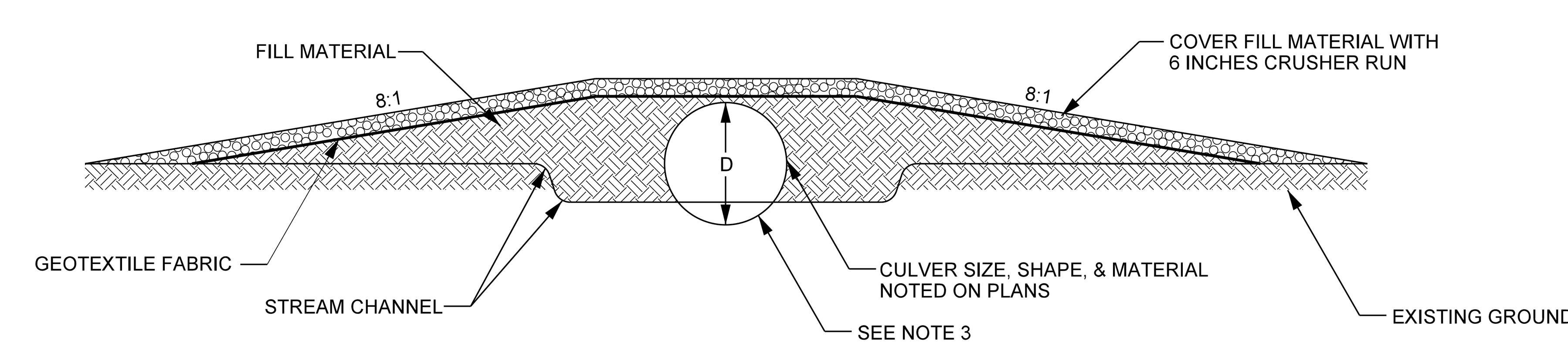


CROSS SECTION VIEW OF BARE ROOT PLANTING

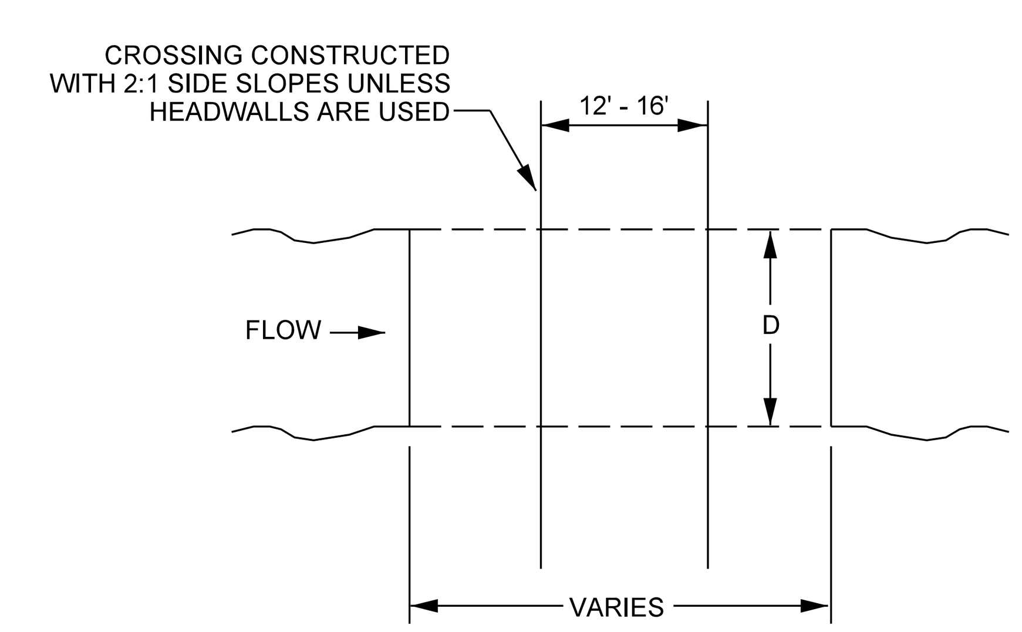
NOTES:

1. PLANT BARE ROOT SHRUBS AND TREES TO THE WIDTH OF THE BUFFER/PLANTING ZONE AS SHOWN ON THE PLANS.
2. ALLOW FOR 6-10 FEET BETWEEN PLANTINGS, DEPENDING ON SIZE.
3. LOOSEN COMPACTED SOIL.
4. PLANT IN HOLES MADE BY A MATTOCK, DIBBLE, PLANTING BAR, OR OTHER APPROVED MEANS.
5. PLANT IN HOLES DEEP AND WIDE ENOUGH TO ALLOW THE ROOTS TO SPREAD OUT AND DOWN WITHOUT J-ROOTING.
6. KEEP ROOTS MOIST WHILE DISTRIBUTING OR WAITING TO PLANT BY MEANS OF WET CANVAS, BURLAP, OR STRAW.
7. HEEL-IN PLANTS IN MOIST SOIL OR SAWDUST IF NOT PROMPTLY PLANTED UPON ARRIVAL TO PROJECT SITE.

PERMANENT STREAM CROSSING



PROFILE VIEW ALONG ROAD

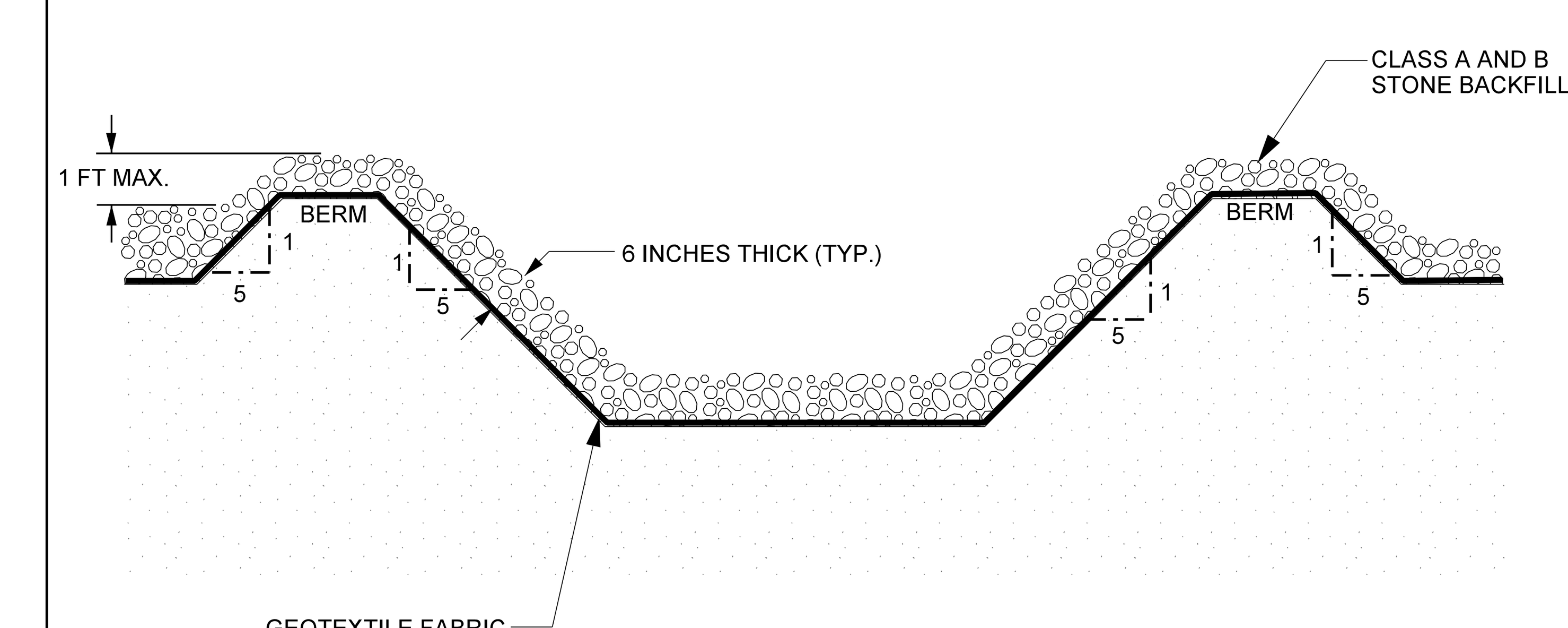


PLAN VIEW

NOTES:

1. INSTALL FLOODPLAIN CULVERTS AS SHOWN ON THE PLANS.
2. UPSTREAM AND DOWNSTREAM ROAD SLOPES SHALL BE PROTECTED WITH CLASS B STONE UNDERLAIN BY FILTER FABRIC OR STACKED BOULDER HEADWALLS AS SHOWN ON THE PLANS.
3. CULVERTS WILL BE BURIED AT LEAST 6" BELOW THE BED OF THE STREAM.
4. CULVERTS SHALL HAVE A MINIMUM OF 1' OF COVER.

FORD STREAM CROSSING

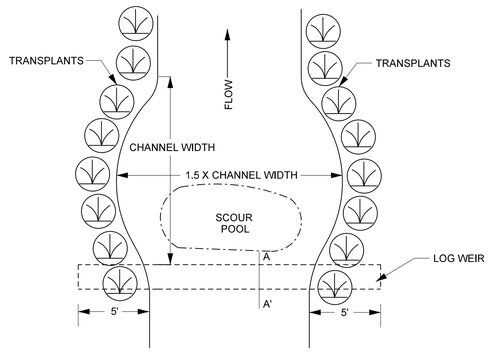


NOTES:

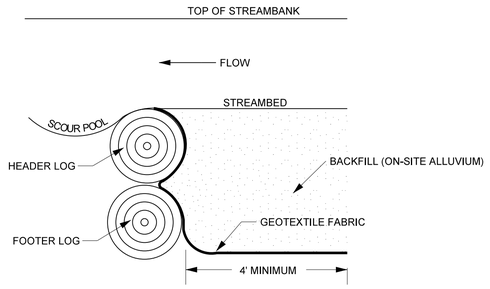
1. CONSTRUCT STREAM CROSSING WHEN FLOW IS LOW.
2. HAVE ALL NECESSARY MATERIALS AND EQUIPMENT ON-SITE BEFORE WORK BEGINS.
3. MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. DO NOT EXCAVATE CHANNEL BOTTOM. COMPLETE ONE SIDE BEFORE STARTING ON THE OTHER SIDE.
4. INSTALL STREAM CROSSING AT RIGHT ANGLE TO THE FLOW.
5. GRADE SLOPES TO A 5:1 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.

2/26/03

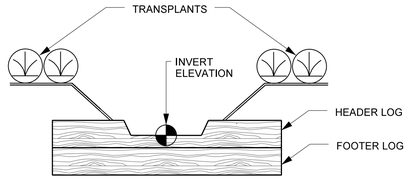
LOG WEIR



PLAN VIEW



SECTION A-A'

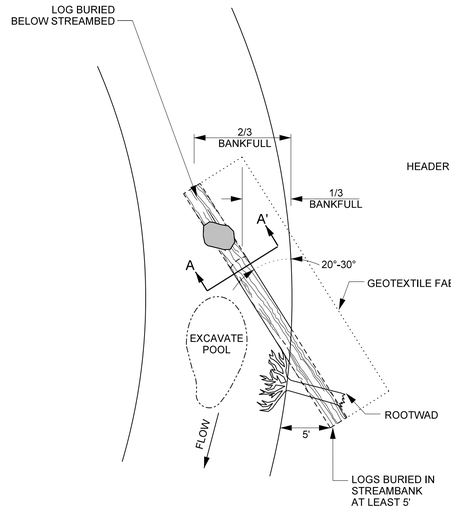


CROSS SECTION VIEW

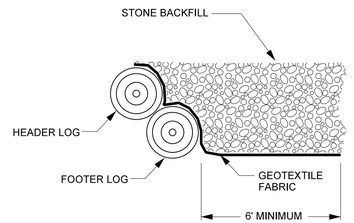
NOTES:

1. LOGS SHOULD BE AT LEAST 12 INCHES IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. LOGS >24 INCHES IN DIAMETER MAY BE USED ALONE WITHOUT AN ADDITIONAL LOG. GEOTEXTILE FABRIC SHOULD STILL BE USED TO SEAL AROUND LOG
3. PLACE FOOTER LOGS FIRST AND THEN HEADER (TOP) LOG. SET HEADER LOG APPROXIMATLEY 3 INCHES ABOVE THE INVERT ELEVATION.
4. CUT A NOTCH IN THE HEADER LOG APPROXIMATLEY 50 PERCENT OF THE CHANNEL BOTTOM WIDTH AND EXTENDING DOWN TO THE INVERT ELEVATION.
5. USE GEOTEXTILE FABRIC TO SEAL GAPS BETWEEN LOGS.
6. PLACE TRANSPLANTS FROM TOE OF STREAMBANK TO TOP OF STREAMBANK.

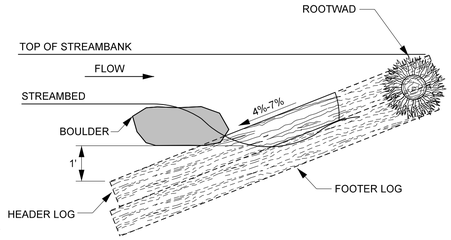
LOG VANE



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.
6. STONE BACKFILL SHALL CONSIST OF A WELL GRADED MIX OF CLASS A, CLASS B, #57 STONE, AND ON-SITE ALLUVIUM WHERE AVAILABLE.

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	2-B

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKEITHAN

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APPROVED BY:

5/17/2019

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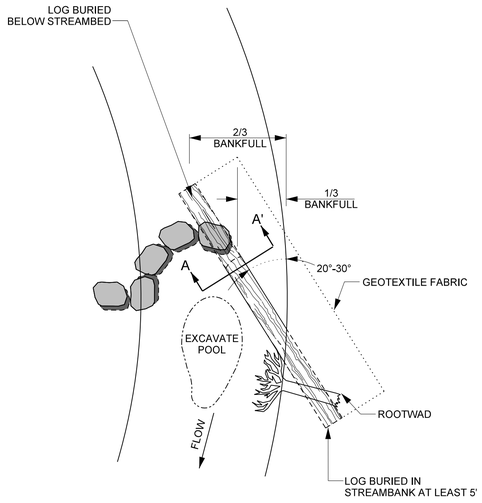
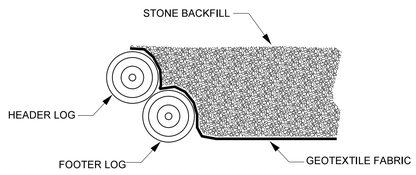
NCDMS ID No. 97083

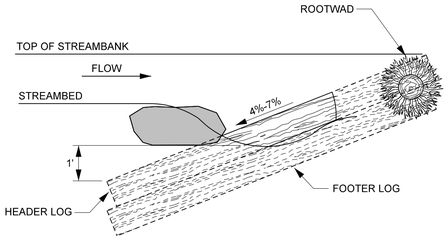
GRADE CONTROL LOG J-HOOK VANE



PLAN VIEW



SECTION A - A'

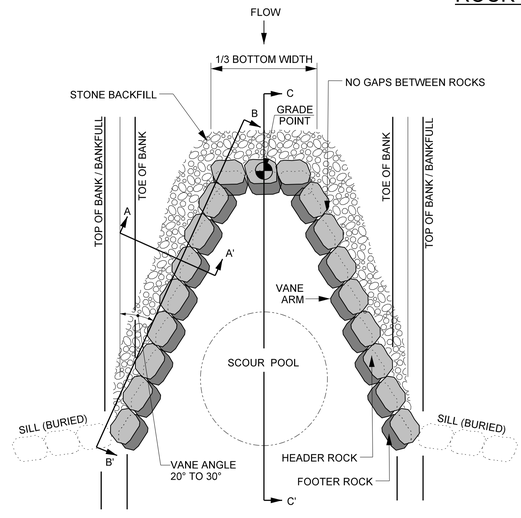


PROFILE VIEW

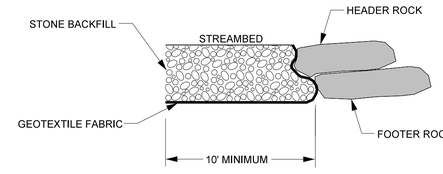
NOTES:

1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. BOULDERS MUST BE AT LEAST 3' x 2' x 2'.
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. STONE BACKFILL SHALL CONSIST OF A WELL GRADED MIX OF CLASS A, CLASS B, #57 STONE, AND ON-SITE ALLUVIUM WHERE AVAILABLE.
7. GEOTEXTILE FABRIC SHOULD BE NAILED TO THE LOG.
8. TRANSPLANTS CAN BE USED INSTEAD OF ROOWADS, PER DIRECTION OF ENGINEER.

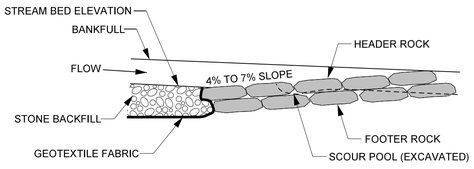
ROCK CROSS VANE



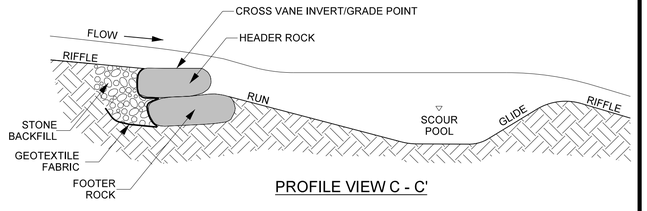
PLAN VIEW



SECTION A - A'



PROFILE VIEW B - B'
VANE ARM



PROFILE VIEW C - C'

NOTES FOR ALL VANE STRUCTURES:

1. INSTALL 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.
8. STONE BACKFILL SHALL CONSIST OF A WELL GRADED MIX OF CLASS A, CLASS B, #57 STONE, AND ON-SITE ALLUVIUM WHERE AVAILABLE.

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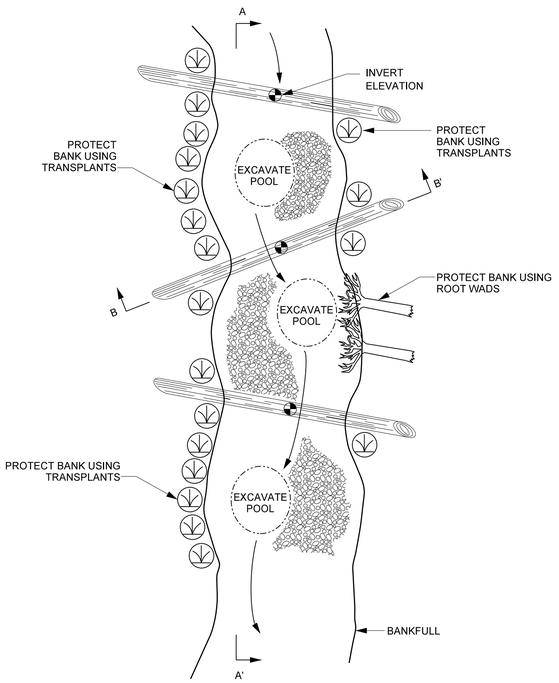
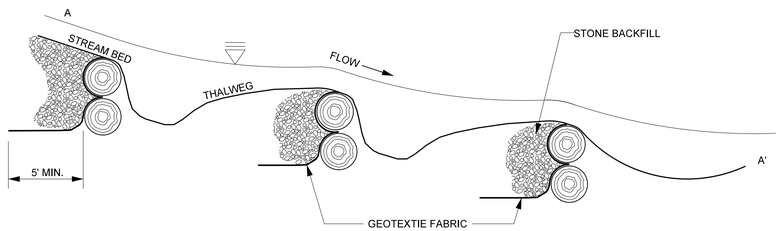
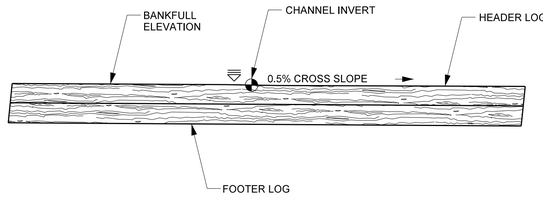
LOG ROLLER



PLAN VIEW



SECTION A - A'

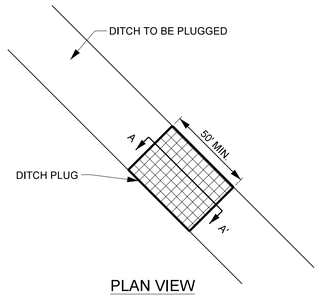


SECTION B - B'

NOTES:

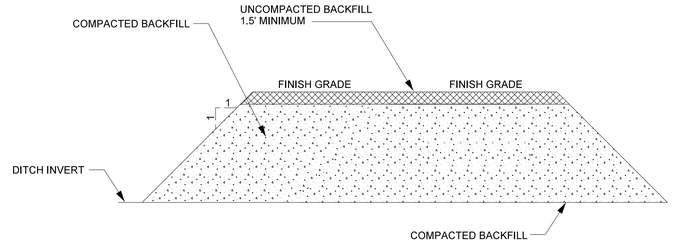
1. LOGS SHOULD BE AT LEAST 10" OR MORE IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, RECENTLY HARVESTED AND EXTENDING INTO THE BANK 5' ON EACH SIDE.
2. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
3. FILTER FABRIC SHOULD BE NAILED (1' ON CENTER) TO THE LOG BELOW THE BACKFILL.
4. TRANSPLANTS, GEOLIFTS, OR ROOT WADS CAN BE USED INSTEAD OF ROOT WADS, PER DIRECTION OF ENGINEER.

DITCH PLUG



PLAN VIEW

NOTE:
COMPACT BACKFILL USING ON-SITE HEAVY EQUIPMENT IN 10 INCH LIFTS.



SECTION A - A'

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	2-C

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M. McKEITHAN

DocuSigned by: Kathleen M. McKeithan 3478E84DF4181473

APPROVED BY:

5/17/2019

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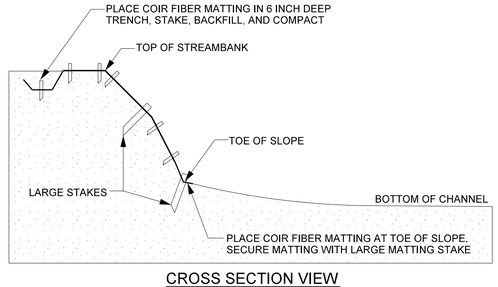
NCDMS ID No. 97083

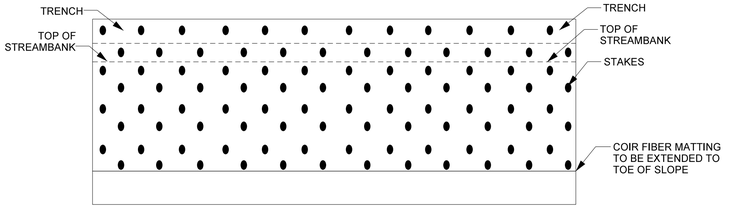
COIR FIBER MATTING



CROSS SECTION VIEW

NOTES:

1. BANKS SHOULD BE SEEDED PRIOR TO PLACEMENT OF MATTING.
2. USE C-7 MATTING.

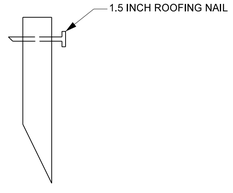


PLAN VIEW

TYPICAL SMALL MATTING STAKE

THE WOOD STAKE SHALL BE THE NORTH AMERICAN GREEN ECO-STAKE OR APPROVED EQUAL WITH THE FOLLOWING DIMENSIONS:

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)



TYPICAL LARGE MATTING STAKE

THE WOOD STAKE SHALL BE THE NORTH AMERICAN GREEN ECO-STAKE OR APPROVED EQUAL WITH THE FOLLOWING DIMENSIONS:

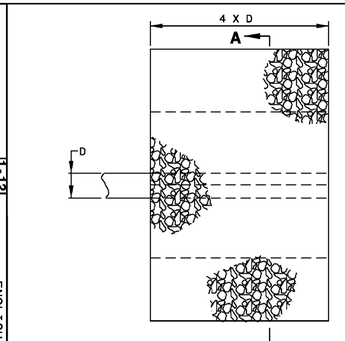
LEG LENGTH	17.00 IN (43.18 CM) (TAPERED TO POINT)
WIDTH	1.00 IN (2.54 CM)
THICKNESS	1.00 IN (2.54 CM)

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.
1-12

GUIDE FOR RIP RAP AT PIPE OUTLETS

ENGLISH STANDARD DRAWING FOR

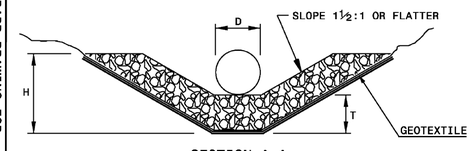
SHEET 1 OF 1
876.02



PLAN

D	OUTLET W/DITCH					OUTLET W/O DITCH				
	CLASS 'B' RIP RAP		CLASS I RIP RAP			CLASS 'B' RIP RAP		CLASS I RIP RAP		
	TONS	STONE T=1.5'	S.Y.	TONS	STONE T=1.5'	TONS	STONE T=1.5'	S.Y.	TONS	STONE T=1.5'
12"	2	5	5	2	5	1	4	2	1	4
15"	2	7	7	3	7	1	5	3	2	6
18"	3	10	9	4	10	2	7	4	2	8
24"	5	14	15	7	15	3	11	7	4	12
30"	8	21	21	11	22	5	16	11	7	17
36"	11	28	29	15	30	7	22	16	10	23
42"	15	37	39	20	39	10	28	22	13	30
48"	-	-	49	26	50	-	-	28	17	38
54"	-	-	60	33	62	-	-	36	21	47
60"	-	-	73	40	75	-	-	44	26	56
66"	-	-	87	48	89	-	-	54	32	67
72"	-	-	102	57	104	-	-	64	38	78

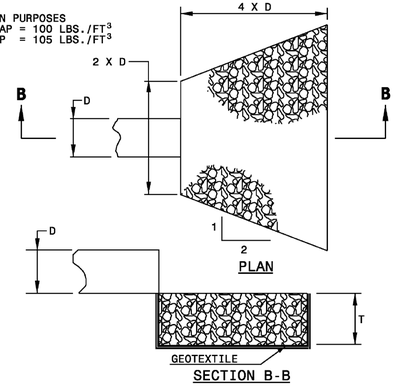
NOTE:
FOR CALCULATION PURPOSES
CLASS 'B' RIP RAP = 100 LBS./FT^3
CLASS I RIP RAP = 105 LBS./FT^3



SECTION A-A

PIPE OUTLET WITH DITCH

H= RIP RAP TO TOP OF PIPE (MAX. H = D + T)
T= 15" CLASS I RIP RAP, UNLESS OTHERWISE SHOWN ON PLANS
T= 12" CLASS 'B' RIP RAP, UNLESS OTHERWISE SHOWN ON PLANS



SECTION B-B

PIPE OUTLET WITHOUT DITCH

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.
1-12

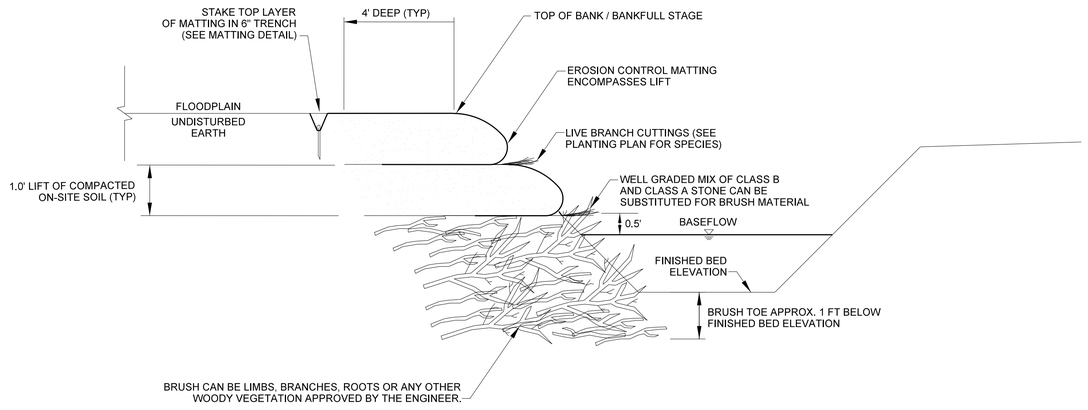
ENGLISH STANDARD DRAWING FOR

GUIDE FOR RIP RAP AT PIPE OUTLETS

SHEET 1 OF 1
876.02

2/26/03

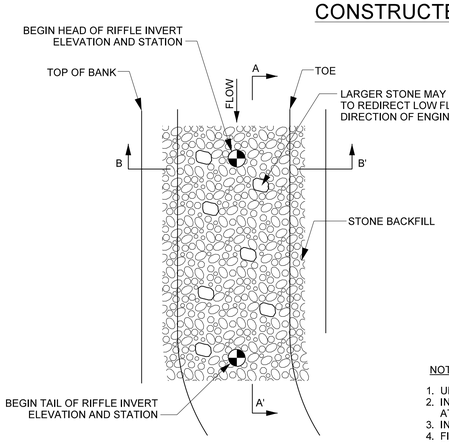
GEOLIFT WITH BRUSH TOE



NOTES:

1. LIVE BRANCH CUTTINGS SHALL BE THE SAME SPECIES AS THE LIVE STAKES AND SHALL BE INSTALLED DURING VEGETATION DORMANCY.
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.

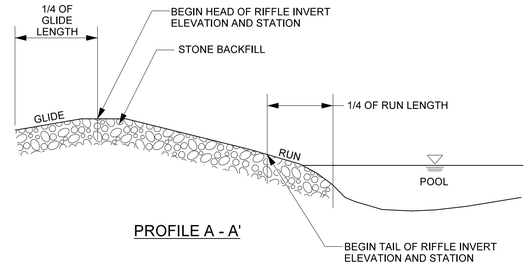
CONSTRUCTED RIFFLE



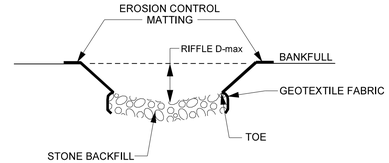
PLAN VIEW

NOTES:

1. UNDERCUT CHANNEL BED ELEVATION AS NEEDED TO ALLOW FOR LAYERS OF STONE TO ACHIEVE FINAL GRADE.
2. 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.
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. STONE SHALL BE WELL GRADED MIX OF CLASS II, CLASS A, AND CLASS B STONE AND A MINIMUM OF 18 INCHES DEEP. ON-SITE ALLUVIUM SHALL BE INCORPORATED WHERE AVAILABLE.



PROFILE A - A'



SECTION B - B'

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	2-D

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKITHAN

DocuSigned by: Kathleen M Mckithan 247E84DF4484473...

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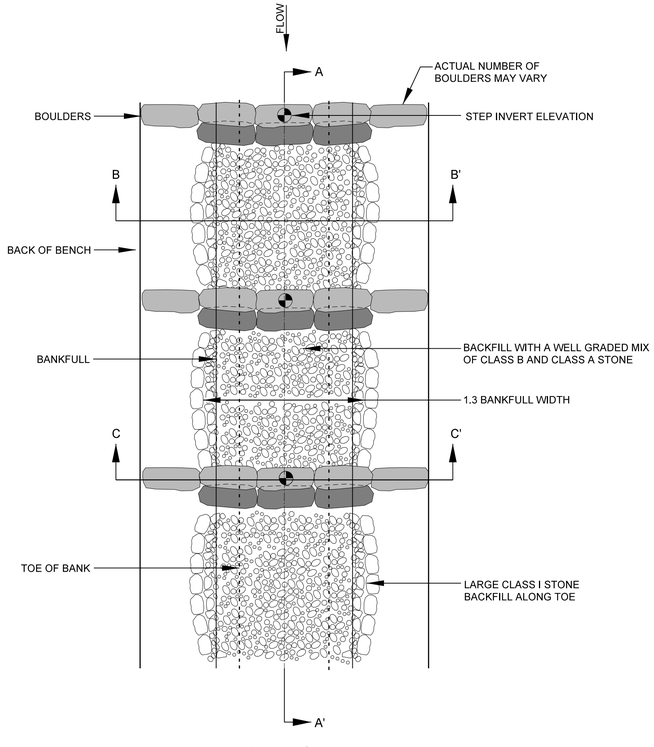
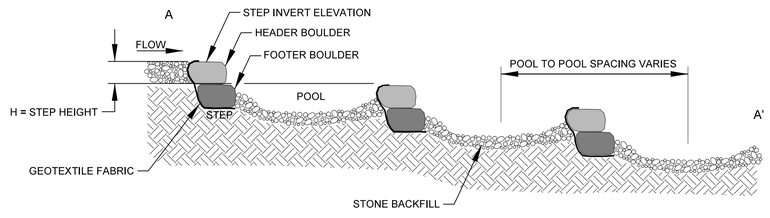
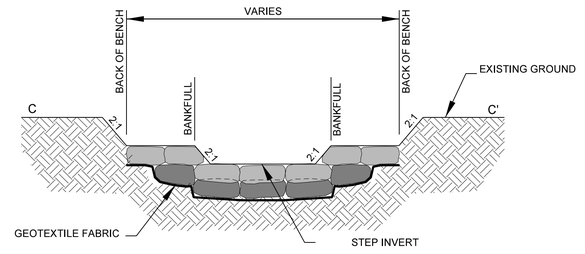
ROCK STEP POOL CHANNEL



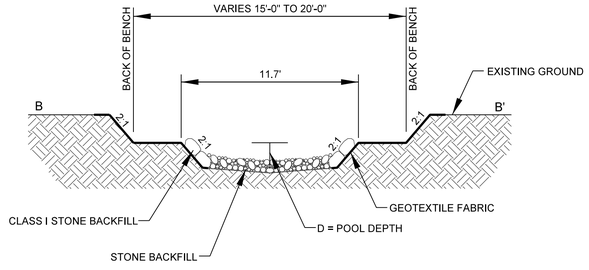
PLAN VIEW



PROFILE VIEW A-A'



POOL CROSS SECTION C-C'



POOL CROSS SECTION B-B'

NOTES:

1. BOULDERS MUST BE AT LEAST 2' X 2' X 3' AND NOT EXCEED 4' X 3' X 2'.
2. FOOTERS SHALL BE INSTALLED SUCH THAT 1/4 TO 1/3 OF THE LENGTH IS DOWNSTREAM OF THE HEADER.
3. SOIL SHALL BE WELL COMPACTED AROUND BURIED PORTION OF FOOTERS WITH BUCKET OF TRACK HOE.
4. INSTALL GEOTEXTIEL FABRIC UNDERNEATH FOOTER BOULDERS.
5. UNDERCUT POOL BED ELEVATION 8 INCHES TO ALLOW FOR LAYER OF STONE.
6. INSTALL COIR FIBER MATTING ALONG COMPLETED BANKS SUCH THAT THE GEOTEXTILE FABRIC AT THE TOE OF THE BANK EXTENDS DOWN TO THE UNDERCUT ELEVATION.
7. INSTALL LARGE STONE BACKFILL ALONG SIDE SLOPES.
8. FINAL CHANNEL BED SHAPE SHOULD BE ROUNDED, COMPACTED, AND CONCAVE, WITH THE ELEVATION OF THE BED APPROXIMATELY 0.5 FT DEEPER IN THE CENTER THAN AT THE EDGES.
9. STEP HEIGHT (H) SHALL NOT EXCEED 0.8 FT.

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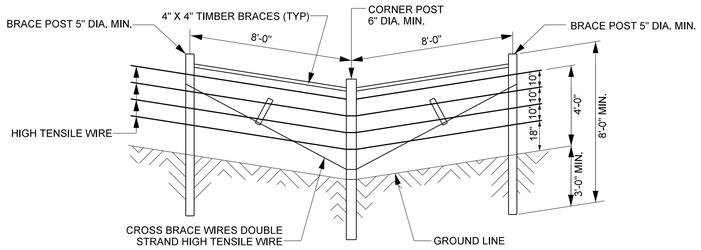
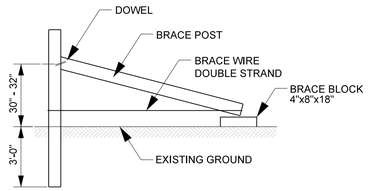
4 STRAND - HIGH TENSILE FENCING



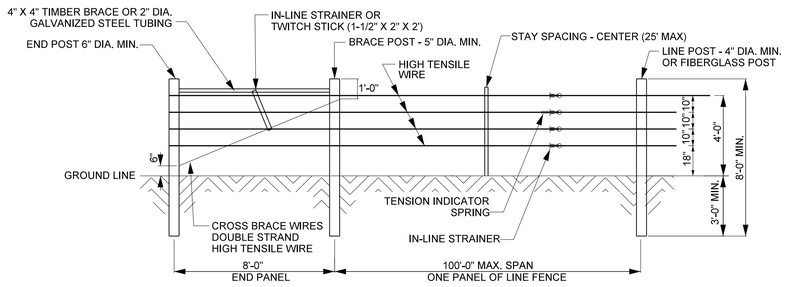
CORNER AND VERICAL CHANGE BRACING

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

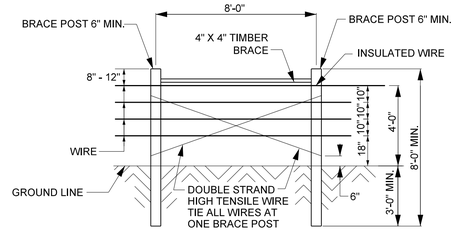


CORNER OR END BRACE ASSEMBLY

OPTIONAL FIGURE 4



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

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).

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	2-E

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKEITHAN

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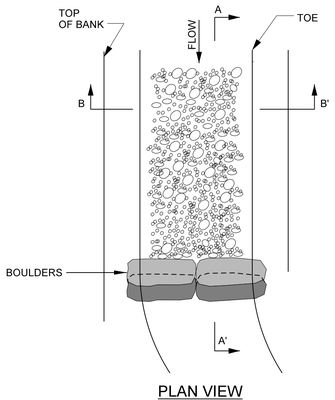
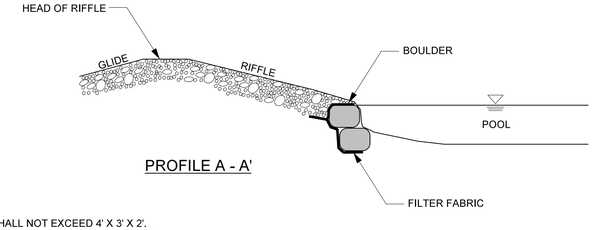
NCDMS ID No. 97083

BOULDER STEP



PLAN VIEW



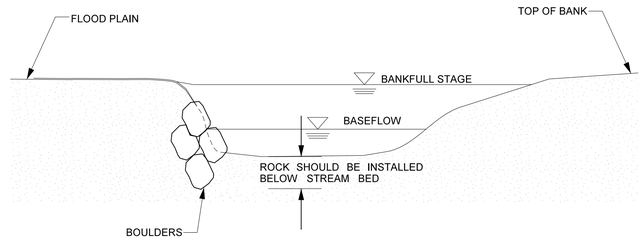
PROFILE A - A'

NOTES;

1. HEADER BOULDERS MUST BE 3' X 2' X 2' AND FOOTERS SHALL NOT EXCEED 4' X 3' X 2'.
2. FOOTERS SHALL BE INSTALLED SUCH THAT 1/4 TO 1/3 OF THE LENGTH IS DOWNSTREAM OF THE HEADER.
3. SOIL SHALL BE WELL COMPACTED AROUND BURIED PORTION OF FOOTERS WITH THE BUCKET OF EXCAVATOR.
4. INSTALL NON-WOVEN FILTER FABRIC UNDERNEATH FOOTER BOULDERS.
5. UNDERCUT THE RIFFLE ELEVATION 16 INCHES TO ALLOW FOR A LAYER OF STONE.
6. 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.
7. FILL TRENCH WITH GRADED MIX OF CLASS A, CLASS B, AND #57 STONE TO THE BED ELEVATION OF THE CHANNEL.
8. BOULDER STEPS MUST BE EXTENDED TO A MINIMUM OF 2' INTO THE BANK. USE SILL BOULDERS IF NECESSARY.
9. THALWEG WILL BE CONCAVE AND SHAPED PER DIRECTION OF THE DESIGNER.

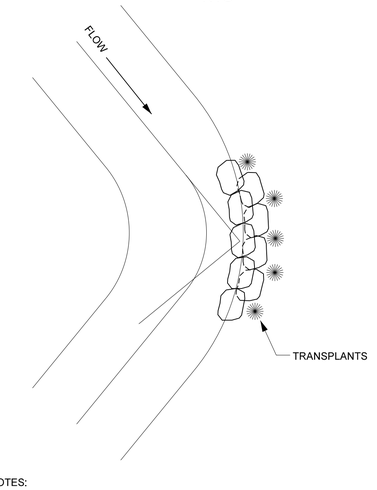
BOUDER TOE PROTECTION

CROSS SECTION VIEW
NTS



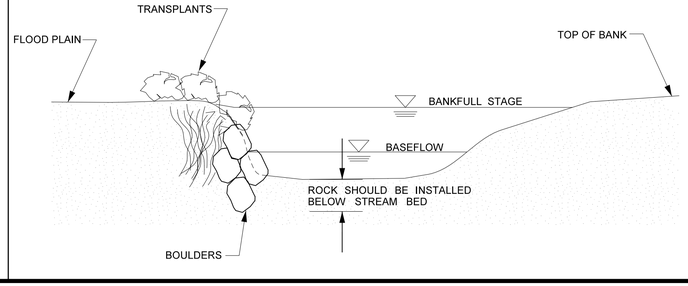
BOULDER TOE PROTECTION

PLAN VIEW
NTS



BOULDER TOE PROTECTION WITH TRANSPLANTS

CROSS SECTION VIEW
NTS



NOTES:

TRENCHING METHOD:
IF THE BOULDERS 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 BOULDERS, ONE-THIRD OF THE BOULDERS SHOULD REMAIN BELOW NORMAL BASE FLOW CONDITIONS.

NOTES:

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

4/24/2019
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2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	3

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKEITHAN

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NCDMS ID NO. 97083

NAD 83

BEGIN REACH 1
STA. 10+00.00

ROCK CROSS VANE (TYP.)

GEOLIFT WITH BRUSH TOE (TYP.)

PERMANENT FORD STREAM CROSSING

TOE WOOD (TYP.)

VEG PLOT 1

GRADE CONTROL J-HOOK VANE (TYP.)

CREST GAUGE #2

X-1

X-2

AS-BUILT THALWEG (TYP.)

LOG VANE (TYP.)

CONSTRUCTED RIFFLE (TYP.)

AS-BUILT TOP OF BANK (TYP.)

MATCHLINE SEE SHEET 4

GILBERT, JANE KELLY &
GILBERT, DAVID W.
PIN: 0805390700

GILBERT, JANE KELLY &
GILBERT, DAVID W.
PIN: 0805390700

LOCHILL FARM
REACH 1
AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

4/24/2019
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mdeal

2/26/03

NAD 83

MATCHLINE SEE SHEET 8

MATCHLINE SEE SHEET 3

AS-BUILT TOP OF BANK (TYP.)

AS-BUILT THALWEG (TYP.)

GEOLIFT WITH BRUSH TOE (TYP.)

BOULDER STEP (TYP.)

LOWER SECTION OF R2 RELOCATED FROM DESIGN

GILBERT, JANE KELLY &
GILBERT, DAVID W.
PIN: 0805390700

AS-BUILT TOP OF BANK (TYP.)

LOG VANE (TYP.)

GRADE CONTROL J-HOOK VANE (TYP.)

TOE WOOD (TYP.)

CONSTRUCTED RIFFLE (TYP.)

MW #1

X-3

VEG PLOT 2

X-3

AS-BUILT THALWEG (TYP.)

STA. 18+34.18

48" RCP PIPE CROSSING
NOT INSTALLED (TO BE REPLACED
WITH SMALL BRIDGE)

STA. 18+14.00

END REACH 2
STA. 16+04.78

MATCHLINE SEE SHEET 5

GILBERT, JANE KELLY &
GILBERT, DAVID W.
PIN: 0805390700

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	4

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKEITHAN

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NCDMS ID NO. 97083

LOCHILL FARM
REACH 1
AS–BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

4/24/2019
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BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	5

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M. McKEITHAN

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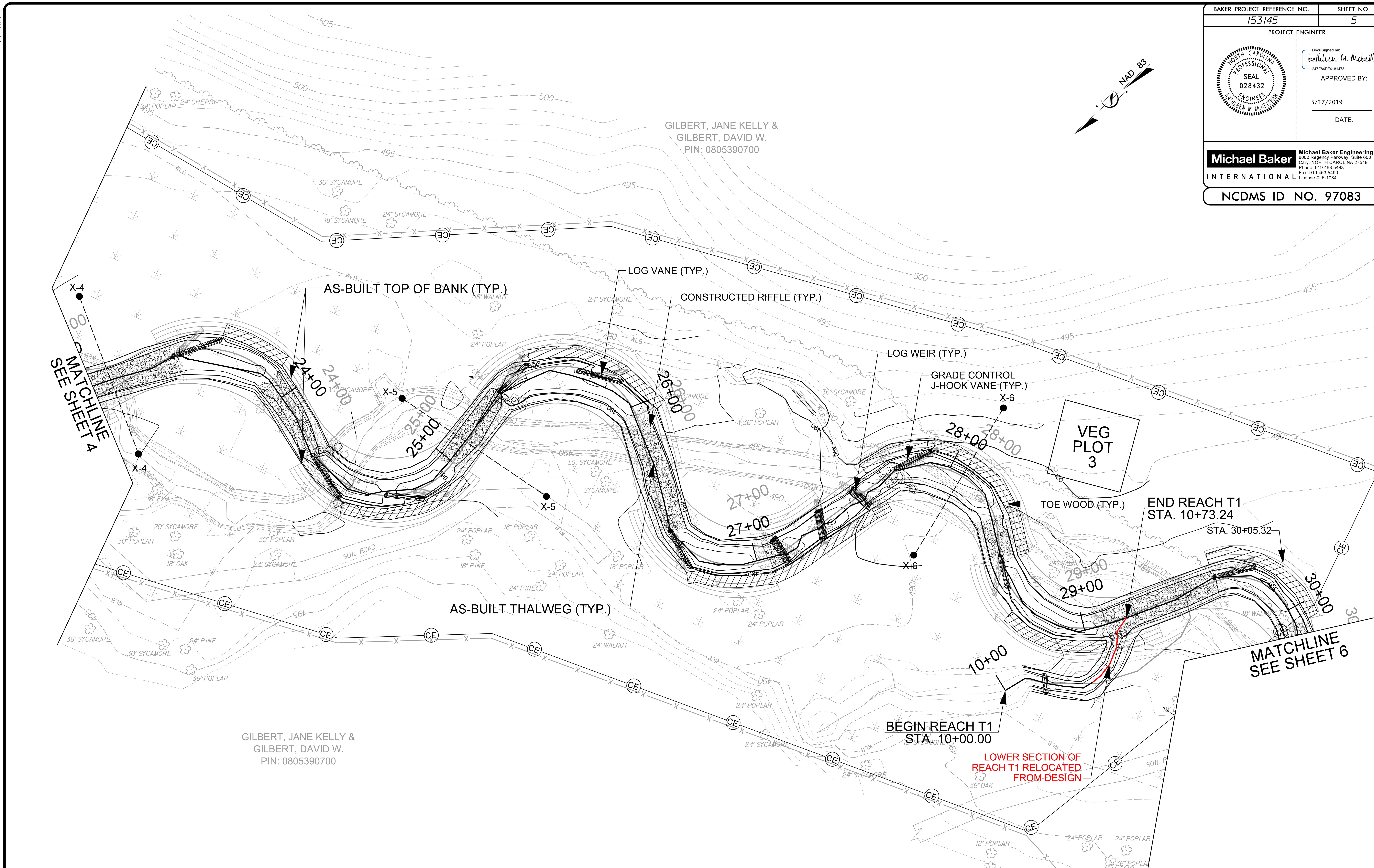

LOCHILL FARM
REACH 1
AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

2/26/03
4/24/2019
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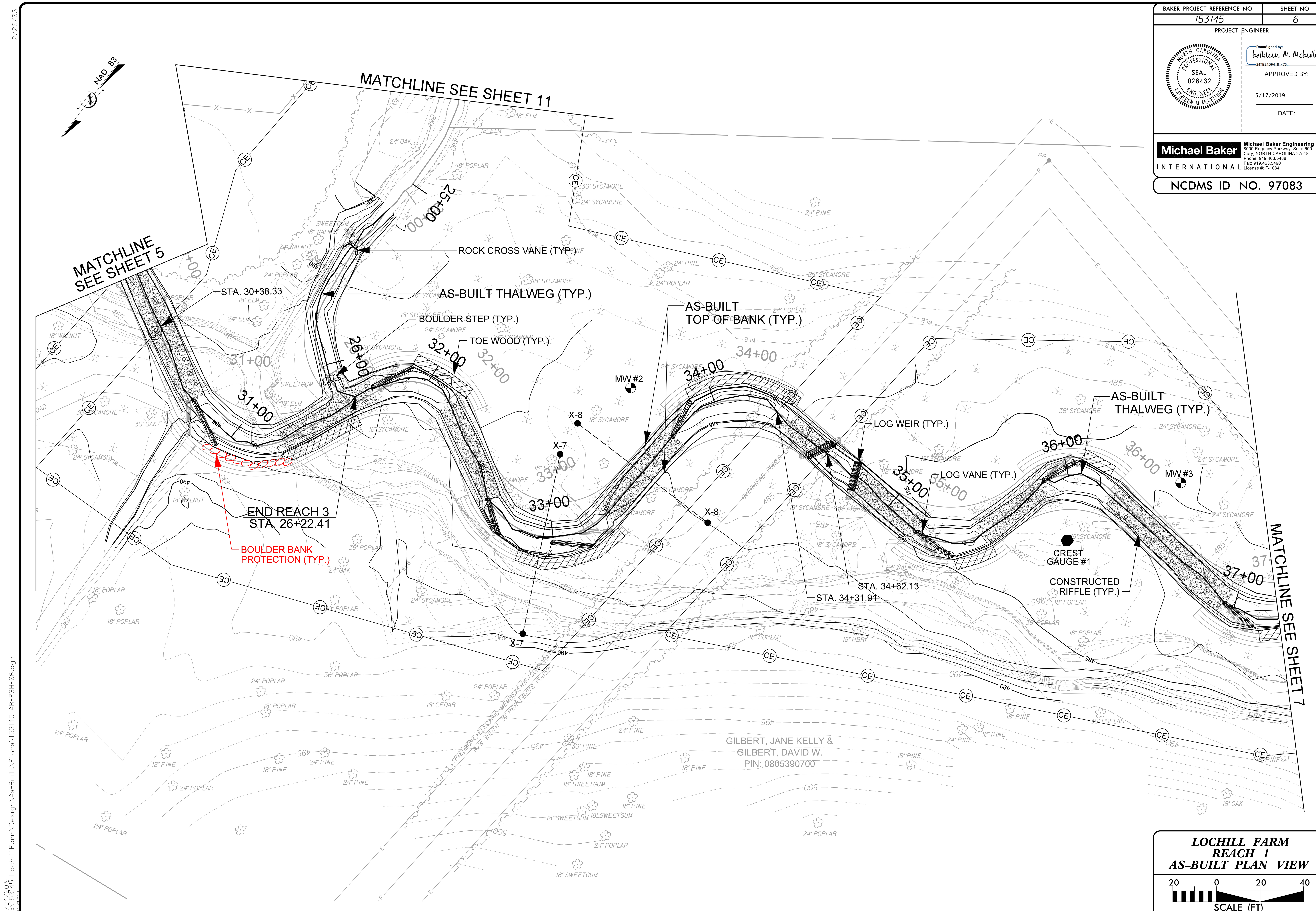

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	7

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M. McKEITHAN

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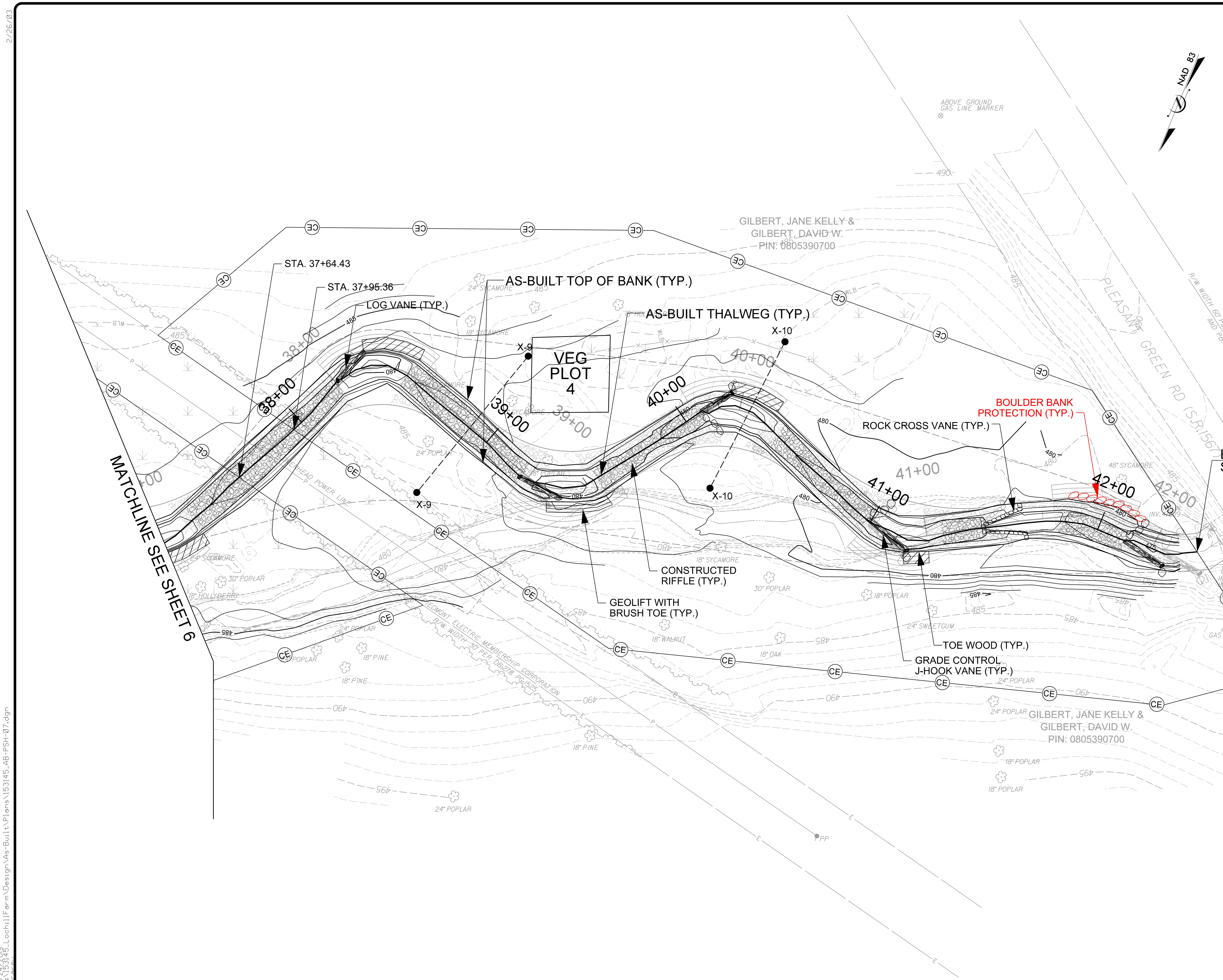

LOCHILL FARM
REACH 1
AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	8

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 028432 KATHLEEN M McKEITHAN

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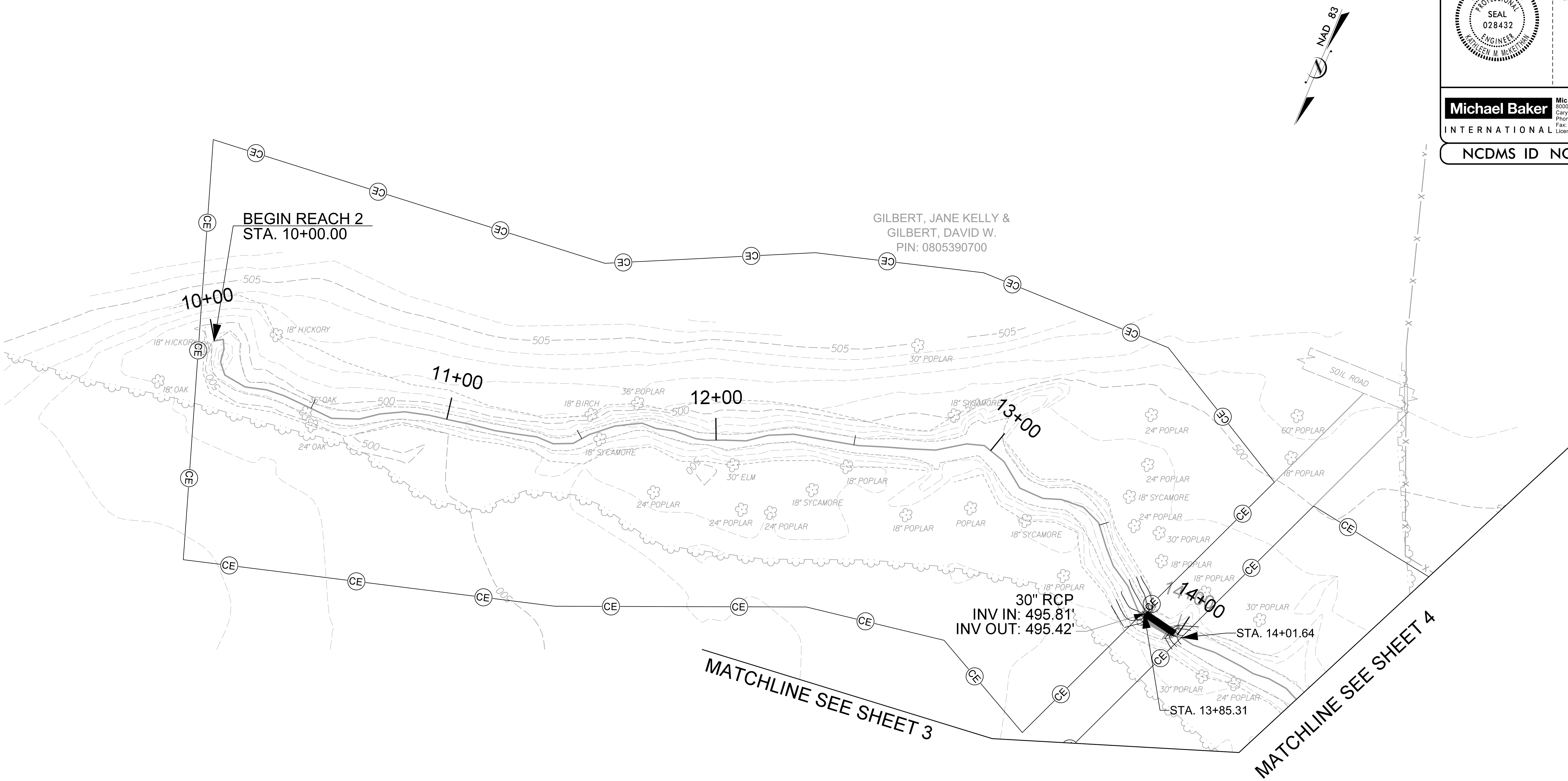
NCDMS ID NO. 97083



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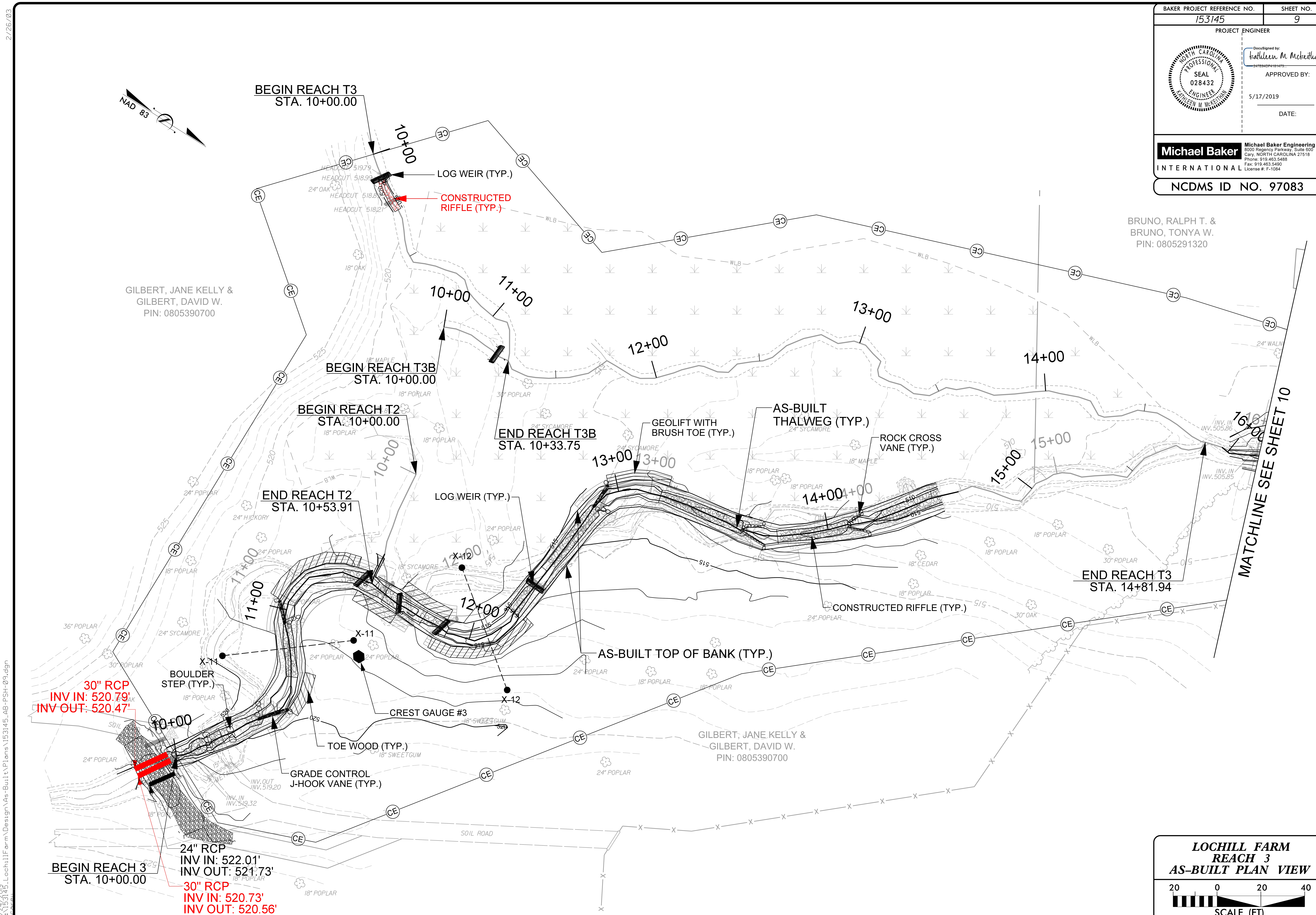
LOCHILL FARM
REACH 2
AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)



BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	9

PROJECT ENGINEER

SEAL 028432 — NORTH CAROLINA PROFESSIONAL ENGINEER — KATHLEEN M McKEITHAN

DocuSigned by: Kathleen M. McKeithan

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NCDMS ID NO. 97083

LOCHILL FARM REACH 3 AS-BUILT PLAN VIEW

SCALE (FT): 20 0 20 40

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	10

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M. McKEITHAN

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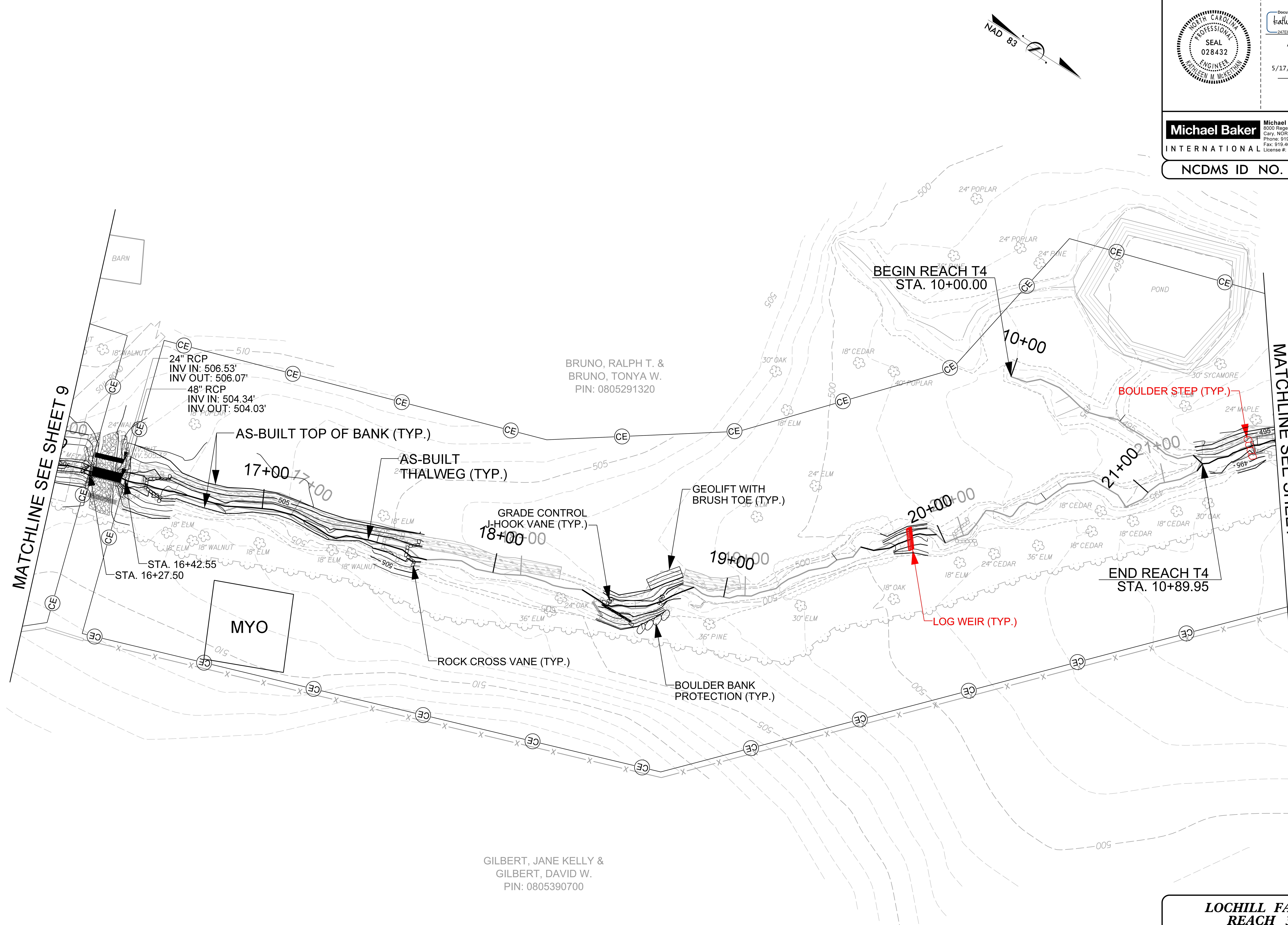

LOCHILL FARM
REACH 3
AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

4/24/2019
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2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	11

PROJECT ENGINEER

SEAL 028432 NORTH CAROLINA PROFESSIONAL ENGINEER KATHLEEN M. MCKEITHAN

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5/17/2019

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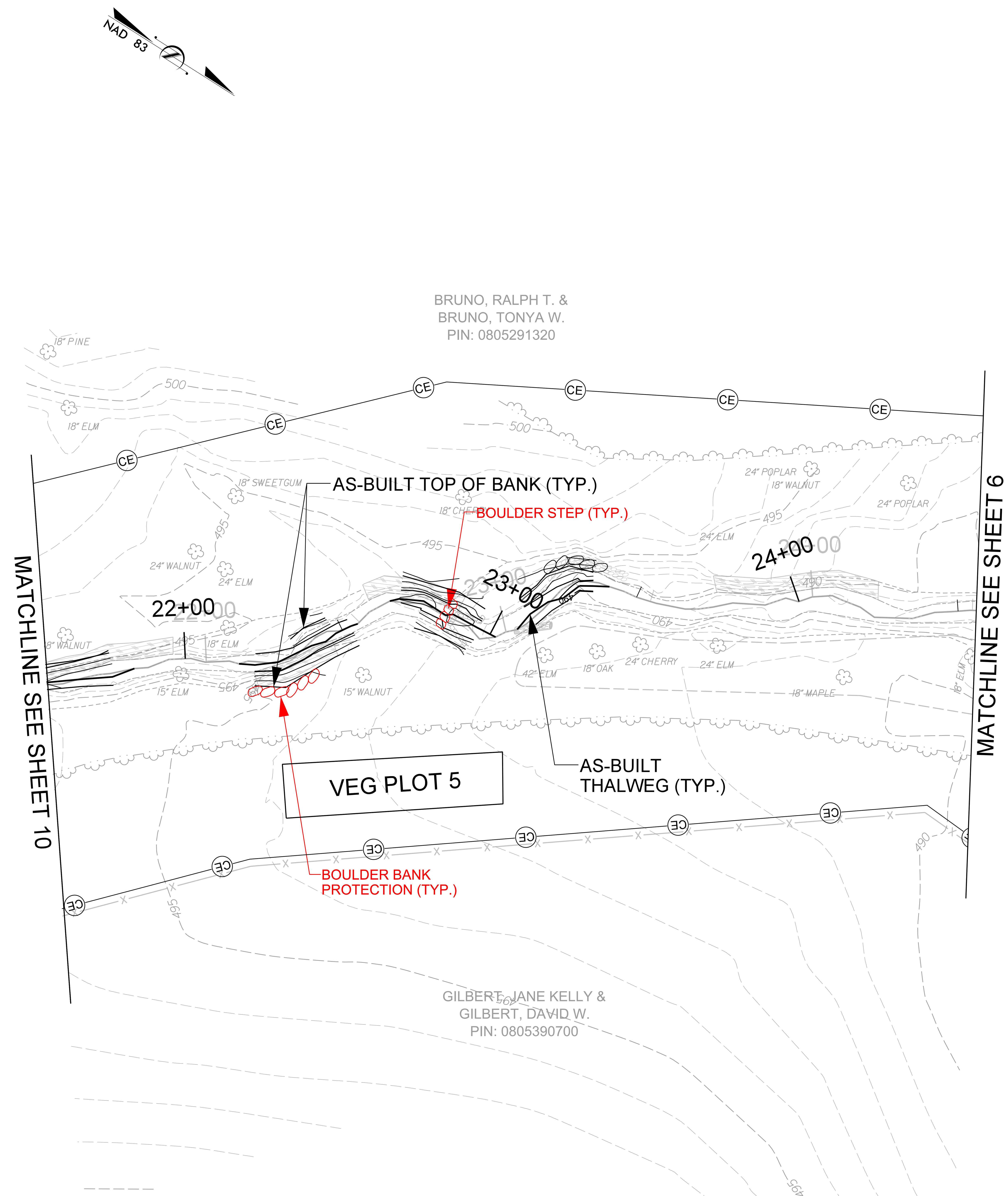

LOCHILL FARM
REACH 3
AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

4/24/2019
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BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	12

PROJECT ENGINEER

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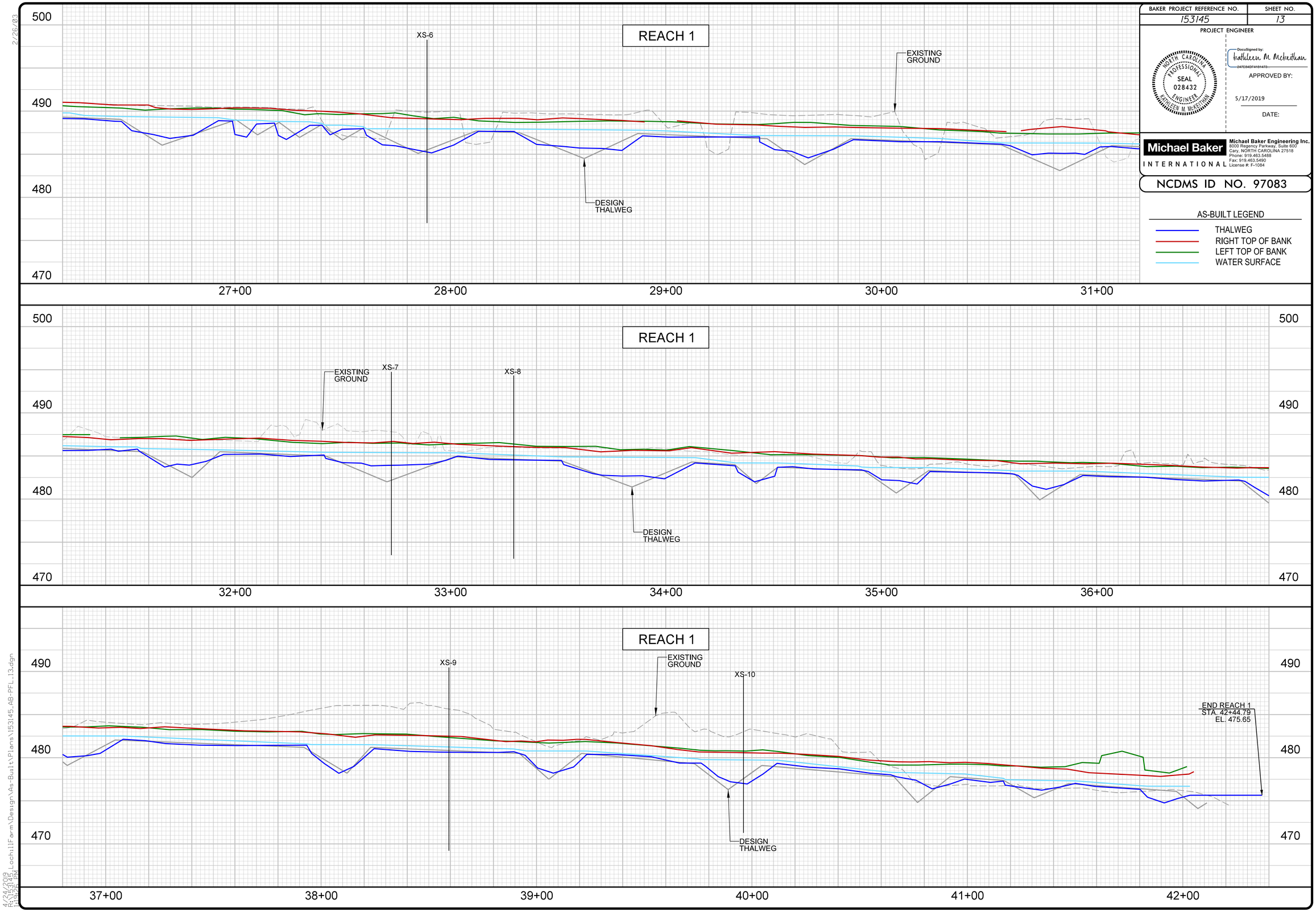
NCDMS ID NO. 97083

AS-BUILT LEGEND

- THALWEG
- RIGHT TOP OF BANK
- LEFT TOP OF BANK
- WATER SURFACE



BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	13

PROJECT ENGINEER

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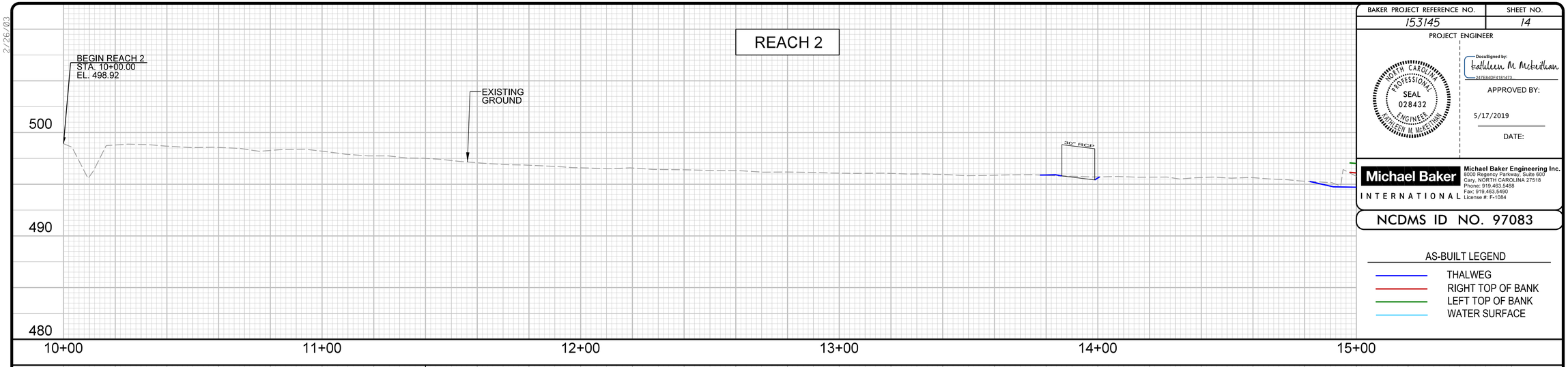
AS-BUILT LEGEND

- THALWEG
- RIGHT TOP OF BANK
- LEFT TOP OF BANK
- WATER SURFACE

2/26/03



BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	14

PROJECT ENGINEER

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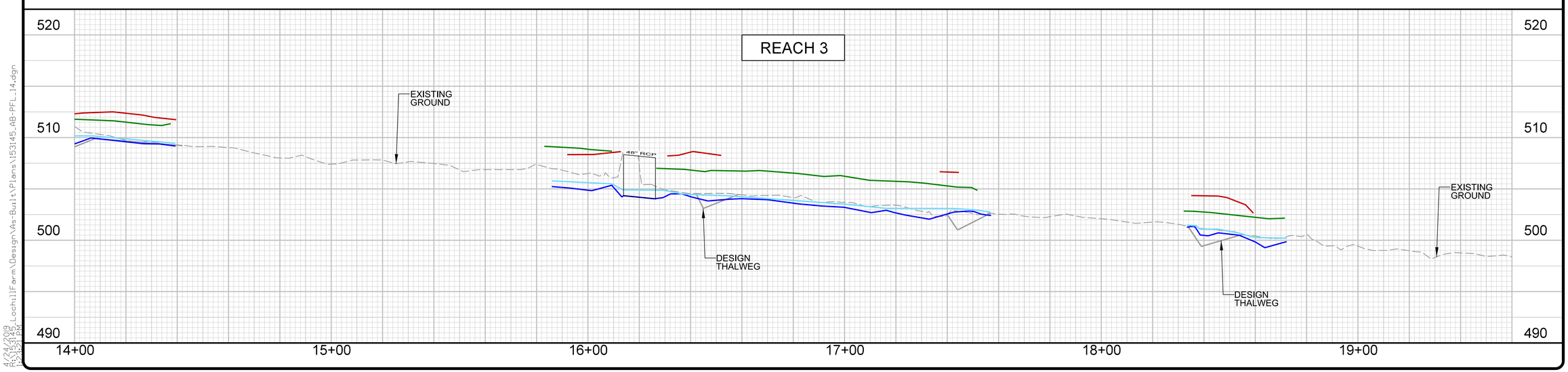
AS-BUILT LEGEND
- THALWEG
- RIGHT TOP OF BANK
- LEFT TOP OF BANK
- WATER SURFACE



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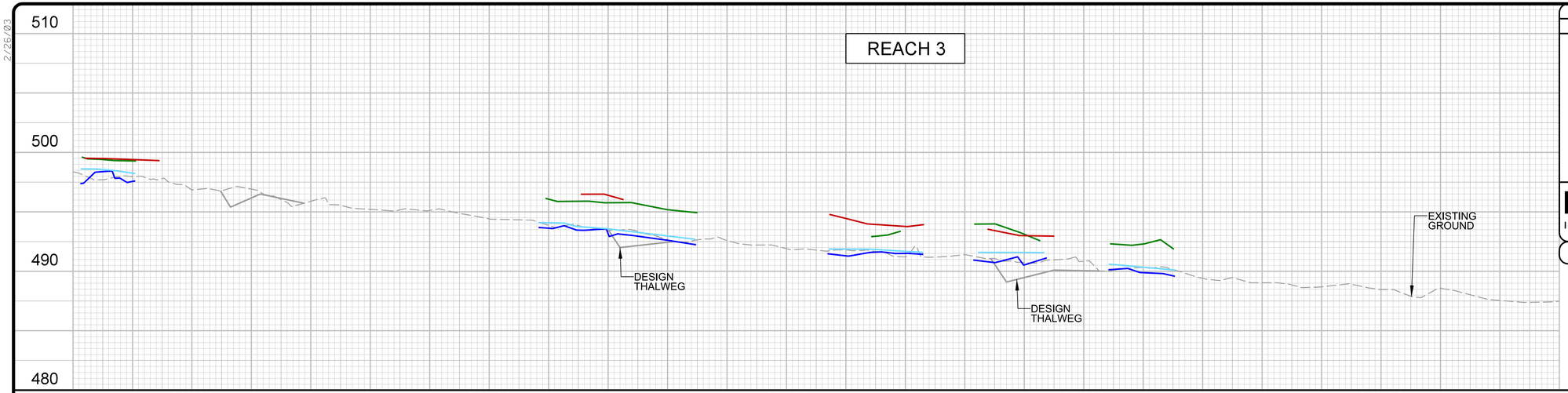

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	15

PROJECT ENGINEER

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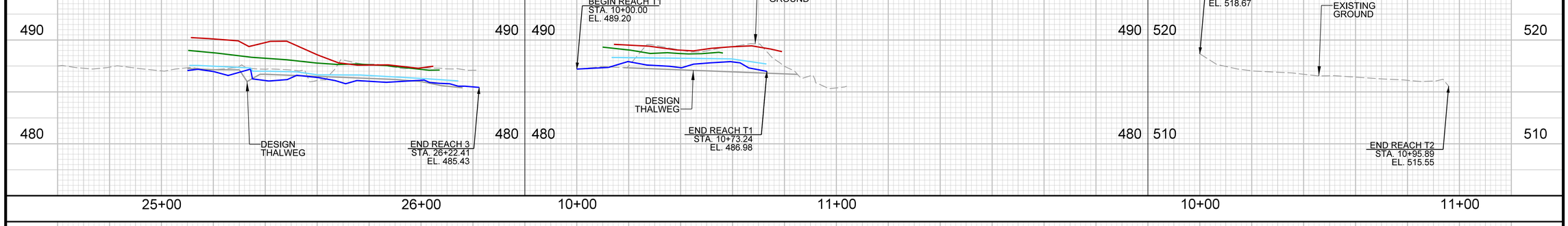
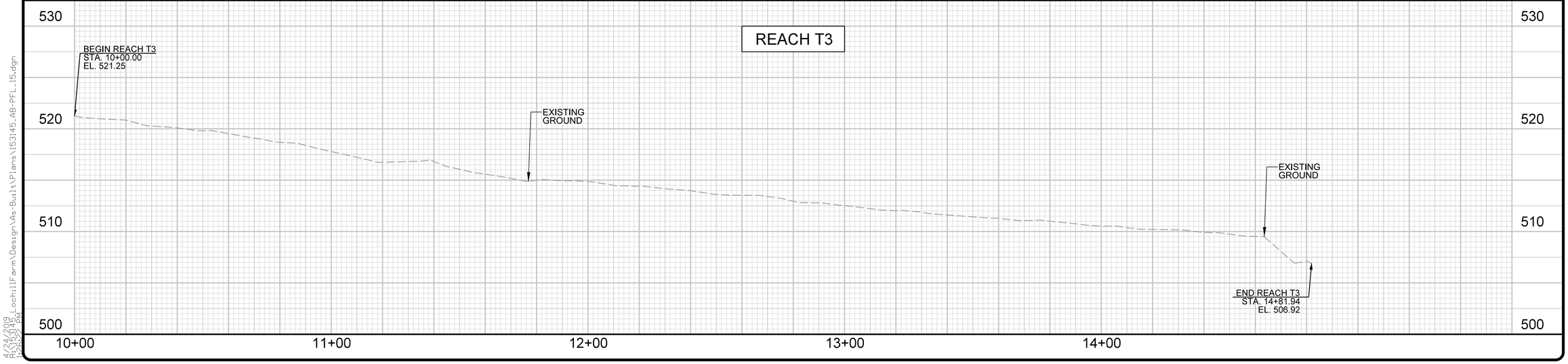
NCDMS ID NO. 97083

AS-BUILT LEGEND
- THALWEG
- RIGHT TOP OF BANK
- LEFT TOP OF BANK
- WATER SURFACE





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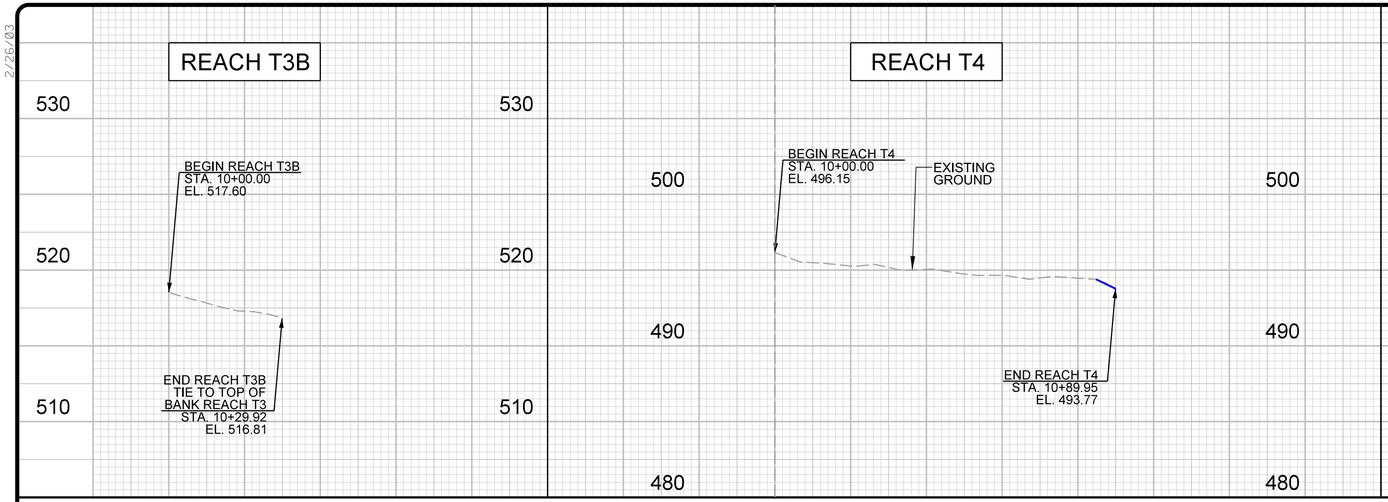

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	16

PROJECT ENGINEER

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AS-BUILT LEGEND

- THALWEG
- RIGHT TOP OF BANK
- LEFT TOP OF BANK
- WATER SURFACE

4/24/2018
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